Dairy production

Level-II

Learning Guide-27

Unit of Competence: Identify and Organizing Dairy Animal Feed Resources

Module Title: Identifying and Organizing Dairy Animal Feed Resources

LG Code: AGR DRP2 M07 LO1-LG-27
TTLM Code: AGR DRP2 TTLM 1219v1

LO1: Recognize nutrients and nutrient requirements of dairy animals

Instruction Sheet	Learning Guide 27

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Identifying and recognizing the source of nutrients for dairy animals
- Identifying and recognizing production of dairy animals
- Identifying and recognizing the consequence of excess and deficiency of nutrients in dairy animals.
- Recognizing the concept of dry matter.

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, **upon completion of this Learning Guide, you will be able to**:

- identify and recognize the source of nutrients for dairy animals
- Identify and recognize production of dairy animals
- Identify and recognize the consequence of excess and deficiency of nutrients in dairy animals.
- Recognize Learning Instructions

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 5.
3. Read the information written in the information Sheets (1, 2, 3 and 4) in page **3,7,11, and 14** respectively
4. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them
5. Accomplish the “Self-check 1, 2, 3 and 4” **in page -6, 10, 13and 15** respectively.

Information Sheet-1	Identifying and recognizing the source of nutrients for dairy animals

1.1. Introduction to feeds and feeding

The dairy feeding program affects productivity and profitability more than any other single factor. The effects of good breeding and management programs cannot be fully realized without good feeding programs. Likewise, good management of cows with good genetic potential will result in the most efficient response to good nutrition.

Feeding for high milk production is efficient since the nutrient requirement for maintenance comprises a smaller portion of the total requirement of high-producing cows

Feed resources

Under the conditions that prevail in developing countries, poor-quality feed (of low digestibility and low nutritive value) is one of the major factors limiting dairy production. Dairy animals are often fed on fibrous feeds – mainly crop residues and low-quality pasture – which are deficient in nitrogen, minerals and vitamins.

Small-scale milk producers in developing countries generally use locally available feed resources, such as natural pastures, crop residues, cut-and-carry grass, forage crops and local feedstuffs (including agro-industrial by-products). Communal grazing of livestock is a common practice throughout developing countries. Grazing fields often lack conservation practices and are of poor nutritional quality.

1.2. Function of nutrients for dairy animals

Feeding dairy cows for efficient production involves supplying the five classes of nutrients in proper amounts. These include

1. **Energy**

The so-called energy contents of a feedstuff can be subdivided into two groups: Carbohydrates and Lipids (fats) Dairy cows demand a large supply of energy for maintenance, milk production, reproduction, growth, and weight gain. High producing cows usually cannot consume enough feed during early lactation to meet their requirements. The energy deficiency is made-up by converting body fat to energy. However, this loss of body weight should be kept to a minimum to avoid metabolic disturbances.

The main sources of energy are provided by carbohydrates and fats. Protein can be metabolized for energy, but it is an expensive source of energy. The carbohydrates of feedstuffs include starch, simple sugars, and cellulose in the crude fiber.

2. **Protein**

Proteins are the building blocks in an animal. Protein is needed for growth, maintenance, reproduction and lactation. In general, every animal must have a constant supply of protein in order to remain healthy. A shortage will result in small calves at birth and/or slow-growing young stock (retarded growth). Other effects due to shortage of protein are:

- Low milk production
- Less protein in the milk
- Loss of body weight in (early) lactation
- Increased risk of infections and metabolic diseases
- Low fertility (longer calving interval)

3. **Minerals:**

The major minerals not adequately supplied by most feedstuffs are (1) calcium, (2) phosphorus, and (3) salt. In certain localities, magnesium may need to be supplemented and rations containing extremely large amounts of grain and small amounts of forage may need supplemental potassium. Calcium and phosphorus are necessary for maintenance, milk production, reproduction, and growth. Most rations will require supplementation with calcium and phosphorus.

Consequences of a shortage of minerals can be:

- Low fertility
- Poor growth
- Diseases
- Deformation of the skeleton
- Low production

4. **Vitamins**:

With the exception of vitamins A and D, the other vitamins needed by dairy cows are generally believed to be present in adequate amounts in normal feedstuffs or are manufactured in adequate quantities by microorganisms in the rumen.

Vitamins are indispensable, but the animals need them only in very small quantities. The most important vitamins are:

- Water soluble vitamins(B complexes and C)
- Fat soluble vitaminsadequate.(A,D,E and K)

5. **Water:**

Although not thought of as a nutrient, large quantities of water are required by dairy cows for normal metabolic functions. Depending upon the temperature and the moisture content of feed stuffs, dairy cows will consume from 3 to 5 pounds of water for each pound of milk produced.

Dairy cattle require water for:

- Chewing and swallowing (saliva)
- Transport of nutrients around the body
- Formation and maintenance of body tissues
- Disposal of waste products
- Regulation of the body temperature
- Milk production

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Mention the five classes of nutrients provided for dairy cows for efficient production. (5points)
2. Mention why dairy animal require water. (6points)

Note: **Satisfactory rating – 11 points** **Unsatisfactory - below 11 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

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Information Sheet- 2	Iidentifying and recognizing production of dairy animals

2.1. **Introduction of production of dairy animals**

A dairy is a business enterprise established for the harvesting or processing (or both) of animal milk – mostly from cows or buffaloes, but also from goats, sheep, horses, or camels– for human consumption. A dairy is typically located on a dedicated dairy farm or in a section of a multi-purpose farm (mixed farm) that is concerned with the harvesting of milk.

Milk producing animals have been domesticated for thousands of years. Initially, they were part of the subsistence farming that nomads engaged in. As the community moved about the country, their animals accompanied them. Protecting and feeding the animals were a big part of the symbiotic relationship between the animals and the herders.

In the more recent past, people in agricultural societies owned dairy animals that they milked for domestic and local (village) consumption, a typical example of a cottage industry. The animals might serve multiple purposes (for example, as a draught animal for pulling a plow as a youngster, and at the end of its useful life as meat

With industrialization and urbanization, the supply of milk became a commercial industry, with specialized breeds of cattle being developed for dairy, as distinct from beef or draught animals. Initially, more people were employed as milkers, but it soon turned to mechanization with machines designed to do the milking. Traditionally the cow, or cows, would stand in the field or paddock while being milked. Young stock, heifers, would have to be trained to remain still to be milked. In many countries, the cows were tethered to a post and milked.

2.2. Identifying and recognizing physiological states of dairy animals and their need of nutrients

The nutritional requirements for dairy can be subdivided as follows:

1. Maintenance
2. Production
   - Growth
     - ✓ to reach maturity
     - ✓ during lactation to reach majority
     - ✓ to improve condition
   - Pregnancy
   - Milk production

1. Maintenance requirement

Nutrients are used to keep the body in good health and to maintain its temperature without Body weight gain/loss. The nutrient requirements for maintenance depend on the bodyweight and the feeding system. The bodyweight of an animal can be "measured" by weighing, measuring and observation.

2. Production

Production is divided into **growth, pregnancy and milk production**.
The body condition of a cow can be estimated by the "condition-scoring" system. Judgment is based on the appearance of the tail head (fat deposits or lack of it) and indicated by a score from 0-5

2.1. Growth, to reach maturity

Growth allowance depends on the policy of age at first calving (required growth rate per day) and consequently required bodyweight at age of first service.

a. Growth allowances during lactation till maturity

In animals calving for the first time at ± 24 months of age, the development of the body continuous. Maturity is normally reached at the end of the second lactation (at an age of ± 4 years). The extra nutrients required for continued growth (growth allowance) till maturity for these animals are:

- during first lactation: 600 FUM and 80 DCP extra per day
- during second lactation: 300 FUM and 40 DCP extra per day

If an animal calves for the first time at 36 months, an extra growth allowance is only required during the first lactation until the animal reaches maturity at 4 years of age. This growth allowance during this first lactation is 10 % of the total maintenance requirement.

The growth allowances during lactation come on top off normal maintenance and production requirements.

b. Growth to improve condition

Due to the energy-gap (negative energy balance) incurred during early stage of lactation, causing loss of condition, requires regaining of bodyweight. This loss of bodyweight is to be gained during the middle and late stage of lactation and possibly during the dry period.

2.2. Pregnancy Allowance

It is common to include some extra nutrient allowance during the last two months of pregnancy (months 8 and 9). Fetus development (including fluids and placenta) is ± 20 kg at 7 months, 35 kg at 8 months, and 65-70 kg at 9 months. In lactating cows, this pregnancy allowance will coincide with the dry period after the previous lactation (last two months before calving). The amount for pregnancy-allowance depends on the condition of a cow after completing her lactation.

2.3. Nutrient Requirement for Milk Production

The total amount of nutrients required for milk production depends on the actual or desired amount of milk production in kg/day and on the quality of the produced milk (butterfat %).
The requirement per kg milk with 4 % fat is:

- 0.37-0.41 kg DM
- 460 units FUM
- 63 gram DCP

NB. DM- Dry matter
FUM- Food unit milk
DCP- Digestible crude protein

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1.Mention the subdivision of nutritional requirements for dairy animals at different physiological stages (5 points)

2. List some common dairy animals in the world (4 points)

Note: **Satisfactory rating – 9 points** **Unsatisfactory - below 9 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date _____

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Information Sheet-3	Identifying and recognizing the consequence of excess and deficiency of nutrients in dairy animals

2.1. The consequence of excess of nutrients in dairy animals

As mentioned before, feed/nutrient requirements of dairy animal depend on the condition of the animal. The present tendency is to bring animals in good condition during the late stage of lactation, as apparently the development of body reserves during lactation is much more efficient than during the dry period. The old approach of "*steaming up*", giving extra concentrates during

the last 3-5 weeks before calving, is now considered to have negative effects by having animals too fat at time of calving. Bringing the cow in a too fat condition before calving is:

1. Costly(not economical), wastage of feed and
2. Has many negative effects on health and production capacity of the cow.

A (too) fat condition at calving time should be avoided, as this may have the following Consequences:

- Difficult birth
- Lower feed intakes
- Diseases like retained placenta and metritis
- Oedematic conditions
- Milk fever

Overfeeding during the last month of pregnancy is costly in terms of money, potential production performance, health and fertility during the early lactation and subsequently affects the total lactation performance. It is wiser to save on concentrates during the dry period, preventing an animal from becoming too fat and spend extra money on concentrates during the period of early lactation as to "guide" the cow to a high peak yield (and thus a high lactation yield).

2.2. The consequence of deficiency of nutrients in dairy animals

Underfeeding during the dry period (condition score below 3) will result in a low yield during the next lactation. This can not be corrected any more during the lactation period. Requirements for peak milk yield are already in excess due to intake capacity. Underfeeding or unbalanced feeding can also disrupt the breeding cycle (lowered fertility status during early lactation) and influence the health of an animal, both directly and indirectly, by reducing its resistance against infections and stress. A lower peak yield will result in a lower lactation yield, as will be discussed later in this chapter. The aim is to reach a body condition score of 3-3½ at calving for maximum health, production and fertility status

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is the impact of overfeeding during the last month of pregnancy.(4 points)

Note: **Satisfactory rating – 4 points** **Unsatisfactory - below 4 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

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Information Sheet-4	Recognizing the concept of dry matter.

4.1. Dry Matter (DM)

All valuable feed substances are contained in the DM. If the DM% in a feed is known, it is possible to calculate how many kg DM an animal obtains from the feedstuff (and how many kg concentrate is needed as a supplement according to the norms for the production level).

The DM of a feedstuff can be divided into two groups:

4.1.1. Organic Matter (OM)

4.1.2. Inorganic Matter (IOM)

A. Organic Matter (OM)

This in a feedstuff consists of:

- Nitrogenous compounds = Crude Protein (CP) *
- Nitrogen-free compounds = Energy

B. Inorganic Matter (IOM)

IOM is also called ash. IOM content is determined by burning samples until no carbon is left. A high level of ash in a sample often indicates contamination with soil. For example, over 10% ash in roughage (silage) or concentrates indicates soil contamination or adulteration with e.g. chaff. Ash contains the minerals. Minerals are very important for building-up the body as in the bones and teeth. Minerals are needed as a part in proteins to make-up the soft tissues of the body. Furthermore, numerous enzyme systems and osmotic regulation of the body require minerals.

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Mention the division of feedstuff DM content and explain them briefly. (4 points)

Note: **Satisfactory rating – 4 points** **Unsatisfactory - below 4 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1

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References

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Dairy production

Level-II

Learning Guide-28

Unit of Competence: Identify and Organize Dairy Animal Feed Resources

Module Title: Identifying and Organizing Dairy Animal Feed Resources

LG Code: AGR DRP2 M07 LO2-LG-28

TTLM Code: AGR DRP2 TTLM 1219v1

LO2: Identify and assess pasture and forage feed resources

Instruction Sheet	Learning Guide 28

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Identifying and assessing pasture and forage.
- Identifying and recognizing fodder crops of dairy animals feed resources.
- Identifying and determining crop and crop residues

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, **upon completion of this Learning Guide, you will be able to**:

- identify and assess pasture and forage.
- identify and recognize fodder crops of dairy animals feed resources.
- identify and determine crop and crop residues

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 5.
3. Read the information written in the information Sheet (1,2, and 3) in page3, 5 and 9 respectively .
4. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
5. Accomplish the “Self-check 1, Self-check 2 and Self-check 3” **in page -6, 8 and 11** respectively.

Information Sheet-1	Identifying and assessing pasture and forage

Definitions

Grassland: - is defined as a natural land surface covered mainly by plants of grass family, herbaceous legumes and other herbaceous species (could be either natural or artificial).

Pasture: - is a land occupied by perennial or annual forage species that are used as food by grazing animals.

Forage: - Fresh plant material used as feed for domestic herbivores. Forages can be broadly classified in the two Grasses and legumes

Grasses (Pasture)

Generally, grasses and its products is the main supplier of roughage in most countries with an advanced dairy-farming system. Pasture (grasses) provides a basis for dairy-production. They are abundantly available and with their good quality (usually) the cheapest source of food for cattle. Unfortunately, the quality of grasses in development countries can be rather of poor quality. The availability may be limited due to land pressure (first priority is to provide staple food for human nutrition) and/or high production costs.

The poor quality is mainly due to:

1. Type of grass (varieties, species). Tropical grasses and natural grasses in temperate climates have often a lower protein content and the CF contents is (much) higher than in well managed special selected temperate grasses.
2. Maturity is usually reached earlier and flowering may be continuous, also due to climatic and soil factors.
3. Quality of grass is affected by management factors, such as:
    i. Fertilizer input. Low or non N input results in lower CP contents and lower quantities of product.
    ii. Stage ad method of harvesting. Late harvesting (over-mature) provides more bulk but the product will be of poor quality (CF).
4. Method of conservation. Usually, warm and humid climates provide a rather poor environment for conservation (hay making, silage making), while similar factors contribute to losses during storage (mould due to moisture).

All in all, the net result often is a rather poor quality and yield. Grasses and its conserved products do have often a much lower digestibility and feeding value.

Growth habit of grasses

- **Tufted** - A cluster of single shoots arising from a single crown (*Panicum maximum*). The culms of tufted grass species may grow erect, in a decumbent fashion (curving upwards), semi-erect or semi-decumbent. The stems can even lie flat on the ground for some length.
- **Creeping** - Stems trail over or grow underneath the ground (e.g. *Cynodon* species).
- **Scrambling** - Most climbing plants are normally creepers but the stems will grow upward and over upright objects (e.g. *Pennisetum clandestinum*).

Legumes

Legumes are dicotyledons with their embryo's containing two seed leaves (cotyledons). The roots of many leguminous plants become infected by bacteria of the species Rhizobium. These bacteria grow and multiply forming growths within the roots called nodules. The nodules differ in size, shape and arrangement on the roots.

The summarized 3 main functions of legumes are:

- To provide a nitrogen rich component to animal diets;
- To improve soil fertility;
- To stimulate growth of associated species (i,e, in multi or inter-cropping systems).

Examples: Annual: cowpea, cluster bean, desmodium
Perennial: lucerne, desmanthes

Growth habit of legumes

1. Bush type

The bush type is typified by a central stalk with side branches appearing along the main stem. Axillary branches also develop. Eg. Desmodium tortuosum.

2. Bunch type

A typical bunch type plant consists of a single crown from which several stems and new tillers arise. It is difficult to identify the main stem. Stems can be erect or decumbent. Eg Stylosanthes guianensis and Medicago sativa.

3. Creeping

Creeping stems of the creeping type trail over the ground surface. Some examples include Calopogonium mucunoides, Macroptilium atropurpureum and some Vigna species.

4. Scrambling

The scrambling type is typified by creeping plants, climbing and growing over upright objects. Examples are *Centrosema pubescens* and *Pueraria phaseoloides.*

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are growth habits of grasses? (3 points)
2. List growth habit of legumes (4 points)
3. List some advantages of legumes over that of grasses. (3 points)

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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Information Sheet-2	Identifying and recognizing fodder crops of dairy animals feed resources

2.1. Fodder Crops

The most common fodder crops are: roots, beets, carrots, cassava, turnips, swedes, mangolds, tubers (sweet potatoes + vines, potatoes), fodder grains (maize, sorghum, oats, rye) and Brassica species (kale, cabbages, rape). The main advantage of these fodder crops is, that they are capable of producing high yields per/ha, often during periods when other roughage (grass) are in short supply. Frequently they are produced on irrigated land and can be fed fresh or conserved (maize silage), while some products can be relatively easy stored (tubers, roots).

Roots, tubers and Brassica species have a low DM% (10-20%) and are relatively rich in energy, supplying nutrients like starches and sugars. Their CF content is low which results in a high digestibility (and palatability). Their protein content is generally low, as well as their Mineral/vitamin contents with the exception of carrots, which are rich in vitamin A.

Fresh/green fodder crops provide a welcome component in a diet, especially where dried roughage and concentrates are prevailing. Care should be taken with the laxative effect these fodder crops generally have, which may cause diarrhoea (introduce gradually) and may depress the fiber digestibility of other components of the ration.

Fodder grains can give high yields: relatively energy rich roughage per unit land. The feeding value depends largely on the quantity and maturity of the seeds included. Sometimes, seeds are harvested for human consumption. This reduces the feeding value of the remaining plant. The protein content is relatively low. Maize is an excellent product for silage making, sorghum can provide several cuts of fresh material (irrigation and cutting at immature stage).

Sorghum should not be grazed during the first 3-4 weeks after cutting. Sorghum may contain a rather high amount of prussic-acid in the young stage, causing poisoning (death).

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Mention the most common fodder crops used in dairy feeding. (6 points)

Note: **Satisfactory rating - 6 points** **Unsatisfactory - below 6 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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Information Sheet-3	Identifying and determining crop and crop residues

3.1. Type, Feeding Potential & Limitations of Crop Residues.

Crop residues are by products of grain, pulse & cereal crop production, which can be used as animal feed. These include Stover's, cobs, hulms, etc.

They are characterized with high fibre and lignin contents. But they are low with CP, calcium & phosphorus contents. Characteristically, they are believed to be low in their digestibility.

The low degree of digestibility of crop residues together with their low passage through the alimentary canal results in low voluntary intake. These conditions seriously limit the availability of net energy for production.

The potential for use of crop residues as livestock feed is greatest in crop – livestock farming system (mixed farming system). Because the availability of these materials are closely related with crop production and intensity of crop cultivation.

Although Ethiopia produces large amount of crop residues that can be used in supplementing animal diets, many of these by products are not efficiently utilized for livestock feeding. This is mainly due to the fact that adequate nutrient evaluation of crop residues has not been carried out & their economic benefits have not been realized.

Detailed inventory of crop residues and their identification does not exist in Ethiopia. However, a rough estimate of the amount of crop residues produced annually could be made from grain yields. This is possible by converting the grain yields of various crops in to the amount of crop residues produced using correction factors.

2. Nutritional Characteristics of Crop Residues

- **Low nutritive value:** they are generally characterized by low nutritive value in that they have very low CP content & low digestibility.
- **Bulkiness:** the bulky physical nature of crop residues does not allow easy pass through the alimentary canal & this results in lower voluntary intake.
- **High fibre content:** the high fibre content of crop residues makes much of digestible carbohydrates that are found only in small amount not easily available.

3. Factors affecting the Nutritive Value of Crop Residues

- Species Difference: Crop residues produced from different species crops have different feeding values. For example, course straws such as from millet, sorghum or maize are generally of better quality than the fine straws such as from wheat or rice.
- Environmental Condition: conditions under which the crops have been grown have an effect on the quality of the crop residue.
- Fertility of the Soil: Fertile soil increases the quality of crop residues.
- Stage of Maturity: Plant species that remain vegetative either because of low temperature or genetic factors are almost always less lignified than those plants that develops to flowering stage under similar environmental conditions.

4 - Improving the Nutritive Value of Crop Residues

To increase the nutritive value of crop residues, different treatment techniques are used.

- Mechanical Treatment: this involves chopping, grinding, pelleting and chaffing in order to reduce the size of the crop residue.
- Soaking of Straws: is also another method (physical) where straw when soaked for few hours before feeding (1 kg of straw in one kg of water) is believed to have a beneficial effect through removal of dust. At the same time the straw becomes soft. However, soaking of straws results in reduction of the dry matter.
- Biological Treatment: this is a treatment using enzymes and bacteria to decrease the degree of lignin in the feed. But this is not a common practice in Ethiopia.
- Chemical Treatment:
  - ✓ Alkali Treatment of Straws: eg. NaOH
  - ✓ Urea Treatment

This two treatments will be explained in detail in level III.

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Crop residues are by products are by products of _____, _____. and _____. (**3 points**)
2. Describe the Nutritional Characteristics of Crop Residues.(**3 points**)
3. Mention factors affecting the Nutritive Value of Crop Residues.(**4 points**)

Note: **Satisfactory rating – 10 points** **Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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Dairy production

Level-II

Learning Guide-29

Unit of Competence: Identify and Organize Dairy Animal Feed Resources

Module Title: Identifying and Organizing Dairy Animal Feed Resources

LG Code: AGR DRP2 M07 LO3-LG-29

TTLM Code: AGR DRP2 TTLM 1219v1

LO3: Identify dairy animal Supplementary feed resources

Instruction Sheet	Learning Guide 29

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics:

- Recognizing concentrate feeds for dairy animals.
- Knowing sources, utilization and consequence of their over and under feeding.
- Identifying and assessing dairy animals energy source concentrate feeds
- Identifying and assessing dairy animals protein source concentrate feeds
- Identifying and recognizing mineral and vitamins for dairy animals,
- Identifying and assessing Dairy animals feed additives
- Assessing Mixed feeds

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, **upon completion of this Learning Guide, you will be able to**:

- recognize concentrate feeds for dairy animals.
- know sources, utilization and consequence of their over and under feeding.
- identify and assessing dairy animals energy source concentrate feeds
- identify and assessing dairy animals protein source concentrate feeds
- identify and recognize mineral and vitamins for dairy animals,
- identify and assess Dairy animals feed additives
- Assess Mixed feeds

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information Sheet (**1, 2, 3,4,5,6 and 7**) in pages **3, 6, 9, 13, 16,20 and 22** respectively.
4. Accomplish the Self-check (1, 2, 3, 4, 5, 6 and 7) **in page 5, 8, 12, 15, 19, 21 and 24** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 ” **in page 25.**
6. Do the “LAP test” **in page – 26** (if you are ready).

Information Sheet-1	**Recognizing concentrate feeds for dairy animals**

Introduction

Concentrates (also mixed feeds, compound feeds or concentrate mixtures) play an important role in modern dairy cattle feeding. Usually, as a basis of most dairy production systems, concentrates are used as a supplement to roughage. Although a specific ingredient can be called *concentrate*, practically it is a mixture of several ingredients mixed in a way as to cover requirements (energy, proteins, minerals and vitamins) of an animal at the least possible costs. The quantity and proportion of ingredients can vary (economics!), but the feeding value of a final concentrate should be kept constant according the requirements

1.1. Concentrate feeds

Concentrates are nutrient-rich feeds – they provide far more nutrients (energy and/or protein) than an equivalent amount of bulk forage. They include compound feeds manufactured by milling companies, such as dairy meals, cubes and pellets, as well as single ingredients, such as brewers' waste, maize germ meal or molasses.

Concentrates differ from supplementary forages in two main ways: they usually have little or no fibre and also usually have a higher dry matter content.

Advantages of concentrates:

- Supply concentrated nutrients.
- Contain very little fibre.
- Have high dry matter content.
- Are palatable (cattle like to eat them) and easy to digest

Disadvantages of concentrates:

- Are expensive.
- Quickly break down in the rumen forming acid which can prevent effective digestion of forages.
- Can cause health problem if too much is eaten, for example where concentrates form 60 to 70 per cent (dry matter) of a ration or more than 14 kilograms is fed per day

Concentrates are mainly derived from the following sources:

1. Cereal grains
2. Pulsus
3. Other seeds & parts
4. By-products from agricultural industries:

- ✓ Oil industries, like *cakes*
- ✓ Milling industries, like *bran*
- ✓ Sugar/alcohol/fruit industries, like *citrus pulp*, *beet pulp*, *brewers grain*

5. Animal products
6. Industrial feedstuffs

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Mention the sources of concentrates from which they are mainly derived from.(**6points**)
2. List down the advantages of feeding dairy cows concentrate.

Note: **Satisfactory rating - 6 points** **Unsatisfactory - below 6 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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Information Sheet-2	Knowing sources, utilization and consequence of their over and under feeding

As mentioned in the previous topic, concentrates (also mixed feeds, compound feeds or concentrate mixtures) play an important role in modern dairy cattle feeding. Usually, as a basis of most dairy production systems, concentrates are used as a supplement to roughage.

The Necessity for Concentrates

In high yielding dairy cattle, it is very difficult (or impossible) to meet nutrient requirements for maintenance and (high) production from only roughage. Poland experiences a constraint in production and utilization of roughage (in aspects of quantity, quality and economics). The digestibility of roughage is often low. This depresses the DMI. The quantity may be limited, and causes an increased demand and/or quality of concentrates. High yielding dairy cows need a better quality diet (tighter protein: energy ratio) than low yielding animals.

More and better quality concentrates are necessary when:

- Roughage is of lower quality and/or is offered to a limited amount
- The animal produces more

Concentrates, as their name implies, are feedstuffs with a high energy and/or protein content per kg and a high digestibility (> 70%), and are consequently very suitable to increase the overall nutrient concentration of the ration. If the use of high amount of high quality concentrates is financially attractive depends on the economic context, in which the dairy production takes place (milk prices, subsidies, government politics etc.).

Too much protein in the ration

Protein-rich feeds are expensive. Feeding too much protein to dairy cows is wasteful because the surplus is broken down by micro-organisms in the rumen and then excreted from the body.

Too little protein in the ration

For milking cows, there will be a rapid drop in milk production if the amount of protein in the ration is suddenly reduced.

Too little energy in the diet

If not enough energy is provided by the cow's ration it will lose body condition and become thin and weak. For milking cows, milk yield will drop. Pregnant cows may become ill after

calving and the calf is likely to be small. In addition the breath of cows can smell unusual – a fruity chemical smell; this condition (ketosis) is most common soon after calving.
And the cow can also develop a disease called fatty liver as a result of making energy available from its own body.

Too much energy in the diet

The most obvious sign is the animal becomes too fat. Cows that are too fat at calving are more likely to have difficult births, retained placenta (afterbirth), displaced abomasums (one of the cows' stomachs) and more often develop the conditions milk fever and ketosis, both of which are dangerous and can cause death

Too little macro-minerals

If animals do not consume enough macro-minerals this will cause reduced milk production, fertility problems, weakness of the bones and increased incidence of certain non-infectious diseases, such as milk fever (due to insufficient calcium).

Too little micro-minerals

Deficiencies in the micro-minerals (also called trace elements) can cause a variety of diseases and conditions depending on which mineral is not present in sufficient amounts. Deficiencies of micro-minerals are sometimes found in certain areas.

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Mention the impact of too much and too little protein in the feed of dairy animal (**4 points**)
2. Mention the impact of too much and too little energy in the feed of dairy animal (**4 points**)

Note: **Satisfactory rating - 8 points** **Unsatisfactory - below 8 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1.

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Information Sheet-3	Identifying and assessing dairy animals energy source concentrate feeds

Concentrates are high in energy and protein, low in fibre and highly digestible. Being the expensive part of feed these are used mostly in small quantities as supplement. Concentrates are of two types: energy rich concentrates and protein rich concentrates. Protein rich concentrates further differentiated on the basis of their origin as plant origin and animal origin

Energy Rich Concentrates:

Cereal grains (wheat, maize, barley, oats, sorghum, rice), wheat bran, rice polishing, molasses, and sugar beet pulp are characterized as energy rich concentrates. Although cereal grains are mainly used as human food and not included in the feed of dairy animals but their by products like rice polishing, maize bran and wheat bran are commonly used as animal feed.

Molasses is by product of sugar industry. It is a thick viscous material which is high insoluble carbohydrates and some minerals. Although molasses is a cheap and energy rich feed but still it is not commonly used by local farmers. Molasses can be included in the diet by mixing it with other concentrates, spraying it on dry roughages or providing it as a free lick or as solidified molasses urea block. The palatability and consumption of poor quality roughages are increased by the use of molasses. See some of them in table below

Table 5.1. Common energy sources for dairy cattle

Ingredient	Source	Remarks
Maize grain	Whole grain	Rarely used as feed except for high-yielding cows
Maize bran	Outer coating of the maize grain	Has moderate energy, CP 11%, CF 10%
Full fat maize germ	Embryo, which contains a lot of oil	High-energy content
Maize germ meal or cake	Left over after extraction of oil from germ	High-protein content
Wheat bran	Coarse outer covering—the husk and some adhering endosperm	Fibre highly digestible, CP 15%, CF 12%
Wheat pollard (middlings)	Part of endosperm, germ, bran particles and some flour	Not as palatable as bran due to its tendency to form a pasty mass in the mouth, CP 16%, CF 7.5%
Barley	Mostly rejected barley	Low starch content, high fibre. Best fed when steam-rolled to increase digestibility, CP 11%
Multiculms (multisprouts)	Sprouts and rootlets obtained from malted barley	Mostly used as protein supplement, CP 27%, CF 16%

Wet brewers grain ('machicha')	Insoluble residue left after fermentable substrates from barley are removed	High moisture content. Wet grains rapidly become rancid. Use immediately or ensile in absence of air, CP 18%, CF 15%
Sorghum	Resembles maize nutritionally	Should be fed to cattle and horses in ground form, CP 12%, CF 3%
Rice hull	Low nutritive value, very fibrous	Due to the high fibre, these hulls are of low digestibility and therefore of little value
Rice bran	Pericarp, aleurone layer, germ and some endosperm	Very palatable when fresh; CP 12.5%, CF 13%, fat 10–13%. Becomes rancid with storage due to high fat content
Rice polishing	Fine powdered material obtained when polishing rice grain after hulls and bran have been removed	CP 12%, CF 4%, fat 11%

Ingredient	Source	Remarks
Oats	Whole grain	Good cereal for cattle due to high fibre content from the hull, CP 11–14%, CF 12%
Cassava root	Whole	Freshly harvested cassava has a high level of prussic acid; boiling or sun drying destroys the poison
Cane molasses	By-product from sugar cane milling, dry matter 75%, CP 5.5%, CF 0.3%	Provides energy, improves palatability of poor-quality feedstuffs; levels > 25% can cause diarrhoea and reduced feed efficiency. Molasses is of value in reducing dust in feed, as a pellet binder, or as a liquid protein supplement when mixed with urea
Fats and oils	Waste fat from eateries	Used to increase the energy density and to reduce dust. High levels of fat in diets lead to rancidity; > 8% fat in ration can cause rumen disturbances

CP – crude protein, CF – crude fibre


Maize Grains
Oat Grains
Rice Grains


Wheat Grains
Sorghum Grains
Wheat Bran
Molasses

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Mention seven energy source concentrates of dairy animal feed (**7 points**)

Note: **Satisfactory rating – 7 points** **Unsatisfactory - below 7 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1.

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Information Sheet-4	Identifying and assessing dairy animals protein source concentrate feeds

Concentrates are high in energy and protein, low in fibre and highly digestible. Being the expensive part of feed these are used mostly in small quantities as supplement. Concentrates are of two types: energy rich concentrates and protein rich concentrates. Protein rich concentrates further differentiated on the basis of their origin as plant origin and animal origin

Protein Rich Concentrate:

Protein rich concentrates are derived from plants and animals. Protein concentrates of plant origin are mostly by products of the oil extraction industry. Oilcakes are produced when oil from seed is extracted mechanically while oil meals are the byproducts of the solvent extraction process. Compared to oil meals oilcakes are low in protein and high in residual fat. They generally include the fibrous part of seeds. Among the available oilcakes, cottonseed cake and maize oilcake have high protein value for ruminants due to their low ruminal degradability as compared to mustard seed cake which is highly degradable. Generally all animal origin proteins are less degradable in the rumen and therefore are good sources of protein for ruminants. These include blood meal, fish meal, bone meal, meat meal, feather meal. But concentrates of animal origin are normally not recommended in ruminant's feeding

Table 5.2. Common protein sources

Source	Comments
Soybean/ soybean meal	Very palatable and highly digestible. The *whole seed* has 40% CP and 15–21% oil, which is extracted to make the meal. Extracted meal contains 47% CP. *Raw beans* have less nutritive value than heated beans or soybean meal, due to toxic substances. The toxins are especially harmful to young animals (calves)
Cottonseed/ cottonseed cake	*Whole cottonseed* has been used with good results for early lactating cows for its energy (fat), protein and highly digestible fibre. CP of whole seed 23%, of cake 35%. Cattle digest it well
Sunflower cake	In cows has performance similar to soybean and cottonseed cake. CP 26%
Peanut (groundnut) meal	Remains after extraction of oil from groundnuts. CP 45%; aflatoxin contamination may be a problem
Corn gluten feed	Mixture of maize bran and gluten. By-product during wet milling of maize. CP 21–23%
Corn gluten meal	Dried residue from the maize after removal of the larger part of starch and germ and separation with bran in wet milling. CP 40–60%
Coconut (copra) meal	Residue after extraction and drying of coconut meat. CP 20–26%. Has high fat content and may become rancid if stored long
Dried brewers yeast	By-product from brewing. Rich in CP (42%)

Meat meal, meat and bone meal	Made from carcass trimmings, condemned carcasses, inedible offal and bones. High fat content increases energy. Ash content is high: up to 28–36%, 7–10% of this being calcium and about 4–5% phosphorus
Blood meal	Produced from dried (either spray or cooker dried) ground blood. It has a high by-pass rate, thus is good for cows. CP 85%
Dry poultry waste	Excreta collected from caged birds, CP 25–28% (dry basis) of which 30% is true protein
Poultry litter	Mostly from broiler operations. Can be fed as is or ensiled with other products
Fish meal	Clean, dried, ground tissue of undecomposed whole fish or fish cuttings with or without extraction of part of the fat. Locally 'omena' is used as fish meal, CP 55%. High levels of fish meal or fish meal with high oil content may give an undesirable flavour to meat or milk. There is no special advantage in feeding fish meal to dairy cattle unless it is for by-pass protein. This protein, however, is expensive.

CP – crude protein

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

2. Mention eight protein source concentrates of dairy animal feed (**8 points**)

Note: **Satisfactory rating – 8 points** **Unsatisfactory - below 8 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1.

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Information Sheet-5	Identifying and recognizing mineral and vitamins for dairy animals

5.1. Minerals

Minerals are very important for building-up the body as in the bones and teeth. Minerals are needed as a part in proteins to make-up the soft tissues of the body. Furthermore, numerous enzyme systems and osmotic regulation of the body require minerals. Minerals are divided in *major* and *trace* elements. The only difference is that animals need large(r) quantities of the major-elements.

The important minerals in dairy cattle feeding are divided into two groups:

- Major Minerals
- Trace Minerals

Recognizing the sources and utilization.

Major Minerals

Calcium (Ca)

Ca is the most abundant mineral element in the body and a very important constituent of the skeleton and teeth, in which 99 % of the total body Ca is found. Substantial amounts of Ca are released in the milk.

Sources: bone meal, shell meal, lime, meat meal, fish meal, milk, legumes, pulses, dicalcium phosphate.

Phosphorus (P)

P is used in bone formation, in close association with Ca and vit.D. In addition, P has more known functions in the animal body than any other mineral element.

Sources: cereal grains, bone meal, di calcium P, milk, and fish meal.

Potassium (K)

K is very important for osmotic regulation of the body fluids and regulation of the acid-base balance in the rumen, along with NaCl.

K-contents in plants is generally rather high.

Sodium Chloride (NaCl)

NaCl is also known as common salt or kitchen salt. The main source of NaCl is common salt which should be provided ad lib., either as a "lick"

Sulphur (S)

S occurs mainly in the proteins in the body.

Potential S sources are: protein rich sources (soya cake, cotton seed cake) or sodium sulphate.

Magnesium (Mg)

Mg is closely associated with Ca and P. 70 % of Mg is found in skeleton, the remainder being distributed in soft tissues and body fluids.

Sources are: wheatbran, legumes, plant protein cakes like cottonseed cakes (not suitable for calves; gossypol) and soya cakes

Trace Minerals

Iron (Fe)

More than 90 % of the Fe in the body is combined with proteins, mainly haemoglobin.

Good sources are: green leaves, legumes, seed coats and meat, blood and fish meals.

Copper (Cu)

Cu is necessary for haemoglobin formation and pigmentation. Seeds and seed by products are normally rich in Cu, provided that there is no Cu deficiency in the soil.

Cobalt (Co)

Co is important for the functioning of the rumen micro organisms (RMO's) in association with vitamin B12, which contains Co. Most foods contain traces of Co and normally deficiencies do not occur.

Iodine (I) I play an important role in the functioning of the thyroid gland.

5.2. Vitamins

Vitamins are indispensable, but the animals need them only in very small quantities. The most important vitamins are:

- Water soluble vitamins
- Fat soluble vitamins

A. Water Soluble Vitamins

Vitamin B (complex)

This group of vitamins is produced by the animals themselves in the rumen and a shortage is not likely in ruminants, except when the diet is short of cobalt. Bran, milk and brewers grain are rich sources of vitamin B for cattle.

Vitamin C

All farm animals can synthesize vitamin C and will not experience a shortage. Green leafy vegetables, citrus and potatoes are sources rich in vitamin C.

B. Fat Soluble Vitamins

Vitamin A

A shortage of vitamin A causes a dry skin, infections of the skin and eyes, the digestive tract (diarrhoea) and the genitals (infertility). Green feedstuffs, carrots and yellow maize contain high amounts of vitamin A. Indoor cattle systems, without green feedstuffs may require

supplementation, especially calves, usually in the form of vitamin AD 3.

Vitamin D

Vitamin D assists in the depositing of Ca and P (skeleton) and produced by the action of sunlight on the skin. So outdoor systems will not experience deficiencies. Indoor animals (calves!) may suffer deficiencies (symptoms: rickets, see Ca and P) and require supplementation
(vit AD 3). Sun dried feedstuffs (hay, straw) are good sources of vitamin D.

Vitamin E

Vitamin E is considered important to fertility in association with Selenium (cows) and muscle development (calves). Green foods and cereal grains are important sources.

Vitamin K

Vitamin K assists in the blood clotting. Green fodders are rich in vitamin K, but the ruminants synthesize vitamin K (RMO's) and deficiencies are normally not experienced.

Self-Check -5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List the common minerals used in a dairy animal feed? (4 points)
2. List 2 water soluble vitamins and 3 fat soluble vitamins.(5points)

Note: **Satisfactory rating – 9 points** **Unsatisfactory - below 9 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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Information Sheet-6	Identifying and assessing Dairy animals feed additives

Feeding high-producing cows continues to challenge dairy farmers and nutritionists.

Feed additives are materials that are administered to the animal to enhance the effectiveness of nutrients and exert their effects in the gut

Feed additives are a group of feed ingredients that can cause a desired animal response in a non-nutrient role, such as pH shift, growth, or metabolic modifier (Hutjens, 1991). Several feed additives contain nutrients, such as sodium in sodium bicarbonate or protein in yeast culture. Feed additives are not a requirement, nor are they a guarantee for high productivity or profitability

- Feed additive is a food supplement for farm animals that provide and include vitamins, amino acids, fatty acids, and minerals that are not taken from regular meals from farmers.
- Antioxidant feed additives are extensively used in poultry, cattle, swine, pet, and aquaculture...
- They also protect feed ingredients from oxidation which results in rancidity of fats and destruction of vitamins A, D and E

What are ingredients in animal feeds/ agro by products

In order to provide the above nutrients the animal feed may include natural ingredients such as **corn** (energy), wheat (carbohydrates and proteins), soya bean meal (protein), fish (protein), oats (fiber), alfalfa (vitamins) and others. Some chemical ingredients are also added to animal feed in order to meet specific requirements

Four factors can be considered to determine if a feed additive should be used: anticipated response, economic return, available research, and field responses (Hutjens, 1991). Response refers to expected performance changes the user could expect or anticipate when a feed additive is included. Several examples are listed below:

Self-Check -6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Mention the types of feed additives in dairy animal feeds. (4 points)
2. What are factors to be considered to determine if a feed additive should be used? (4 points)

Note: **Satisfactory rating – 8 points** **Unsatisfactory - below 8 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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2

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Information Sheet-7	Assessing Mixed feeds

7.1. Mixing of Concentrates

Mixing of concentrates can be done on the farm or in special plants. Mixing on the farm can be done simply by using a spade. It is best to start with the ingredient taking part in highest proportion. The remaining ingredients are added in order of decreasing proportion, minerals and vitamins last. Then the mixing can start, using the spade to make the mixture as homogeneous as possible. The incorporation of urea in these "home-made" mixtures is not recommended because of the risk of poisoning.

7.2. Calculating Compositions

Nowadays, most mixed feeds are composed with the aid of computers, which are able to combine several ingredients in such a way, that the cheapest mixture with the desired feeding value is obtained with similar DM values.

Calculating the feed ingredient composition will be also carried out using favorable calculating methods based on their nutritional values.

The following tables are showing results of some ingredients of chemical compositions of nutrient.

Type of feed	DM as feed	CP, %	ME. Kcal/kg	Ca	CF	EE	P	Ash
Noug seed cake	92.5	32.18	2774.5	0.67	21.4	8.4	-	15
Brewery dry grain	-	21.54	1811	-	-	-	-	-
Maize grain	-	10.04	3425	-	-	-	-	-
Wheat short	-	21.89	2200	-	-	-	-	-
Wheat bran	89.77	15.2	2075.3	-	-	-	--	-
Wheat middling	89.69	15.6	2153.1	-	-	-	-	-
Fish meal	91.7	65	3320	3.5	-	10.3	2.6	-
Meat and bone meal	-	43	3437	10.89	-	19.87	3.97	-
Alfalfa meal	-	10.1	700	1.78	27.4	1.8	0.25	-
Wheat	86.1	12.1	2980	0.07	2.2	1.8	0.35	-
Corn gluten meal	-	19.4	1900	0.04	7.9	2.6	0.87	-
Blood meal	90.5	87.5	3020	0.17	-	0.6	0.17	-
Bone meal	90.5	40.7	1500	16.04	-	5.4	7.42	-
Sesame	-	42	820	-	-	-	-	-
Sorghum meal	89.5	10.2	3270	0.037	2.5	3.1		1.68
Cotton seed meal	-	41	-	-	-	-	-	-

Steps

- Identify the availability of mixes
- See the nutritive value of the ingredients
- Measuring ingredients in a specific ratio.
- Blending ingredients adequately and hygienically
- Mixing with appropriate equipment

Self-Check -7	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Mention how mixing on the farm can be done and describe the best way to start mixing (**3 points**)

Note: **Satisfactory rating – 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1

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- _____
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Operation sheet -1	Mixing feed

Techniques mixing feeds as follows:-

Step 1.Wear personal protective cloth
Step 2. Identify materials, tools and equipment used for determining
Step 3. identify ingredients used
Step 4. Blended the ingredient thoroughly by spade/using Mixer
Step 5: feed animals according to feeding schedule

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 3 hours.

Task1. Perform mixing feeds.

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Trainers prepared the TTLM with their full address

No	Name of trainer d	TVET Represent	Occupation	E-mail	
1	Addisu Desta	W/Sodo ATVET College	Animal and range science(B.sc)	0913270120	addiserahel2701@gmail
2	Ayele Mengesha	Holeta Poly tech. College	An. Nutr.(MSc)	0911802467	ayelemengesha@ymail.com
3	Sead Taha	Agarfa ATVET College	Animal science(Bsc)	0920356174	tahasead@gmail.com
4	Sisay Fekadu	Gewane ATVET College	An. Production (MSc)	0913115358	sisrobel09@gmail.com
5	Tesfahun Kebede	Alage ATVET College	Animal breeding & Genetic (MSc)	0910618584	praiselord21@gmail.com
6	Ybrah Weliyergs	Michew ATVET College	Livestock production &pastoral Dev't (MSc)	0910569723	ybrahababa@gmail.com
7	Sintayehu Belina	Assossa ATVET College	Animal Science Bsc	0953307311	Sintayehubelina@yahoo.com
8	Tesfu Abtie	Burie Poly TVET college	Animal Science	0910162233	tawe2111@gmail.com
9	Tamirat Chanyalew	Bako ATVET College	Animal and Range science(Bsc.)	0942922400/ 0917819403	tamiratgeletac@yahoo.com