CHAPTER 5: PRODUCE AND FORMULATE LIVESTOCK FEEDS/FORMULATE LIVESTOCK FEEDS.

5.1 Introduction

This unit specifies competencies required to produce and formulate livestock feed. It involves determination of animal nutritional requirements, calculating livestock feed ratios, producing animal feeds and feedstuff, animal feedstuff mixing, packaging animal feeds and storing animal feeds that an animal consumes in a day. This unit is a part of animal nutrition that is very critical to a farmer as it determines the productivity of a particular animal thus determining the profit a farmer gain. The aim of formulation is to have a balanced ration in terms of required nutrients by the animal and have an economical ration without compromising the palatability and balance of nutrients.

The critical aspects of competencies to be covered include; Determining animal nutrition requirements, formulation of livestock feed ration, production of animal feed and feedstuffs, processing of animal feedstuff, packaging and storage of already processed feedstuff. The basic resources required for this particular unit include: Animal feed ingredients, feedstuffs, animal feed meals, animal feed mixers, shovel, protective clothing, hay boxes, legumes etc.

The unit of competency covers six learning outcomes. Each of the learning outcome presents: learning activities that cover performance criteria statements thus, creating trainee's an opportunity for the trainee to demonstrate knowledge and skills in the occupational standards and content in curriculum. Information sheet provides: definition of key terms, content and illustration to guide in training. The competency may be assessed through written tests, demostration, practical assignments, interview/oral questioning and case studies. Self assessment is provided at the end of each learning outcome. Holistic assessment with other units relevant to the industry sector workplace and job role is recommended.

5.2 Performance Standard

Determine animal nutrition requirements, followed by formulation of livestock feed formulation by use of different methods of feed formulation e.g. the Pearson square method as per the requirement of a specific livestock. All these are possible according to different aspects such as Ecological zone, breed of animal and good agricultural practices which bring about a good ration at the end of formulation.

5.3 Learning Outcomes

5.3.1 List of learning outcomes

a) Determine animal nutrition requirements
b) Calculate /compute/formulate livestock feed ration
c) Produce or procure animal feed and feedstuffs
d) Process animal feed stuffs
e) Animal feedstuffs mixing
f) Package animal feeds
g) Store animal feeds

5.3.2 Learning Outcome No1: Determine animal nutrition requirements

5.3.2.1 Learning Activities

Learning Outcome No1: Determine animal nutrition requirements	
Learning Activities	**Special Instructions**
1.1. Categorize animals as per breed, age, production level and physiological status of the animal 1.2. Determine feed requirements as per feeding standard tables	Group Discussion

5.3.2.2 Information Sheet No5/LO1: Determine animal nutrition requirements

Introduction

The learning activity covered is the animal nutrition which is further subdivided into: definition of terms, nutrient requirements, nutritional elements, feed values, animal feed intake, recipes/formula and rations.

Definition of key terms

Feedstuff: A food provided for the cattle or the livestock.

Nutrition requirement: Levels of the particular's nutrients in lowest/ highest amount that is necessary to maintain a person in good health.

Content/procedures/methods/illustration

5.1 Animals are categorized as per breed, age, production level and physiological status of the animal.

The essential nutrients required by the grazing animals are: water, energy, proteins, minerals and vitamins. These nutrients are needed to maintain body weight, growth, reproduction, lactation and health.

Water

Water is essential for all livestock and the producer should plan an adequate supply of clean water when designing any livestock enterprise. Dirty water can lead to inadequate water, consumption which will reduce feed and forage intake and compromise livestock performance. The amount of water required depends on the physiological stage of the animals and the climate. Lactating animals require more water and the amount of water required increases as the atmosphere temperatures increases. Example is at temperatures of 35^0 and above where animals require 8-15 liters of water. Lack of water may lead to death.

Proteins

Amount of protein supplied in the diet is more critical than the quality of the protein. Ruminants have the ability to convert low quality feed of protein sources to high quality proteins through bacterial action. Proteins is required by all grazing animals for tissues growth and repair.

Energy

Insufficient energy probably limits the performance of livestock more than other nutritional deficiencies. Energy requirements vary greatly with the stage of production and adequate amounts of energy are extremely important during late gestation and early lactation. Energy deficiencies can cause; reduced fertility lowered milk production and reduced fertility lowered milk production and reduced wool quantity and quality. Energy is obtained from carbohydrates in plant materials and can be stored in the form of body lipids. Live weight gain can only occur after these animal's energy requirements for the maintenance and location are met.

Vitamins and minerals

Ruminants require all the fat-soluble vitamins (A, D, E and K) but they can synthesize the B vitamins in their rumen. Forage and feed supply contain all essential vitamins in adequate amount except vitamin A which is obtained as carotene from green plants and is often deficient in dormant forage. When formulating a ration, performance criteria must be defined because ration formulation involves constructing a ration that will supply the nutrients needed to support the performance criteria. The performance criteria for animals raised for the food and fiber are targets in ration formulation. Ration is a fixed allowance of nutrients or of a service for a specified period.

Identifying requirements and selection of the product of feeds

Nutrients need of livestock within classes, breeds of production and use vary because of individual differences in the ability to utilize feeds and differing responses to environmental and management conditions. Individual animal variations enforce the need to individually manage the feeding of livestock especially those imposed by rapid growth, heavy states of production or intense work. There are numerous methods used to formulate and evaluate rations, ranging from methods similar to those simple examples to more controls and require higher degrees of accuracy. To be conducted correctly, ration formulation and evaluation require knowledge of feedstuffs, feed manufacturing process, routine feeding management practice and nutritional requirements and psychology of the livestock.

Determining the nutrients of feeds

Methods used to estimate the nutritional value of feeds include: Information from feed tags, nutrients database and nutrients analyses via tests in laboratories. Nutrients requirements can be broken down into four principal components and maintenance, lactation growth and reproduction. For these component requirements energy, proteins, minerals and vitamins are calculated.

Maintenance

Maintenance component include all the nutrients required for the animal health, more digest food, keeping warm, repairing tissues and maintaining body weight. Weigh age, breed, physiological status activity and environmental conditions are primary variables impacting maintenance requirements. The larger the animal, the greater its maintenance requirements especially energy and proteins. Extremely heavy muscled breeds, pregnant and lactating animals increase basal metabolism hence the maintenance requirements are altered accordingly.

Lactation

Heavy lactation has greater nutrients demands than any other production state. Nutrients requirements for lactation are based on the amount of milk at peak lactation and the composition of the milk. Animals that produce more milk with more fats and proteins will have higher nutrient requirements.

Growth

Measured as increase in body weight. Requirements for growth are determined by actual weight average daily gain, weight at maturity and composition of gain. Composition of gain either means that the animals are putting a lot of muscles or more fats. Nutrients requirements per unit body weight are greater for younger animals.

Reproduction

Requirements for reproduction are based on expected birth weight and stage of gestation. Requirements include development of material tissues as well as the foetus. Nutrient deficiencies prior to breeding may result in low fertility or failure to maintain pregnancy.

Factors affecting nutritional requirements

- Breed
- Weight
- Body condition
- Age
- Sex
- Stage of gestation
- Work
- Environment

5.2. Feed requirements are determined as per feeding standard tables

Feed is the food given to animals which are domestic and often refers to fodder in course of care and management of farm animals by humans for profit. Feedstuff is food provided for cattle or livestock.

Feedstuff include in feed tables are:

- Compound feedstuffs
- High moisture industrial product
- Roughage and related places
- Miscellaneous.

Food value of a foodstuff is a measure of its main nutritional components. The worth of any fodder depends mainly on the concentration energy and proteins in dry matter of the feed. Nutrition components of the foodstuff can greatly influence cattle production e.g. minerals, vitamin deficiencies such as calcium and phosphorous. Excess of particular substances in feedstuff can cause lowered production and even death e.g. copper toxify nitrite poisoning form in some grasses. Nutritional components range of foodstuff commonly fed to cattle are:

- Dry matter
- Metabolizable energy
- Crude proteins

Feeding of cattle should be managed adequately by providing the nutritional requirements according to the level of the production desired.

Dry matter

One should have an idea of the dry matter in the content of foodstuff because cattle usually consume a predictable quantity of dry matter per day. If feed is readily available, cattle generally eat a quantity of dry matter each day equivalent from two to three percentage of their body weight.

Energy

There has been a number of different systems used for defining the energy value of feedstuff for livestock. The starch equivalents system and total digestible nutrients systems are two examples. The metabolism energy system has been adopted as the standard system for defining the energy value of ruminants ME value of feedstuff is the amount of energy value that the ruminant is able to use per unit of dry matter of foodstuff eaten.

Two reasons why farmers should know relative values of feedstuff.

- To satisfy the energy demands of various forms of production, the diet of a ruminant must have an average energy value above a particular level.
- When feed is in short supply or when any feeding management is being planned, its useful to cost out each of the foodstuff on its monetary value per unit of ME.

Proteins

The protein requirement of cattle varies according to the weight and type of breed as well as the level of production. This is important to know the protein levels of various feedstuffs so that feeding management can match the protein available in an animal's diet with the animal's needs. The crude proteins value of feedstuff is determined by the quantity of nitrogen it contains.

Control of feed intake in livestock

- **Animals behavior**

The productivity of ruminants is determined by many factors out two of the most important are what and how much they eat.

- **Selection**

Sheep and goats graze more selectively than large ruminants. Cattle are less able to graze selectively than small ruminants because they take larger bites and the what in which they prelend plants is not conducive to selection.

- **Dysphagia**

Dysphagia is the ingestion of materials that can be determined as nutritionally inert or even harmful and which are not normally consumed.

Factors in feed that affect intake

They include: small animals reject feed without tasting it e.g. smell of dung reduces the intake of pasture. Chopping straw into short lengths tend to increase intake of the straw. Fine grinding and pelleting also increases the intake of straw but has low applicability in the developing countries because of high energy costs associated with this form of processing.

Food processing and the costs associated with processing include a wide range of unit operations including: receiving, grinding proportioning, mixing, pelleting, load out, and delivering. Nearly every one of these operations can have either a negative or a positive influence on subsequent animal's performance and can certainly influence final profitability. Grinding, mixing and pelleting are likely to have greatest influence on animal's performance and feed quality. Grinding is a major function of feed manufacturing and is by far the most common method of feed processing and the cheapest and a simple process and result in substantial reduction in particle size. It improves feed digestibility and acceptability increasing the bulk of some ingredients.

Conclusion

This learning outcome covered animal nutrition a whole with more emphasis put on definition of terms, nutrient requirement, nutritional elements, feed values and animal feed intake formula of calculating feed rations with an aim of coming up with a balanced ration in terms of the required nutrients by the livestock.

Further Reading

1. www.fao.org>nutrition-requirements

5.3.2.3 Self-Assessment

Written assessment

1. The 3 are essential nutrients for animals except one. Which one?
    a) Carbohydrates
    b) Proteins
    c) Vitamins
    d) Minerals

2. What are the factors affecting nutritional requirements?
    a) Breed
    b) Weigh
    c) Sex
    d) Health
3. The following are feedstuff included in feed tables except one?
    a) Roughages
    b) Miscellaneous
    c) Proteins
    d) High moisture industrial co-products
4. Which of the factors affect feed intake?
    a) Smell
    b) Palatability
    c) Grinding
5. If you are missing soybeans meat 44% and ground corn 99% CP together to make 2000lb of 10%, the number of soybeans required will be?
    a) 200bls
    b) 300bls
    c) 400bls
    d) 500bls
    e) 600bls
6. What is nutrition requirement?
7. Components of feed stuffs to be listed are?
8. State 6 major nutrients for cattle.
9. What is formulation ration?
10. Mention how grinding helps the animal feeds.

Oral Assessment

1. What are the components of a healthy diet?
2. Why is nutrition important?

Case Study Assessment

1. Discuss the importance of nutrition and digestion for animal's growth
2. Clearly the actual dietary requirements of an organization of an organism will vary according to the age, sex and levels of physical activity discuss.

Practical Assessment

1. Determine dry matter content, organic matter are crude proteins and fractioning of cell wall in forage and concentrates
2. Analyze the physical characteristics of feed by estimating average particles size and a distribution with sieves of different mesh size.
3. Assessing nutritional value of feed through vitro in situ and enzymatic methods.

4.3.9.4 Tools, Equipment, Supplies and Materials

- Feedstuff
- Animal feed mills
- Animal feed mixers
- Shovels

5.3.9.5 References

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5.3.3 Learning Outcome No 2: Formulate livestock feed ratio

5.3.3.1 Learning Activities

Learning Outcome No 1: Formulate livestock feed ration	
Learning Activities	**Special Instructions**
2.1 Animal feeds ingredients are identified as per animal feeding standard tables. 2.2 Livestock feed ingredient rations are formulated using formulas or computer programs as per animal feeding standard tables	Demonstrate field formulation method

5.3.3.2 Information Sheet No4/LO2: Formulate livestock feed ration

Introduction to learning outcome

Learning outcome covered include: feed formulation, animal feed rations, weighing methods, feed formulation formulas/recipes and feed analysis.

Definition of key terms

Feed analysis: This is the process establishing contents of nutrients and other biological essential ingredients in the feed. It can be physical analysis which involves visualization on color, dryness, odour or presence of a foreign materials that interfere with fed quality especially palatability or chemical analysis that involves evaluation and knowing levels of moisture, dry matter (DM), nitrogen, fat, crude protein, cellulose and ash in a feed.

Feed rations: A ration is the daily portion of feed prepared from a combination of various feeds based on various animal feed requirements.

Content/procedures/methods/illustrations

2.1. Animal feeds ingredients are identified as per animal feeding standard tables.

A feed ingredient is a component part/constituent or any combination/mixture added to and comprising the animal feed. Animal feed ingredients might include: grains, milling by-products, added vitamins, minerals, fat/oils and other nutritional and energy sources

Feed ingredients

i) Dry matter

This is part of food stuff or other substance which would remain if all water content is removed. It is a measurement of mass of something when it is completely dry. It constitutes fats, protein, vitamin, minerals and antioxidants.

Calculation of DM

Procedure

i. Weigh empty containers selected to hold the feed and record its weight
ii. Place the feed in the container (step 3)
iii. Weigh and record the container from total weight
iv. Subtract weight of container from total weight (step 3) to determine weight of feed before drying
v. Thoroughly dry the feed
vi. Weigh and record the container and feed weight immediately after drying
vii. Subtract the weight of the container from total weight (step 6) to determine the weight of the feed after drying
viii. Divide the weight of the dry feed (step 4) by weight of the wet feed (step 7)
ix. multiply by 100 to get percentage

Example

Container weight =300 g

Container and sample before drying= 450g

Wet sample weight= 450g - 300g

= 150g

Container and sample weight after drying = 354g

Dry sample weight = 354g-300g

=54g

Dry matter= $\frac{54}{150} \times 100$

= 36%

Note: Routine dry matter determination is essential in keeping the feeding programme on target.

Total Ash

This is the residue remaining after incineration. It is the final burnt product without water and any possible volatile products that escaped during incineration. Total ash has a sub-ingredient of acid insoluble ash which is the part insoluble in diluted hydrochloric acid. Analysis of ash content in feed involves burning away organic content and leaving inorganic minerals, thus helps to know amount of minerals and type; thus, determining physiochemical properties of foods.

Determining Total Ash value

Requirements:

- Porcelain crucible (50ml)
- Furnace (600∓20)
- Weighing machine
- Desiccator

Procedure

i) Weigh accurately 2gm of feed sample prepared in a crucible
ii) Incinerate up to 4 hours until ash turns while
iii) Cool crude having ash and weigh
iv) measure the weight
v) Find the difference

Crude protein

It is the amount of protein present in a specific feed.

Crude protein depends on nitrogen content in a feed without other non-nitrogenous proteins. They are the best as animal sources proteins are easily digested than vegetable protein. Crude protein is determined through laboratory feed analysis.

Calculating crude protein

Procedure

i. Remove water in a feed, e.g. 100g powder-5.3 H_2O = 94.7g of DM and feed had 82g of P.
ii. Convert from "as is" to (DM basis) by taking the percentage protein on a DUB basis and dividing it by new percentage of dry product % protein DMB=as in protein/ (1-% of water).

Thus % protein DMB = 82(1-053)
= 0.866

Crude Fiber

This is the measure of quality of indigestible cellulose partisans, lignin and other components. It is different from dietary fiber because dietam fiber is plant-based food that mostly passes through the digestive system without being digested. It can either be soluble fiber or insoluble fiber.

Determination of crude fiber

- Determined using Weende method
- Crude protein, crude fat and crude ash are determined and the moisture and carbohydrate content can then be calculated by difference i.e.

Carbohydrates = Amount of Total sample – Moisture - (Crude protein+ crude fat)

An advanced method 2 is the use of acid **hydrolysis** especially in developed countries is 25% H_2SO_4 is used in extraction of sugar and starch followed by alkaline hydrolysis with 25% NaOH which removes protein and some hemi-cellulose and lignin.

Minerals

These are solid substances that are present in nature and can be made available of one element or more. They can be macro-elements or micro-elements. Macro-elements are needed by the body in larger quantities since they do major growth roles e.g. Calcium, Magnesium, and Sodium. Some of the useful minerals in live stone include:

- Cobalt
- Copper
- Iodine

- Iron
- Manganese
- Selenium
- Zinc

Vitamins

A vitamin is an organic molecule and an essential micro-content that an organism needs in small quantities for proper biological functioning. Vitamins are essential in boosting immune system and repair damaged cells. Vitamin include:

Fat soluble: A, D, E, K – cannot be lost during making water soluble B-complex and C

The body does not need fat soluble vitamins because they are stored in the liver.

Water

Water plays a very important role in the body. Water softens feed and comes through digestion tract. It is also a component of blood (90% of blood content) water also contain nutrients and maintain the cell living part. Water also carries away waste products.

2.2. Livestock feed ingredient rations are formulated using formulas or computer programs as per animal feeding standard tables

Feed formulation: This is the process of quantifying amount of feed ingredient that need to be considered to form a single uniform mixture. Before feed are fed to the animal they are then formulated and weighted and the right quantity given to the animal.

Feed formulation Methods

i) Use of person square

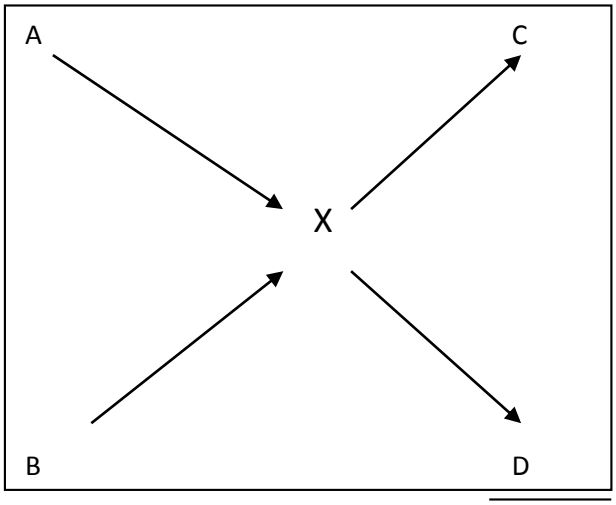
This use a simple box procedure method of balancing rations that can be used for many years. It is of great value when the ingredients are mixed.

Other Methods

- Trial and error methods
- Simultaneous equation method
- 2x2 matric method
- Computer method
- WAG method
- Algebraic equation methods
- Substitutions method

Pearson square

- Simple nutrients needs are met with simple feed formula
- Lesser value is subtracted from greater value
- Record diagonally
- One feed must have a value higher than the derived value and one must have a value lower than the designed value.



Total =

A – X =D

B – X=C

Table 7: Pearson square

Substitution Method: Involves substituting ingredient with another in a new ingredient.

Example:

Original Information:

Ingredient	Amount (lbs)	% CP	CP ibs
Smooth become hay	60.0	6.0	3.60
Ground corn	33.0	9.0	2.97
SBM	7.0	46.0	3.22
	100.00		9.79

Table 8:Substitution Method

Assume you want to increase crude protein content to 13% by substituting SBM for corn. Rather than using a trial and error approach establish one for one substitution.

Add lb.- cone = 0.46lb. CP

Remove 1b – con =0.916 CP met change in protein = +0.37lb CP

Since you want to increase from 9.79-13% CP, you will meet 3.21lbs (13.0-7.97) additionally protein in each look mixture.

Thus, if each one for one substitution increase CP by 0.37lb, then 3.21/0.37=8.68lds SBM needed to substitute for 8.65lb.

Table 9:The revised formulation

Ingredient	Amount (lbs.)	% CP	CP lbs.
Smooth become hay	60.00	6.0	3.60
Ground corn	24.32	9.0	2.19
SBM	15.68	46.0	7.21
	100.00		13.00

Computer formulation (Linear programming)

Computerized feed formulation programme are often called least-cost program because they compare nutrients needed by livestock to nutrients supplied in food stuffs.

Example

Requirements = $aX_1 + bX_2 + cX_3 + dX_4$

Where a. b. c. d represent amount of each of the focus ingredient in the diet and X_1, X_2, X_3 and X_4 represent the amount of specific nutrient in each ingredient, simultaneous manipulation can be done by compete than manual methods. The feed formulation software programs used by major feed companies are useful in long-term important formulation programmes. Computer formulation will provide information on inclusion levels of ingredient, nutrients analysis, cost margin and amount of each ingredients for a given batch size.

Algebraic Equations/Simultaneous equations method

Formulate a diet which contains 0.85 % lysine using the following fine ingredient barley, wheat, soybean, and premix and Lucerne meal. These ingredients have been analyses. The Lucerne mean contains 0.69% lysine and is fixed at 5% of the diet. The premix contains no lysine and is fixed at 3.5% of the diet. The wheat contains 0.33% lysine and make up 25% of the total diet. The barley has 0.39 lysine and soybean has 30.5% lysine. At this state the diet is composed of:

Solution

i) With the wheat and Lucerne meal percentage food we can calculate that the mixture already contains 0.12% lysine (0.25× 0.33) + (0.05× 0.69) = 0.12%
   The remaining component, barley and soya bean must therefore provide 0.73% lysine is 66.5% the total mix i.e. [100- (25.0+5.0+3.5) = 66.5%]

ii) Let × equal the proportion of barely in the diet and let (66.5 – X) equal to the portion of soya bean in the diet. The amount lysine required will be 0.73% i.e (0.85-0.12= 0.73%)

iii) The amount of protein supplied by barley will be 0.0039X where X is the amount of barleys and 0.039 is the fraction of barley that is lysine (0.39% w/w). The amount of lysine supplied by soya bean meal will be 0.0305(66.5-X) where (66.5-X) is the amount of soya bean on the diet and 0.03.5 is the fractions (g/g) of lysine in the soya bean meal.

Algebraic equation to solve this problem is

0.0039X + 0.3.5(66.5-X) = 0.73

Equation

0.0039x + 0.0305(60.5) – 0.03.5x = 0.73

0.0039x = 2.0283 – 0.0305x = 0.73

-0.0266X + 2.0283 = 0.73

x = 48.8%

The amount of barley in the diet will be 48.8 while soya bean will be 17.7% (66.5-48.8). The Final made up is

Barley = 48.8%

Wheat = 25.0%

Soya bean = 17.7

Lucien = 5%

Premix = 3.5% lb.

Total = 100%

1. **Batch weighing:** This is a method of weighing that utilizes a special shortened and separate conveyor installed specifically for the purpose of controlling balance of feed.
2. **Automated weighing:** This is the use of electric machines in determining the ration that has been formulated in reactive of mixing. This is more accurate as it provides up to gram measurement thus is very precise.

Conclusion

This learning outcome covered feed formulation methods animal feed ratio, weighing methods and feed formulation formula which are important in this unit as this will help in finding a balanced ration for the livestock.

Further Reading

1. www.Youtube .com//Dairymealformulatiobalancedfeedforday cattle.
2. De bias, C. and Mateou, C. C (2010), 12 feed formulations. Nutrition of the rabbat, 222.
3. Tavon, A. G. (1995). Feed formulation and on-farm feed management. FAO fisheries technical paper, 61-74.

5.3.3.3 Self-Assessment

Written assessment

1. Formulation of feed ration is limiting animal referral food intake requirement.
    a) True
    b) False
2. Food analysis is a waste of time and resources since feed are composed of natural nutrients.
    a) True
    b) False
3. The following are food ingredients except
    a) Dry Matter
    b) Total Ash
    c) Mineral
    d) Maize Bur
4. Water is not an ingredient of food in animal nutrition
    a) True
    b) false
5. Pearson square is the only method of feed formulation
    a) True
    b) False
6. Batch weigh is not an effective method in feed measurement
    a) True
    b) False
7. Crude pattern is the total amount of protein in a feed
    a) True
    b) False
8. Give the importance of feed analysis
9. state two feed weighing methods
10. Highlight 3 feed formulation methods
11. Active feed rationing and feed analysis
12. Give three feed ingredients important to livestock

Oral Assessment

1. Whey is feed formulation and analysis important
2. What is the importance of Pearson square in feed formulation methodology?

Case Study Assessment

Students during their holiday to identify animal feed ingredient, formulate ration, using person square and batch weight methods and record their project results in the handbook, they should visit nearby farm feed lots for technical assistance and use of materials and equipment.

5.3.3.4 Tools, Equipment, Supplies and Materials

- Feedstuff
- Animal feed mills
- Animal feed mixers
- Shovels

5.3.3.5 References

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5.3.4 Learning Outcome No 3: Produce or Procure Animal feed and feedstuffs

5.3.4.1 Learning Activities

Learning Outcome No 3: Produce or Procure Animal feed and feedstuffs	
Learning Activities	**Special Instructions**
3.1. Source propagation materials as per agro-ecological zone 3.2. Prepare land is as per planting material requirements 3.3. Establish propagated materials as per good agricultural practices 3.4. Manage fodder crops as per good agricultural practices 3.5. Harvest fodder crops as per maturity index and height	Identify different types of fodder crops in the farm. Illustrate how to prepare vegetative materials in groups

5.3.4.2 Information Sheet No5/LO3: Produce or Procure animal feed and feedstuffs

Introduction

The learning outcome covers land preparation, livestock feed and feedstuffs, types of feedstuffs, sources of livestock feeds, type of pasture species and their nutritive values, Pasture establishment and management, harvesting, range management and conservation of feedstuffs

Definition of key terms

Range management: It is the professional natural science that centres around the study of herbivores that could have resulted in altered ecological states.

Plant propagation: It is the process of growing new plants from a variety of sources (e.g.) seeds cuttings and other plan parts.

Fodder crops: They are crops that are cultivated primarily for animal feed.

Content/procedures/methods/illustrations

3.1. Propagation materials are sourced as per agro-ecological zone

Agro-ecological zoning (AEZ) refers to the division of an area of land into smaller units, which have similar characteristics related to land suitability, potential production

and environmental impact. An agro-ecological zone is a land resource mapping unit defined in terms of climate, landforms and soils and a land cover and having a specific range of potential and constraints for land mapping unit. The essential elements in defining an agro-ecological zone are the growing period, temperature regime and soil mapping unit. There are several systems of describing agro-ecological zones in the topic. In Kenya two are used:

- FAO classification for topic generally
- An order Kenya version which is only applicable in Kenya

Classification of Kenya Agro-ecological zone simple

Simple agro-ecological zones were established by Fao in 1981. They are suited to make decisions in international and long-term agricultural policies. In order to give advice to same districts, a move differentiated system showing yield probability and risks as well had to be developed.

Zone groups are temperature baits defined according to the maximum temperature limits within the crop in Kenya. The highest zone is high altitude for rough grazing (e.g.) tropical alp lined vegetation. The threshold value of annual mean temperatures has been established along similar lines but supplemented by limiting factors for crops.

Zone one

Annual average rainfall of over 350mm. The zone is divided into two areas

- Areas with an annual average rainfall of over 600mm where rainfall pastures can be grown successfully
- Areas with an annual average rainfall between 350mm to 600mm but not less that 300mm during two hinds of the monitored years and where it is possible to grow two successful crops every year. The main crops are Wheat, legumes and summer crops such as watermelon.

Zone two

Annual rainfall of 250mm to 300mm in not less than two hinds of the monitored years. It is possible to grow pastures every three years. Besides, the areas of the zone 2473000ha, forms 13.4 percent of the natural area

Zone three

Annual rainfall of 250 to 350mm with not less that 250mm during half of the monitored years. It is possible to grow crops incorporated with pasture crops especially legume pasture. The area of these zones 1306000ha accounts 7.1 percent of the total national area.

Zone four

A marginal zone between the available zones and the desert zone with an annual rainfall between 200 and 250mm and not less than 200mm during half of the monitored years. This area is suitable for permanent grazing. The area of it is zone,1823000ha forms 9-8 percent of the national area. This area is suitable for pasture production.

Zone five

Desert and steppe zone. This area covers the rest of the country and is not suitable for rained crops and pastures. The area of this zone is 10218000ha and accounts for 55.1 percent of the total nation area, there are some area in this zone adjacent to rivers which permits irrigated agriculture and natural rangeland. As rainfall decreases towards the interior it becomes desert.

In the desert areas only irrigated agriculture and nomadic grazing are possible in the steppe and native pasture systems, where the rainfall is below 200mm steppe occupies most of the land areas. It is too dry to crop, although at the wetter margin of the steppe there originally, it is characterized by ephemeral vegetation of very low productivity. Even the rainfall exceeds 250mm, it is native pasture that occupies land which are too steppe and where the disappeared due to overgrazing. Steppe land and native pasture are used primarily for the grazing of small ruminants and only rarely can it be supportive to livestock year-round. They are grazed mainly in winter and springs.

Selecting forage species

Forage grass and legumes performance vary depending on environmental conditions. The adaptation of a species on its potential longevity in the field is determined greatly by genetic, cold-hardiness traits and its tolerance of other site, soil and use conditions.

When selecting fodder crops the following factors may be considered that attract the suitability of fodder species

- Drought tolerance
- Soil pH level
- Fertilizer nutrients requirement
- Soil drainage
- Intensity
- Harvest or grazing

3.2. Land is prepared as per planting material requirements

Land is prepared depending on the method of saving an establishment. For example, either direct sowing of seeds, under-sowing and over-sowing on vegetative propagation.

Steps in seedbed preparation

The steps to properly prepare seedbed will result to more germination. A key to plants growth rests in the concept that there must be good seed to soil contact

The characteristics of a good seedbed are: depth of soil to depict 5 inches (12.7cm), adequate soil moisture and weed free. Each of these characteristics helps the seed to have the best chance to germinate and flourish.

The steps to obtaining a good seedbed include:
The soil to 5 inches (12.7cm) in depth.

i. Using a disk to carve though soil is especially beneficial when the disk is run though the soil twice with the second strip cutting perpendicularly to the first cut.
ii. Is the soil ploughed north south? The second disking would be east to west more thoroughly disturbing the soil.
iii. When ploughing, weed seeds are brought closer to the surface and with the closer contact with the sunlight and soil moisture they will germinate soon thereafter.
iv. After disking or ploughing a procedure will allow the weed seeds to germinate and use herbicides to indicate them.
v. The soil is disked to promote soil seed contact.
vi. Tilth to be acquired depends on the size of the planting materials.

3.3. Propagated materials are established as per good agricultural practices

General establishment and management of the seeds and pasture. There are three methods of pasture establishment

- Direct sowing
- Under-sowing
- Over-sowing

Direct sowing

It is the establishment of pasture grasses without a nursery or career crop. It consists of sowing seeds in a fine firm and weed free seedbed. Pasture should be sown in to land that has been under crop for 2 or more years for example Lucerne which is slow to germinate is often sown together with barley or oats (under-sowing). The barley or oats is then harvested early for silage or direct feeding to give room for the Lucerne to grow when it is ready

How to prepare seedbed

- On previously cropped land, plough the end of the proceeding dry season ploughing shortly before rain.
- On virgin land I ploughing and 2 harrowing may be required to make a good seedbed.

When and how to sow

i. Sow as early in the rainy season as possible. In bimodal rainfall area sowing is preferred in the short rains so that annual weeds are eliminated.
ii. Seeds should be sown close to the surface in order to contact with most soil so as to enhance germination. Seed should be deeply buried since initial vigor is not sufficient to push through a heavy cap of soil
iii. Grass seeds can either be broadcasted or disked in rows 30-40 cm apart
iv. Mix the seeds with sow-dust rough sand or phosphate fertilizer.

v. Sowing of the grass is effectively done with a wheat drill. Hand sowing is recommended for smaller averages where close supervision and attention in detail is possible

vi. Immediately after sowing the seedbed should be compacted to enhance germination of the grass seed by improving contact with the soil. This can be done by use of three branches or even by trapping by foot on small plots. In mechanized farms a roller can be used.

Fertilizer used at plating

Use phosphate fertilizer or farm yard manure at planting to promote strong root development

Over-sowing

(e.g.) non plough able land. The technique improves the quality of the natural pasture by introducing high quality herbage.

Over-sowing is done into way

- Overgraze the natural pasture field then broadcast to improve pasture species
- Overgraze the natural pasture field then harrow or ex-plough using a hard hoe and broadcast the improved species

3.4. Fodder crops are managed as per good agricultural practices

Good management practices are just as important as proper establishment techniques. Pasture establishment involves a considerable investment and returns depending on how effective the pasture can be managed and converted into milk or meat. It involves:

- Weed control
- Graze management
- Fertility management

Weed control

Weeds can reduce the productivity of the sown pastures particularly during the establishment year. Therefore, control weeds control during the first year by either:

- Hand weeding
- By the use of herbicide

In subsequent years, keep fields clean by slashing or hand pulling on moving weeds.

Grazing management

Grasses reach early flowering stage 3-4 months after planting. At this stage the plant is not firmly anchored in the soil and therefore, it is usually advisable to make hay rather than graze the pasture to avoid the risk of the cattle pulling out the young shoots

- If grazing must be done during the establishments, it should be light enough to enable the plants to establish firmly in the soil
- For maximum benefits use the pasture not later than the start of flowering stage. Graze or cut at an interval of 4-6 weeks leaving stubble height of 5cm
- Graze animal when the grass is at early flowering stage by moving animals from paddock to paddock

- One animal will need 1-2 areas of improved pasture per year in areas receiving over 900mm rainfall
- Conserve excess pasture inform of hay for dry season feeding
- If you are Zero-grazing your animal, note that an average sized dairy cow requires 80-100kg of fleshly cut grass per day
- A cow in mid lactation period produces on average 5-7 kg milk

Fertility Management

Many areas in Kenya show symptoms of deficiencies in the grass fields. Some of the common deficiencies are copper and selenium deficiencies but also nitrogen, phosphorous and potassium deficiencies. If your pasture does not look green and healthy during rainy season, it will pay to get a soil sample analyzed to see what is missing. Any deficiency can severely lower the production of pasture and cropland.

Importance of weeding

- Minimized the competition for moisture and nutrients thereby promoting early growth and vigor for the seedlings.
- Reduce the risk of fire
- Facilitates perception of water and soil accumulated heat released during the day.
- In forestry area, bare soil accumulates heat the day reaction in forest prone areas

Shoots when carrying out coppicing the following must be observed:

- The cut must be at angle
- The bank should not be damaged
- Only the best shoot should be left when arising from the new stump, when reaching an appropriate length of 1m
- Young copies should be kept weed free
- It should be done in the early season

Species suitable for judge production and being promoted by SDDP to contract farmers are not good at coppicing and might even die. If they are cut too low, they are most suitable for pollarding and side pronging species. Tree species used by SDDP, which can stand coppicing are; calendar and *L. leucocephale*. They are both low altitude species

Pollarding

It refers to cutting back of the crown at a height of 1.5 to 2m. The main purpose of pollarding is to remove the heaviest branches and leavers to stimulate growth of new palatable fresh leavers to get well formed productive crowns to reduce negative shading effects on the adjacent crops.

When pollarding is carried out maximize the production of fodder. Not all species can withstand pollarding. However, there are Species that can withstand pollarding and are promoted by SDDP.

Side pronging

This is the removal of lower branches from the tree. The steps involved are as follow

i. Seed improved species are mixed with fertilizer, broadcast on the overgrazed area at the rate of 10kg grass seed or 2-3 kg of legume seed unit 1-2 bags of missing rock phosphate per hectare
ii. Graze heavily for one or two days to ensure that seeds come in contact with soil due to cattle trapping
iii. Then remove the livestock from the field to allow new species to establish
iv. During establishment year, graze lightly to avoid grass being uprooted

3.5. Fodder crops are harvested as per maturity index and height

Harvesting of fodder

In the establishment of multipurpose trees for forage production it is critical to identify and use the most suitable species for adaptation for the difference agro ecological zone. Likewise, for high quality option yield of forage from planted fodder trees is proper harvesting techniques should be used so that the leafy portion is higher than the steamy portion in the biomass harvested.

Fodder crops need to be harvested timely and regularly for higher and sustainable yield. It must also be understood that there are different harvesting methods for the different fodder species.

- Coppicing

It is the cutting the stem or back of a tree at height of 10-50 from the ground to stimulate production of new crown. Its importance is;

a) Reduce shade on the agricultural branches
b) Harvest the branches for fodder fuel wood

In inter-cropping system side pronging should be done before or the beginning of the cropping season in order to minimize shade on the crop. Pruning should be done in a declining angle with a sharp stroke in order to allow water to run off and thus minimize the risk for fungal attack. The branches should be cut 2-3 cm from the stem. Pronging should be straight from the bottom and then move upwards in general a cutting height minimum 1.2-1, 5 m is recommended and they should be given a chance to get established properly before cutting.

Subsonic is best cut before it is a year old and should thereafter be cut at a height of approximately 1m. *Leucaena*, *Calandra* and *Tagasaste* should be cut at a height above 1.2m some experiments have however shown that *leucaene* produces most biomass when at height of 3m.

Conclusion

This learning outcome covered land preparation, propagation materials for feedstuffs, management of propagated materials and lastly harvesting of the materials in preparation for processing and storage**.**

Further Reading

1. OudaJO (2001). Feeding and caring of livestock in: Managing dry land resources. A manual for Eastern and southern Africa

4.3.4.3 Self-Assessment

Written assessment

1. Which one of the following is not a method of harvesting?
    a) Pollarding
    b) Copping
    c) Over-sowing
    d) Side pronging
2. The following are methods of a pasture establishment. Which one is not?
    a) Direct sowing
    b) Over-sowing
    c) Pronging
    d) Under-sowing
3. Which one of the following is not a factor to consider during selecting fodder crop?
    a) Soil drainage
    b) Soil pit level
    c) Water content
    d) Drought tolerance
4. Which one of the following is not a fodder crop management practice?
    a) Weed control
    b) Grazing management
    c) Water control
    d) Fertility management
5. Which of the following is not a necessity of weeding?
    a) Minimize competition
    b) Reduce fire risk
    c) increase fertility
    d) Facilitate water preservation
6. What do you understand by the term fodder crop?
7. Distinguish between forage and fodder
8. Name three methods of establishing fodder crops
9. Name two methods of harvesting fodder crops
10. What do you understand by the term pollarding?

Oral Assessment

1. Differentiate between cropping and pollarding
2. Give an example of crop housesit by pollarding

Case Study Assessment

Visit to the nearest pasture land in the surrounding farm. From the visit answer the following questions

i. Name type of pasture planted
ii. Methods used by farmers to harvest crops
iii. Types used for fodder management

Practical Assessment

5.3.4.4 Tools, Equipment, Supplies and Materials

- Feedstuff, rhizoid
- Panga
- splits
- Seeds
- Vines
- Stolon

5.3.4.5 References

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5.3.5 Learning Outcome No 4: Process Animal feedstuff

5.3.5.1 Learning Activities

Learning Outcome No 4: Process animal feedstuff	
Learning Activities	**Special Instructions**
4.1. Procure animal feeds ingredient as per type of feed to be formulated 4.2. Weigh. Ingredient proportions as per feed formulation formula 4.3. Mix ingredients as per feed formulation formula 4.4. Analyze feed as per standardization requirements. 4.5. Package Animal feeds as per market requirements 4.6. Store animal feeds as per occupation safety standards	Arrange for learners to visit a processing industry. Guide students in formulating animal feeds Demonstrate packaging on a video-ICT integration

5.3.5.2 Information Sheet No5/LO4: Process animal feedstuff

Introduction

The learning outcome covered include; types of animal feed processing, hay making, silage making, animal feed supplements and additives, livestock feed mixing equipment animal feed mixing technologies requirement, blending, product standardization requirement (KEBS), branding, animal feed storage structure and storage safety standards.

Definition of key terms

Hay: These are grasses, legumes or any other herbaceous plants that are dried to be stored for use as animal fodder.

Silage: This is grass or any other herbaceous fodder that are first compacted and stored in airtight conditions without 1st being dried and used as animal feed.

Blending: This is the activity of mixing or combining varied things together into one.

Additives: This is a substance which is added to something in small quantities to either serve as a preservative or for improvement purposes.

Feeding processing: This is altering the physical or chemical nature of feed commodities to optimize utilization by animals and to enhance mixing and stability of the diet.

Content/procedures/methods/illustrations

4.1. Animal feeds ingredient are procured as per type of feed to be formulated

Animal feeds should have high nutritional content and digestibility and should cater for all the animals needs through all the life stages. Thus, quality products especially ingredients should be selected for their appropriateness for the production system and even the bioavailability.

Feed ingredients are broadly classified into;

- Cereal grains
- Protein meals
- Fats and oil
- Minerals
- Feed additives
- Other raw materials e.g. tubers

Factors considered in selecting feed ingredients

- The absence of anti-nutritional of toxic factors
- Their palatability or voluntary feed intake
- The cost of the ingredients
- The nutrients the ingredients can store i.e. key nutrients to be supplied by feed ingredients are amino acids contained in proteins, vitamins, minerals and energy obtained from starches, lipids and proteins.

Process of procuring animal feed ingredients

This is done as per the types of feed to be formulated and usually quality of ingredients will vary.

Procedures involved in the process include;

i. First the buyer to set standards for ingredients to be purchased and list of reputable ingredient seller.
ii. Sampling the purchased ingredients periodically to ensure the ingredients are meeting specification.
iii. All incoming ingredients should be inspected and tags/labels feed for medication or trace minerals and other additives.
iv. Check the feed ingredients for any form of contamination i.e. Cu toxins should not be found in moldy feedstuff.
v. There should be a warranty included in purchase order showing suitability of an ingredient feed for use.
vi. All suppliers should have permit documents showing the type of product of the feed mill they belong to.

Transportation of procured feed ingredients

Suppliers or transportation personnel should be responsible and ensure that;

- All equipment should be cleaned before loading the feed

- No other materials should be in the truck, containers or other which could be hazardous.
- The conveyance process should be clean and free of materials that could affect animals or human health.

Types of animal feed processing

The major components of any diet, roughage and grain are the feeds that are to be processed.

Requirements for feed processing

- Processing methods should be based on mechanical, biological smoking, extraction precipitation and siltation.
- Water, ethanol, plants and animal oils, vinegar, carbon dioxide, nitrogen or carboxylic acids may be used for extraction.
- Filtration substances shall not be made of asbestos nor be permeated by substance which may negatively affect feed product.
- Irradiation is not allowed.

Feed processing facilities

This is to be managed throughout to avoid mixing without organic products or ingredients and maintain organic integrity.

Organic feed production lines must be separated from non-organic feed production line. Processed products are classified variedly; 100% organic, organic (not less than 95%, made with organic (at least 70%) salters/ less than 70% ingredients of certified origins which may not be called organic, but indication may appear on ingredients list.

4.2. Weighing ingredient proportions

This is done as per the type of feed formulation and the feed ingredients of plant and animal origin used in formulation of animal feeds with maximum inclusion of each feedstuff.

Expressing the Nutrients and Energy content

This is before weighing whereby it is expressed in forms of;

- **Dry matter (DM) basis**

This is the amount contained only in the Dry Matter portion of the feed ingredient without water.

Feeds contain varying amounts of Dry Matter, so composition and nutrient requirements are expressed on a Dry Matter basis for accuracy.

- **As fed basis**

This is amount entailed in the feed ingredient/diet as it would be fed to the animal including water.

- **Air-dry basis**

Usually assumed to be approximately 90% Dry Matter that most feeds will equilibrate to about 90% Dry Matter after prolonged anerobic storage. Air dry basis and as-fed basis may be the same for many common feeds.

- **Percentage dry matter**

Determined by drying a sample to remove all the moisture and then the weight of the remaining is expressed as a percentage of the original weight.

Example; 1.0g of corn is dried and 0.90g of corned remained after drying

Then % dry matter $=\frac{0.90}{1.00} \times 100 = 90\%$ Dry Matter

Conversion of as fed basis to Dry Matter basis can be converted by the formulae;

$$\frac{\text{Nutrients \% as fed basis}}{\text{\% Dry Matter in the expressed as a decimal fraction}} = \text{Nutrient \% on Dry Matter basis}$$

Or

$$\text{\% Nutrient (as fed basis)} = \frac{\text{\% Nutrient (Dry Matter basis)}}{\text{\% feed Dry Matter}} \quad 100\% \text{ Dry Matter}$$

Example;

Alfalfa silage analyzed to contain 7% cp an As- fed basis contained 40% Dry Matter. What would be the cp content on Dry Matter basis?

Method 1

$\frac{7}{0.40} = 17.5\%$cp on Dry Matter

Method 2

$\frac{7}{40} = \frac{x}{100}$ $x = 40x = 700 = 17.5\%$cp on Dry Matter

$x = \frac{700}{40}$

Dry Matter basis converted to as fed basis

Can be converted by;

Nutrient %on Dry Matter basis × %Dry Matter in the seed expressed as decimal fraction

Or

$$\frac{\text{Nutrient (as fed basis)}}{\text{\% feed Dry Matter}} = \frac{\text{\% Nutrient (Dry Matter basis)}}{100\% \text{ Dry Matter}} = \frac{\text{\% Nutrient (Dry Matter basis)}}{100\% \text{Dry Matter}}$$

*Calculate an example with trainer

Conversion to air dry basis

a) Dry Matter basis to air dry basis 90% Dry Matter

Nutrient % on Dry Matter basis ×0.90=Nutrient % on air dry base

b) As fed basis to air dry basis 90% Dry Matter

90 × Nutrient % on as fed basis =Nutrient % of air-dry basis

Amount in Dry Matter as in fed

A. Amount in Dry Matter= Amount in as fed × Dry Matter content (decimal)

B. Amount in Dry Matter= x (amount in as fed) ×Dry Matter content (decimal)

So, amount as in fed $= x = \frac{\text{Amount in Dry Matter}}{\text{Dry Matter content (decimal)}}$

Rules of thumb for converting

1. When converting from "as fed" to Dry Matter
    - The nutrient content will increase
    - The weight will decrease
2. When converting from Dry Matter to as fed
    - The nutrient content will decrease
    - The weight will increase

4.3. Mixing ingredients as per feed formulation formula

After weighing the ingredients, the next step is mixing which is an important process in the feed production process whereby with efficient mixing leads to solid feed production.

On mixing, the assessment of ingredients (formula)

- **Mixing technology**

Basically, mixing means to transport the individual particles to an exact position in relation to other particles and thereby avoid segregation.

It is important to mix the ingredients properly to achieve a good feed quality.

Optimum mixing of the feed ingredients will ensure uniform distribution of nutrients, vitamins and minerals which will result in a homogenous nutrient content in each feed pellet.

Characteristics of a good mixer

- Speed and quality; Customers prioritize fast and efficient mixer
- Mixer should be easy to clean and maintain
- Feed millers, a list of principles is to be followed i.e. type of feed formulation.

Sample diet formulation techniques

1. Formulating a diet with 2 ingredients

Can also be used for 2 mixtures rather than 2 ingredients

Common method i.e. Algebraic diet formulation using an equation

Pearson square method-a procedure

1. Using an equation with one unknown x

Example; Formulate 9.14% crude protein cp diet using corn (8.8%cp) and a protein supplement (38%cp) and also check results for accuracy

18% supplement =%

corn=100x

0.088 (100x) (1bcp from corn) + 0.38x (1bcp from supplement) =0.14 (1b cp in 1001b of diet)

8.8-0.088x + 0.38x=0.141

0.38x -0.088x=14-88

0.29x=5.2

x=17.8 (1b supplement)

100-x=82.19

=1B corn

=0.088 (82.19) + 0.38(17.81) = 14.00 accurate

Using Pearson square method

Methods;

- The desired solution is placed in Centre (1x)
- Feed sources A1 and B1 are then added
- To solve the difference between X and A goes in the D position and the difference between B and X goes into the C position without regard to sign.
- Then answer is expressed as

Corn 8.8%cp 24.0parts cm

14%

Supplement 38%cp 5.2 parts supplement

29.2 total parts

24.0 parts

29.2 total parts × 100 =82.19%corn

5.2 parts ×100 =17.8% supplement

29.2 parts total

Where; 8291b corn ×8.8%cp =7.231b cp

1781 lb. supplement ×38.0%cp=6.77cp

100lb in diet =14.00lb cp

Other methods include;

- Inducing a fixed ingredient
- Algebraic equation with two unknowns (x and q)

Then formulating a complete diet supplement and base mix which usually needs balance for important nutrients CA and CP.

Approaches to formulate a diet with only 2 ingredients can be used here.

Hay and silage making

Hay making is the process of forming seen and perishable forages into a product that can be safely stored and easily transported without danger of spoilage while keeping nutrient use to a minimum.

Suitable crops for making hay

These are crops with thin stems and more leaves. They are better suited as they dry faster than those with thick, pity and small leaves. Those common in Kenya are: oats, disodium, Lucerne, maize, sorghum, Napier grass, Rhode grass (according to KARI, Kenya).

Methods of hay making

i. Cutting the forage before it is fully matured to maximize its nutrient value and cut with as much leaf and little stem.
ii. Do not leave out forage in a moist environment, as this will enhance growth of mould.
iii. The cut forage is dried on sun out in as thin layer as possible, raked a few times and turned regularly to speed drying.
iv. They can also be chopped to fasten drying (drying takes 2-3 days)
v. After drying they should be stored in form of bales

Silage making

Silage is the material produced by controlled fermentation under anaerobic conditions of chopped crop residues or forages with high moisture content.

Ideal characteristics of materials used in silage making

Moisture content of 60-70%

PH below 4.2 for net crops and below 4.8 for wilted silage. Species of grasses used: Napier grass, sorghum, maize and sugarcane tops.

Advantages of silage

Helps ease feed shortages during dry season

Adequate seed is available all year found hence the animals will remain in good health

Silage is made using better wilted silage materials and increases animal productivity.

Methods of silage making

i. The crops should be ready to harvest i.e. the seed of forage sorghum/maize should be soft not milky when you squeeze and one that opens. Napier needs to be about 9 meter high.
ii. Legumes should have pods which are not dry
iii. If it has been raining and the forage is wet or if the forage is seen immature, then best to harvest and leave it in the sun for a few hours to wilt (too much water in the forage can spoil).
iv. The chopping and bagging area of silage pit must be clean and ready for the forage
v. Ensure proper compaction whether pit or bag silage
vi. Seal the silage material and make sure the seal is airtight. (silage is formed through anaerobic fermentation by microorganisms)
vii. Carefully and step by step open a small portion of the silage when needs arises for feeding and seal the remaining silage immediately after removal.

In Kenya the common methods of silage making are;

- French/pit silos; Built underground or semi underground
- Plastic bag silos

4.4. Analyze feed as per standardization requirements

This is a comprehensive activity involving testing of the feeds to ensure they meet the standards and to keep animals healthy while ensuring that suppliers/manufacturers and users are compliant.

Standardization requirements in Kenya is done by KEBS who inspect and validate.

Requirements

People involved in supply livestock feed need to know that the right nutrients are included in the right quantities.

Also, vital that seeds don't exceed maximum allowed number of mycotoxins, veterinary drugs, pesticides and other chemical contaminants.

Then, the process involves testing by accredited testing laboratories involving;

- Comprehensive animal feed inspection
- Analysis
- Testing service to ensure the product doesn't endanger health of animals or humans.

Importance of analyze and testing animal feeds

- Knowledge in ingredients through testing is vital as it makes farmers have an idea of the nutrient requirement.
- Lab analysis is an influential aspect of quality control
- To check for adulterated seed ingredients and contaminants that might seriously affect the feed quality and animal productivity.
- Testing and analysis enhance accurate feed analysis and promote feed quality.

Branding

Animal seeds are becoming more relevant brands where the animal feed industry has a role in feeding the world. So, manufacturing industries dealing with animal feeds need to maintain quality brands for profit i.e. Cooper K. Brand Ltd whereby a good brand is a great marketing strategy.

Advantage of having a strong brand in seed industry

- A strong brand creates a personality for the product
- Helps differentiate a product from competitors
- Branding can help small businesses increase and retain market share and launch new products.
- Also, important in maintaining profitable pricing levels.

4.5. Packaging Animal feeds

This is done as per market requirements including;

- Packaging methods and materials must protect the nitrogen of organic feed and have no adverse effects on the environment.
- Biodegradable, recycling, reusable systems and eco-friendly packaging shall be used

- Materials used for packaging shall not contaminate animal feed
- Packaging materials, containers and storage containing or treated with synthetic chemicals or prohibited substances must not be used
- Recycled packaging materials or containers that had come in contact with substances that may compromise the organic integrity of organic feed must not be used
- The packages shall be closed in such a manner that substitution of the content cannot be achieved without manipulation or damaging the seed.

Advantages of packaging feeds

- Protects the product
- Help keep the product from going bad
- Decreases costs
- The packages help inform on the product i.e. trade name and quality e.g. 100kg
- Packaging provides hygiene as it is a preventive measure

Labeling

After all the organic processed animal feed, they shall be labelled as per requirements.

4.6. Storing animal feeds as per OSH

Animal feeds should be stored in proper well-designed storage structures. Factors which affect quality and weight feedstuff during storage include;

- Losses due to human theft, fire and consumption of scavenging animals i.e. rats.
- Damage due to rain, condensation and to high temperatures
- Damage by insects
- Damage by fungi
- Changes in quality of feeds due to enigmatic actions and the development of oxidative rancidity.

General recommendations for storage

1. Provide a building for storage which is secure and can be adequately locked
    - Ensure that its roof will protect from rain and surface water cannot enter the store
    - Provide it with ventilation points (windows)
    - Orient the building so that one of the long sides faces the prevailing wind
    - Ensure all the entry points are moved to prevent entry of birds, rats etc.
2. Do not accept deliveries of raw materials which are visibly damaged or moldy or inserted with insects.
3. Do not overstock the quantity
4. Always keep the store clean; floors and walls should be regularly swept
5. Arrange your store so that new deliveries are not put in front of old stock
6. Make small shed to control heat generator

7. Ensure that ingredients are clearly and indelible labelled so that in drawing correct ingredients is drawn.
8.Do not walk on the stock of compounded feed unnecessarily; this will break pellets on surface.
9.Do not allow stocks to reef against the outer walls of the store; leave a space between the stocks and wall.
10.Do not allow staff to sleep or eat food in the store and preferably not to smoke

Conclusion

This learning outcome covered process of animal feedstuff which included various activities such as Types of animal feed processing hay making, silage making, animal feed supplements and additives, livestock feed mixing equipment animal feed mixing technology requirement among others.

Further Reading

1. Wu, G (2017) principle of Animal nutrition CRS Press
2. Animal institution handbook let formulation and common feed ingredients D. Rustin sullistian page 573, section 18.

4.3.5.3 Self-Assessment

Written assessment

1. Grasses or other herbaceous plants cut and dried to be stored for use as animal fodder
    a) Silage
    b) Hay
    c) Additives
    d) Plants
2. Silage and hay can be prepared and stored for future use
    a) True
    b) False
3. Which of the following is not a seed ingredient
    a) Cereal grains
    b) Protein meals
    c) Hay
    d) Feed additives

4. The following are factors considered in selecting feed ingredient. Except one?
    a) Palatability
    b) Cost
    c) Nutrients
    d) Bio availability
5. Ingredients and nutrients can be expressed in dry matter basis and fed basis method only
    a) True
    b) False
6. Which of the following is a rule of thumb conversion
    a) When concerting from as fed to Dry Matter the weight will decrease
    b) When converting from Dry Matter to as fed the weight will decreases
7. Which one is not characteristics of a good mixer
    a) Size
    b) Speed
    c) Easy to clean
    d) Quality
8. List factors considered in selecting feed ingredients.
9. Give procedures involved in procuring animal feed
10. Highlight the role of thumb for conversion
11. Give the importance of analysis of seed
12. State 5 requirements for storage of seeds

Oral Assessment

1. What are the common ingredients as per seeds?
2. Which requirements are required when packaging animal seeds?

Case Study Assessment

Trainees to visit an industry dealing with processing animal fields and familiarize themselves with all the activities undertaken and then they write a report.

5.3.5.4 Tools, Equipment, Supplies and Materials

- Feed mixers
- Shovel
- Silage bags
- Hay bailers
- Masking tapes
- Animal feed store

5.3.4.5 References

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