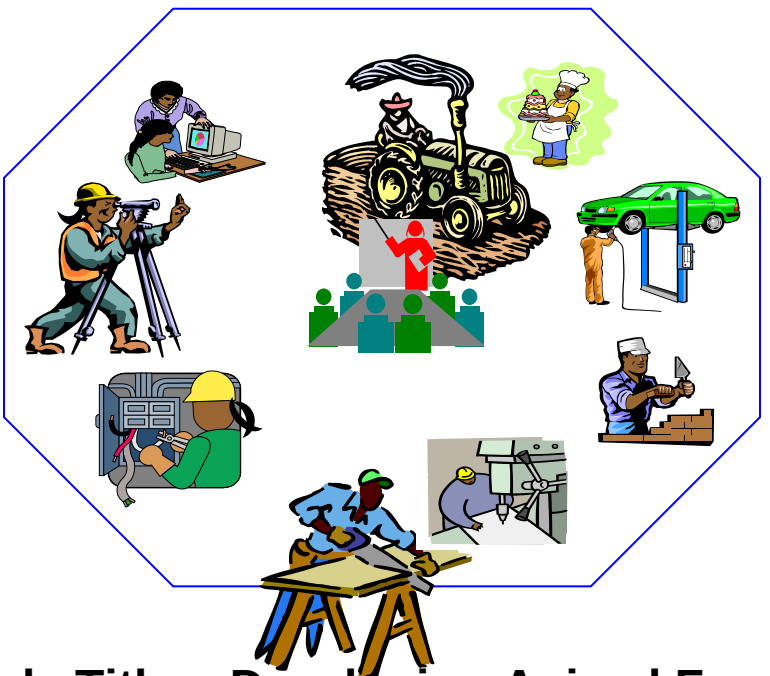
ANIMAL PRODUCTION

Level –IV

Based on March, 2018, Version 3 Occupational Standards (OS)



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CONTENT PAGE

LO1 - ASSESS LIVESTOCK CONDITION AND NUTRITIONAL REQUIREMENTS 5

Instruction sheet 5

Information sheet 1- Assessing and recording livestock condition 7

Self-check 1 10

Information sheet 2- Identifying and assessing animal production status 11

Self-Check -2 19

Information Sheet-3. Identifying Livestock nutritional requirements and the nutritional value of pasture and feedstuffs 20

Self-Check -3 23

Information sheet 4: Determining essential requirements for animal nutrition 24

Self-Check -4 30

Information sheet 5- Identifying animals that do not fit within the established ideal range, and making a written record 31

Self-Check -5 35

Operation sheet 36

LAP Test 37

LO2- DETERMINE SUPPLEMENTARY FEEDING PROGRAM 38

Instruction sheet 38

Information sheet 1- Identifying and determining types of supplementary feed 40

Self-Check -1 43

Information sheet 2- Determining economic basis to supplementary feeding system 44

Self-Check -2 45

Information sheet 3- Determining supplementary feeding program 46

Self-Check -3 50

Information sheet 4- Determining feeding requirements of livestock 51

Self-Check -4 53

Information sheet 5- Introducing supplementary feeding 54

Self-Check -5 65

Information sheet 6 - identifying suitable feed conservation methods 66

Self-Check -6 72
Operation Sheet-1 73
Sheet-2 73
LAP Test 74
LO3- APPLY RATION FORMULATION TECHNIQUES 75
Instruction sheet 75
Information sheet 1 - Calibrating scales and containers 77
Self-Check -1 79
Information sheet 2 - Identifying methods of ration balancing 80
Self-Check -2 92
Information sheet 3 - Identifying ingredients 93
Self-Check -3 95
Information sheet 5 - Blending ingredients adequately and hygienically 98
Self-Check -5 101
Information sheet -6 Milling ingredients 102
Self-Check -6 106
information sheet 7 suitable controls 107
Self-check 7 110
Information sheet – 8 selecting, using and maintaining suitable PPE 111
Self-check 8 114
Operation sheet 115
LAP Test 116
LO4. DEVELOP ANIMAL FEEDING PLANS 117
Instruction sheet 117
Information sheet- 1 Confirming and adjusting feeding plan 119
Self-Check -1 122
Information – 2 Developing and monitoring feeding plan 123
Self-Check -2 125
Information sheet 3. Selecting a feeding method options to meet condition, growth and production needs 126
Self-check 3 128
Information sheet – 4 determining a feed budget 129

Self-check 4 132
Information sheet - 5 undertaking costs benefit analysis 133
Self-check 5 135
Information sheet- 6 Documenting data for continual assessment and effective management planning 136
Self-check 6 138
Information sheet- 7 Monitoring and controlling workplace safety and positive environmental practices 139
Self-check 7 141
Operation sheet - 142
LAP Test 143
REFERENCES 144

LG# 33	LO1 - Assess livestock condition and nutritional Requirements

Instruction sheet

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

- Assessing and recording livestock condition
- Identifying and assessing animal production status
- Identifying Livestock nutritional requirements and the nutritional value of pasture and feedstuffs.
- Determining essential requirements for animal nutrition
- Identifying animals that do not fit within the established ideal range, and making a written record.

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 –**

- Assess and record livestock condition
- Identify and assess animal production status
- Identify Livestock nutritional requirements and the nutritional value of pasture and feedstuffs.
- Determine essential requirements for animal nutrition
- Identify animals that do not fit within the established ideal range, and making a written record

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,

If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information sheet 1- Assessing and recording livestock condition

1.1. Introduction

Body condition for welfare purpose can be assessed with a simple three category system of ‘too thin’, ‘acceptable’ and ‘too fat’. These categories are differently defined for dairy and dual purpose or beef breeds. Dairy cows can be scored individually, with random representative sample being taken. Beef cattle are likely to be less easy to score individually. Identification of any animals which are too thin should be attempted, although there is a risk of either double counting or under estimation. Body condition assessment for veal calves has not been validated, therefore it is not possible to make definitions and recommendations for target condition scores

1.1. Monitoring livestock condition

Body condition influences productivity, reproduction, health, and longevity of dairy cattle. Thinness or fatness can be a clue to underlying nutritional deficiencies, health problems, or improper herd management. If done on a regular basis, body condition scoring can be used to troubleshoot problems and improve the health, longevity, and productivity of the dairy herd.

Over conditioning, or fatness, may result from poor nutrition or reproduction management. A fat cow is more susceptible to metabolic problems and infections, and is more likely to have difficulty at and after calving. Over conditioning usually begins during the last three to four months of lactation, when milk production has decreased, but dietary energy and total nutrient levels have not been reduced accordingly. Other common causes of over conditioning are prolonged dry periods or overfeeding during the dry period.

Under conditioning, or thinness, can frequently lower production and milk fat levels because

of insufficient energy and protein reserves to maintain production. Thin cows often do not show heat or conceive until they start to regain--or at least maintain--body weight. In feeding these animals, care must be taken to maintain production while increasing body reserves.

Body condition scoring is also useful in dairy heifer feeding management. Thin heifers may not grow rapidly enough to reach puberty by 11 to 13 months of age. They may also be too small to calve at 22 to 24 months or to carry enough weight to maintain a normal first lactation production. On the other hand, fat heifers have been shown to be difficult to breed, and if fat when they are near calving, have difficult calving and produce less milk when they enter the milking herd, especially if they have been fat at puberty.

1.2. Importance of Body Condition

The important stages of production are:-

Pre-calving (drying off)

Condition should be “fit not fat”, and should be such to allow a moderate level of supplementation to prepare cows for early lactation

At calving

Cows should not calve in an excessively fat condition. Fat cows may develop fatty liver disease or ketosis and are more prone to milk fever, mastitis, lameness and infertility.

Early Lactation

Dairy cows are under considerable nutritional stress and adequate feeding is essential to avoid excessive weight loss. Excessively thin cows can suffer discomfort in a housing environment such as cubicles.

At service

Livestock should not be in energy deficit by this stage as this may result in low fertility.

The technique links together three major factors:

- Good Welfare

- Good Husbandry
- Good Performance

1.3. Keeping farm record on dairy animal condition:

This record help farmers keep a track of the amount of feed that is provided for the animals. It could be anything like the amount of supplements fed to a cow, or the total amount of concentrate fed for pasture-grazed cows, and so on.

Feeding records can be utilized both for every day administration and change of the feed proportion. If a milking cow requires more concentrate, or help in choices about inspecting animals which appear to not develop, but rather still eat a lot.

Some of the records mainly important for the expression of animal conditions:

- Helps in detection of abnormal conditions or disease status of the herd that leads to loss in body weight, loss in milk production etc.
- Helps in finding the commonly occurring diseases in the herd and thus to formulate in time precautionary measures like vaccination, deworming
- Animal welfare and environmental sustainability policies etc. are identified and reported to the concerned body.

Self-check 1	Written test

Name _____ Date _____

Directions:

Part I. choose the best answer (2points each)

1. At the stage of service if Livestock should not be in energy deficit this technique links together

   A. Good welfare B. Good Husbandry C. Good Performance D. All

2. One is not the influences of body condition of dairy animals?

   A. Reproduction B. Health C. Longevity D. None

3. Body condition for welfare purpose can be assessed with a simple category system of

   A. 'too thin B. 'acceptable' C. 'too fat D .All

Part II. Answer all the questions listed below.

1. Mention some of the records mainly important for the expression of animal conditions.(3 points)

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

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

Information sheet 2- Identifying and assessing animal production status

2.1. Introduction

Different stages of growth, production and reproduction have different nutrient requirements. Generally the highest nutrient requirements are during lactation. The lowest nutrient requirements are during mid to late gestation of the mature female. Growing animals and producing animals have different needs to those of animals that are simply meeting their maintenance requirements. To be profitable in livestock production these different dietary requirements need to be met as inexpensively as possible.

Maintenance Requirements, requirements for growth and Production requirements for Breeding Requirements for Working Animals Requirements for Vitamins and Mineral Seen from a different perspective, poor livestock keepers attempting to make the best use of limited

Resources will need to be able to target those resources to obtain the best effect, given variety of desired outcomes. At the simplest level, the desire is to maintain livestock survival.

1.2.1. Maintenance Requirements

For an animal to survive, it needs a certain amount of feed. This feed needs to provide it with the water, energy, protein, vitamins and minerals that are needed to keep the life processes (heart beating, liver functioning, etc.) going. The amount of feed needed to meet these "maintenance" requirements depend, obviously, on the quality of the feed (less high quality feed needs to be eaten to provide the same amount of nutrients as a large amount of poor quality feed). However, the amount of nutrients needed to maintain the animal depends mostly on its size. A large animal clearly needs more feed to keep it alive than does a small animal. However, an animal that weighs twice as much as another does not need twice the nutrients.

A. Energy Requirements

The relationship between animal live weight and its energy requirement for maintenance s shown in the figure below. This is the amount of energy needed to maintain the animal when it is fasting, and when it

does not need to expend extra energy to overcome challenges from the environment.

If it is too hot (or too cold), then the animal will need to use more energy to lose or conserve heat. The very act of eating and digesting feed will also require some additional energy. Fighting off disease will also cost energy (and protein). These are also AVERAGE figures- some species use more or less energy than this (cattle use slightly more, sheep slightly less). There are also likely to be differences between breeds in the amount of energy they actually need for maintenance (and other functions). There are certainly differences between animals of different ages, with younger animals having a higher metabolic rate (and therefore higher maintenance energy requirement for their size) than an adult animal. Energy used for fasting metabolism for adult animals of different live weights. The amount of energy that an animal will actually need will depend on its productive state (do you want it to grow, produce milk, produce eggs or young, or simply survive?) It also depends on the environment (as mentioned above, it costs energy to keep the animal warm in a cool environment, or cool in a hot environment). Preventing the development of disease also requires energy (see box).The amount of energy an animal will need, just to maintain itself, will also be greater if it is active.

B. Protein Requirements

As with energy, the animal needs a certain amount of protein just to maintain itself. Animals are not able to store protein, and so continually need to be supplied with protein because animals are constantly breaking down their body's proteins and then building them back up again. As this process is never completely efficient, there is always some protein that is being excreted (as ammonia in the urine or as uric acid in the droppings of birds), and this must be replaced if the animal is not to lose weight. Again, combating disease may also require more protein. For example, sheep supplemented with protein develop more resistance to internal parasites (worms) than do sheep that are not fed as much protein.

Meeting an animal's requirements for maintenance

In the end, feeding animals is as much an art as a science, and requires skilled care by the

livestock keeper. If the animals are losing weight and succumbing to disease, then they clearly need more feed. It is likely that it is energy that will be limiting. If the supplementation of the diet with energy (e.g. from cereal grains) overcomes the problem, that is good. If not, some other strategy must be considered, which may be to consider whether it is protein (supplied by leguminous forages or from oilseed residues) or vitamins and minerals that may be limiting. If none of these strategies work, then there may be some underlying disease, which cannot be corrected by better feeding, that is affecting the livestock and that will need to be treated before the livestock will be able to thrive.

1.2.2. Requirements for Growth and Production

When livestock are not just surviving, but growing or producing milk or rearing young, they need extra feed to meet these increased requirements. There is a limit to the amount they can produce, which is determined by their breeding, but it is unusual for any animal to be limited by its breeding and much more usual that its feed supply is limiting its production. Feeding them more will therefore make them produce more, but eventually each increase in feed results in a smaller increase in animal production. Again, in the tropics, it is unusual for livestock to reach this stage and the more usual scenario is that the livestock keeper has to decide when they can afford to concentrate feed resources on particular animals so as to optimize their response in increased production.

A. Lactation

Lactation is the time of greatest feed requirement for the animal. Increasing the quantity and quality of feed offered to lactating females will improve the health, survivability and growth of the young, as well as reducing the time before the lactating animal conceives again. If the milk is being sold, then the amount of saleable milk that is produced will be increased by improving the animal's diet. Energy is nearly always the first limiting nutrient preventing further increases in milk yield, but the requirement for protein increases substantially during

lactation as well.

B. Growth

An animal obviously needs more feed when it is growing, and again it is usually energy that is limiting but extra protein is needed as well. If the animal is overfed then it will lay down fat rather than lean meat, but this may be wanted if the market is for fat animals. Giving the animal extra feed for a month or two before it is sold may help to increase the sale price, but the cost of that extra feed has to be compared with the increased sale price to decide whether it is worth the investment.

C. Egg Production

The composition of the diet does not need to change for laying hens, but when a hen is in full lay she will need to eat more feed to meet her increased requirements for energy and protein. She will also need more calcium because of the high requirement for this mineral in making the eggshell.

D. Rearing Young

The greatest cost of rearing young for goats, sheep and pigs is the slightly increased feed requirements for pregnancy and the much increased requirements in lactation. The cost to brooding hens is not as great. The composition of their diet does not need to change, and compared with laying hens their feed intake can be reduced.

E. Requirements for Breeding

Healthy, well-fed livestock are much more likely to breed successfully than those that are weakened by disease and/or poor nutrition. If the animal has to use its feed to fight off disease, it is not able to use that feed to produce healthy young. The housing and the

conditions under which the animal is kept therefore need to be as clean as possible. Energy is also used to keep the animal at a comfortable temperature, and so if at all possible, the animal should be protected from very high or low temperatures, and great changes in temperature. This will often not be possible, and so the animal needs to be provided with enough feed to cope with these environmental challenges, as well as sufficient feed to enable it to breed successfully.

1. Females

Females that give birth to live young (sheep, goats, pigs and rabbits) have a much greater feed requirement for breeding than males. However, there are times when they can be fed a poorer diet without encountering too many problems.

A. Mating

It is well established that breeding females produce more eggs (and therefore more young) if they are well fed at the time of mating. Ideally, they should also be on a "rising plane of nutrition", which means each day they are fed slightly more than they were fed the day before. This practice, known as "flushing" encourages the development of more eggs. However, if they are too fat, then this reduces their fertility as well, so it is important to try and get them to be fed just the right amount that, at the time of mating, they have a condition score of about 3 (see section on condition scoring). If a pregnant female becomes sick or if her diet is cut dramatically soon after she conceives she is very likely to lose her young. It is therefore important that she is kept as healthy and well fed as possible for the first third of her pregnancy to reduce the risk of her losing her young.

B. Mid pregnancy

If the pregnancy is divided into thirds, then in the second third the fetus is much less

vulnerable. Provided the mother does not suffer a major disease, or becomes extremely malnourished, it is likely that the fetus will survive. The amount of feed given to pregnant animals in mid pregnancy can be reduced a bit to conserve feed resources for a time of greater need.

C. Late pregnancy

In the last third of pregnancy, the fetus begins to grow extremely quickly. It also occupies much more space in the mother's abdomen so that there is less space for her gut. There is therefore insufficient space for her to eat large amounts of bulky, fibrous feed to meet her increased requirements, and the only way that her requirements can be met is to feed more concentrated (higher quality) feed. Disease or malnourishment at this time can also lead to abortion. However, some care must be taken when increasing the amount of concentrated feed offered, particularly to sheep and goats. If too much feed isfed, then the fetus will grow very large and the likelihood of problems at kidding or lambing will increase.

D. Dry period

In late lactation and once the young have been weaned, the amount of feed offered can be reduced again (depending, of course, on what stage of pregnancy she is in).

2. Males

The amount of energy and protein needed to produce sperm is extremely small and so extra feed is not required for this. However, adult male animals have much higher metabolic rates than adult females and so need more feed just for maintenance than a dry, non-pregnant adult female does.

Keeping adult males for breeding is expensive in terms of the resources needed, and they are usually the most aggressive members of the flock or herd and so require more skilled

management. Since breeding males are usually in short supply, they need to work much harder and will require more feed to meet their increased requirements. When they come on heat, females need to be served quickly to maximize the chances of conception.

Walking a long way to a breeding male (and then having to walk all the way back again) will reduce her chances of conception. Although keeping breeding bucks, rams or boars is expensive, it may be worth trying to form a farmers' group in the village with the aim of keeping breeding males so that does, ewes and sows do not have too far to go when they are on heat. Breeding males need to be changed regularly to reduce the risks of inbreeding.

1.2.3. Requirements for Working Animals

An animal that does not need to go out and forage for its feed uses up much less energy than one that has to walk long distances in search of feed or water. Animals that do need to walk long distances increase their feed requirements by as much as 40%. If they are being used as pack animals, then the need for more feed is increased even more. It may well be that their increased requirements for energy and protein are so great that they cannot get all of their nutrient requirements from forages and fibrous feeds because they cannot eat enough of these feeds (especially if for part of the day they are occupied by work and therefore unable to feed). The appetite limits of the animal may mean that the diet needs to be supplemented with more concentrated sources of energy and protein so that the animal is able to eat sufficient energy and protein (as well as vitamins, minerals and water).

Requirements for Vitamins and Minerals

In addition to energy, protein and water, animals also need a range of vitamins and minerals to keep them healthy. Many of the vitamins (particularly copper, zinc and iron) also help them to fight off disease and so supplementation with these minerals may help combat disease. However, all vitamins and minerals are present in only very small amounts in feeds, and it is usually very difficult or impossible to know exactly how much of any particular

mineral an animal is consuming. Many of the minerals also interact with each other, so that for example over-feeding an animal with iron or molybdenum can cause the animal to become deficient in copper. If possible, the best way of ensuring an adequate and balanced intake of vitamins and minerals is to provide the animal with a commercially prepared vitamin/mineral mixture. Such a mixture, though, should be formulated for that species of animal, as requirements between different species vary considerably, as do the tolerances for different minerals. A mineral mixture prepared for a pig, for example, could kill a sheep by copper poisoning. It is also worth remembering that while feeding sufficient vitamins and minerals is good, feeding them to excess can be extremely harmful. Although with many minerals there is a wide margin between a required dose and a toxic dose, with some minerals (for example copper in sheep and selenium in all species) the margin is quite small. There is therefore the risk of poisoning animals with minerals (and to a lesser extent vitamins) if excessive amounts of vitamins and minerals are fed. Such a practice is also extremely expensive and wasteful. If using commercial mixtures, therefore, make sure that the manufacturer's recommended intakes are not exceeded by any individual animal (by, for example, inadequate mixing of the mineral mixture in a feed that is then offered to a group of animals).

Self-Check -2	Written Test

Directions: part I. Answer all the questions listed below.

1. Mention the division of nutritional requirements of animal (5 points)

2. Describe the impact of overfeeding at late pregnancy period. (3 points).

Part II. Say true or false

1. Animals that do need to walk long distances increase their feed requirements by as much as 40%. (2 points).

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

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

Information Sheet-3. Identifying Livestock nutritional requirements and the nutritional value of pasture and feedstuffs

3.1. Identifying nutritional requirements

Nutrient status has been defined as the difference between intake of nutrients via the dietary supply on the one hand and nutrient requirements for maintenance and production purposes on the other hand. Production can be the maximum production output within the genetic capacity of the animals under the specific conditions in which the animals are kept or a predefined production output based on previous performance or given by specific economic circumstances. It should be noted that the genotype of the animal also influences the balance between nutrient supply via the diet and nutrient requirements. The main groups of nutrients considered in animal nutrition and components of feed are:

1. Energy (in the form of carbohydrates, fats, protein and amino acids and short chain fatty acids)
2. Protein and amino acids
3. Minerals (Ca, P, Cu, Zn and other trace minerals)
4. Vitamins Essential fatty acids
5. water

In the present study emphasis will be given to the categories 1-3 as major variation in status will be encountered in farm animals in practice for these nutrients. In modern production systems, the requirements for vitamins and essential fatty acids are supposed to be adequately covered via the use of supplemented vitamin premixes and adequate formulation of the diet with regard to the levels of essential fatty acids.

3.2. Classification of Animal Feeds and their nutritive value.

There are various types of animal feeds available for livestock feeding. Based on the amount of specific nutrient they contain (CF in this case) these livestock feeds are generally classified in to two broad categories Roughage and concentrate. CF is hard to digest part of the food and includes cellulose, a variable portion of hemicelluloses and lignin. It is found in plant material.

3.2.1. Roughage

Roughage is feed stuffs that contain relatively large amount of CF (more than 18%). These feed stuffs are mostly bulky feeds with lower amount of T.D.N (Total digestible nutrient) which is less than 60 % and they are usually of very low digestibility.

Examples or Source of Succulent feeds: The following are the major examples of Succulent feeds are Pasture, Cultivated fodder crops, Tree leaves, Root crops, Silage and examples of Source of dry roughage are Hay and Straw

3.2.2. Concentrates:

Concentrates are feed stuffs containing relatively lower amount of CF, which is less than 18 %. They are more digestible than roughages and generally contains higher amount of T.D.N that is greater than 60 %. Concentrates are a feed material either high in protein or energy (carbohydrate and fat).

Concentrates are again sub divided into two groups based on their CP (crude protein) content. When the CP is greater than 18 % they are termed as protein supplements or protein rich concentrates and when the CP content is less than 18 % they are termed as energy rich concentrates.

A. **Protein source/ rich supplements**:

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

B. **Energy Rich Concentrates**:

Cereal grains (wheat, maize, barley, oats, sorghum, and 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 there 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 in soluble 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

Feed ingredient is a component part or constituent or any combination/mixtures added to and comprising the feed. Feed ingredients might include Grains, milling by products, added vitamins, minerals, fat/oils and other nutritional and energy sources. Animal foods provide a practical out let for plant and animal byproducts not suitable for human consumption.

The inclusion of forage legumes in low-input grassland mixtures is vital to improve biomass

production, forage quality and ultimately soil fertility. Mixing legumes with grasses increases the CP concentration of the herbage mixture relative to that of grass monoculture

Self-Check -3	Written Test

Name _____ Date _____

Directions: part I. Answer all the questions listed below.

1. Mention the generally classification/ broad categories of animal feeds. (2points)

2. Mention the Consequences of a shortage of minerals. (5points)

Part II. Choose the best answer (2points)

1. The inclusion of forage legumes in low-input grassland mixtures is vital to improve
   A. biomass production,
   B. forage quality
   C. Ultimately soil fertility.
   D. All

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

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

Information sheet 4: Determining essential requirements for animal nutrition

4.1. Essential requirements for animal nutrition

Efficiency of nutrient utilization is an important issue in farm animal production as it relates to animal productivity, environmental impact of animal production and also to the efficiency of use of nutrient resources and their competition in use for either feed, food or fuel. The efficiency of nutrient utilization in farm animals is related to the balance between nutrient supply via the diet and nutrient requirements for maintenance and production purposes

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Nutrient supply is dependent on the supply of feed and/or voluntary feed intake (feeding strategy) and the nutrient composition of the diet or ration. The requirements for nutrients by an animal or population of animals are dependent on their requirements for maintenance processes and requirements for their zoo technical performance (output in terms of body weight gain, milk and egg production) and also relate to variation in genetic makeup and their interactions with environmental factors. The final output can be considered as the result of the dietary supply of nutrients, however, in reverse, nutrient supply can also be adjusted to achieve a defined animal performance. In relation to the latter, feeding strategies can be adopted to create a maximum animal performance, an optimal animal performance in the economic perspective or from a nutrient efficiency point of view. Choices to be made on the latter issue are dependent on the conditions in which the animal production system operates. Independent of the former, determination of the balance between the supply of nutrients via de diet and the requirements for nutrients by the animal is a key issue in animal nutrition.

It should be emphasised that both the supply of nutrients via the diet and the nutrient requirements of animals are not fixed factors. Both are dynamic and are influenced by a large number of factors. The dietary supply is affected by variation of composition in feed ingredients

and their digestibility in the gastro-intestinal tract. In practice, diet composition varies from batch to batch as batches of ingredients are being used with a high turnover rate in the feed industry. The nutrient digestibility of feed ingredients is not measured for each batch of feedstuffs, but is derived from data in tables providing information on the “average” nutrient digestibility of individual feed ingredients for different animal species as reported in databases (e.g. CVB and NRC). Variation in nutrient digestibility as related to age of the animal and genotype are generally not considered.

Also nutrient requirements of animals are not constant and dynamic of nature. Nutrient requirements are affected by production output (productivity) and by animal factors (e.g. age, genotype, and sex) and also influenced by health status, environmental conditions and animal and farm management. Various sources of information are available on nutrient requirements of farm animal species (CVB, NRC, management guides of animal breeding companies, information from feed additive producers). Diets in the feed industry are usually optimized using rather “fixed” data on nutrient requirements. The other influential factors mentioned are usually only considered to a limited extent. This is mainly due to a lack of actual information on the more precise nutrient requirements of the group or population of animals for which the formulated batch of feed is produced.

Nutrient requirement studies are often performed with a dose response design using a basal diet in which only the nutrient of interest is limited and to which increasing levels of the nutrient of study are supplemented. The animal response is measured for all treatment groups and the dose response relationship is determined. A requirement value is derived from the response curve being the value at which the maximum or proportion of the maximum performance or output is achieved. Alternatively, factorial approaches can be taken to estimate nutrient requirements. The latter approach calculates nutrient requirements for a particular animal with a defined zootechnical output considering nutrient use for deposition in the end product or in the whole animal, nutrient use for maintenance purposes and using (in) efficiency factors for transforming metabolically available nutrients for final deposition of the nutrient in the body or

output. E.g. NRC (2012) uses models for the prediction of requirements for standardized ideal digestible amino acids and nitrogen, standardized total tract digestible phosphorus, and total calcium in growing finishing pigs, and gestating and lactating sows.

3.2. Nutritional requirement of animal

The term feed nutrient may be defined as any food or feed constituent be it organic or inorganic that has the same general chemical composition and aid in the support of animal life. Nutrient requirement of domestic animals could be obtained from NRC (National Research council of USA) and ARC (Agricultural research council of Great Britain) by referring to different text and hand outs. This refers to the different types of nutrients required by the animal of different spices, age, sex, production status and other factors.

For example - daily nutrient requirements of a calf growing at the rate of 0.5kg per day during first two years and reaching adult body weight at the age of approximately 3 years.

Body Wt (kg)	DCP (kg)	TDN (kg)	ME (kcal)	Ca (g)	P (g)	Vit. A (I.U)
45	0.17	0.9	3290	7	6	2000
70	0.22	1.3	4680	12	10	3000
150	0.35	2.6	9360	13	12	6500
200	0.40	3.0	11500	13	12	8500
300	0.47	4.0	12600	13	12	12500
450	0.48	5.0	13600	12	12	17000

Nutrient requirement is a statement of what animal on average require for a particular function allowance is greater than the amount by safety margin designed principally to allow for variation in requirement between animals. Feeding standards may be expressed in quantity of nutrient or in dietary proportion. The major classes of these feed nutrients are Carbohydrates, proteins, lipids, vitamins and minerals.

Function of nutrients for dairy animals

Feeding livestock 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. Themost important vitamins are:

- Water soluble vitamins(B complexes and C)
- Fat soluble vitamins adequate.(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

p

ound 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 -4	Written Test

Name _____ **Date**_____

Directions:

Part I. Answer all the questions listed below.

1. _____may be defined as any food or feed constituent be it organic or inorganic that has the same general chemical composition and aid in the support of animal life. (2pts)

2. mention the 5 types of nutrient required by the animals (5pts)

Part II. Choose the best answer.

1. Which one of the following is not a Consequences of a shortage of minerals (2pts)

   A. Low fertility

   B. Poor growth

   C. Diseases

   D. Deformation of the skeleton

   E, None of the above

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

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

Information sheet 5- Identifying animals that do not fit within the established ideal range, and making a written record

5.1. Introduction

Animals arriving at shelters as a result of a natural disaster need special care. Because they may have been exposed to contaminated water and may not have had access to safe food and fresh water, many are stressed and dehydrated and some may be injured and/or ill. Stressed animals may or may not show signs of illness and may also exhibit behavioral disorders. Following some simple animal management and disease control guidelines can help improve animal health and reduce the risk of disease transmission and injury between animals and people.

5.2. Identifying Animals

If you observe some abnormality signs and animals are coming from other place, it is important to identify and separate the animal before mixing with other farm animals.

- Animals should not be housed or permitted in food or break areas.
- Separate newly arriving animals from animals that have been housed one week or longer.
- Animals of different species should not be housed together
- If animals of unknown origin must be housed together, care should be taken to not mix genders for unneutered animals.
- Routinely monitor animals for signs of illness.
- Separate sick animals from healthy animals, especially animals with diarrhea or signs of upper respiratory disease
- People assigned to care for sick animals should care for those animals only, and

should not move between sick and healthy animals.

- Limit contact of young children, the elderly, pregnant women, and immune compromised people with rescue animals, particularly animals that are ill.

5.3. Making written record

After identifying the animal do not fit, record is important to to separate the animals from normal range.. During recording we have to remember the following points; animal ID, type and sex of animal, weight, type of the problem, treatment given, price of the treatment etc

5.4. Identifying shy or problem feeders

5.4.1. Sickness behavior

Abnormal feeding and drinking behaviour and decreased activity are indicative of general malaise

5.4.2. Predictive value of behaviour

- Some behavioural patterns may have predictive value in identifying risk of various health disorders

✓ We can often identify environmental (housing, feeding, and management) factors which may influence the expression of that behavior

So….some behaviours may then

- Be used to identify something wrong with the animal

✓ Use to identify the need for treatment

➢ Indicate a problem in the environment

✓ Use to identify need to make changes

What are we going to look at today?

➢ Examples of behaviour and health issues related to nutrition and nutritional management

➢ Sub-acute ruminal acidosis

➢ Subclinical ketosis

➢ Mastitis

Sub-acute ruminal acidosis (SARA)

- No clinical signs, difficult to diagnose
  - ✓ Fluctuating feed intake
  - ✓ Reduced digestibility
  - ✓ Loose manure
  - ✓ Low milk fat
  - ✓ Laminitis
  - ✓ Decreased rumination?

What else can monitoring sorting tell us?

- Dairy cows will select a diet to reduce effects of low rumen pH
  - ✓ Long alfalfa over pelleted alfalfa
  - ✓ Long forage particles
  - ✓ Sodium bicarbonate

Behavioural patterns and risk of mastitis

- Environment is a potential risk factor for acquiring infection

✓ environmental bacteria

- Standing and lying behaviour patterns have potential to influence the risk of such infections

Identifying cows at risk for subclinical mastitis…

- Greater risk in…

✓ Those that lay down immediately after milking (within 30-60 min)

- Longer for 3x milked cows

✓ Those that wait for extended periods of time (2 hours and beyond) following milking prior to lying down

Take home messages…

- Behaviour can be used to identify dairy cattle experiencing, or at risk for, illness
  - ✓ Important to watch cows!
  - ✓ Visual detection of changes in behaviour is sometimes difficult

- But…technologies do exist to help monitor behavior
  - ✓ Changes in a behaviour do not always identify the problem
  - ✓ Housing and management changes can be made to change these behavioural patterns and reduce risk

Self-Check -5	Written Test

Name _____ **Date** _____

Directions: Part I. Choose the best answer (2pts each).

1. What else can monitoring sorting of animal can tell us
   A. select a diet to reduce effects of low rumen pH
   B. Environment is a potential risk factor for acquiring infection
   C. Identifying cows at risk for subclinical mastitis
   D. all
2. Which one is behavioral patterns and risk of mastitis
   A. Environment is a potential risk factor for acquiring infection
   B. environmental bacteria
   C. Standing and lying behaviour patterns have potential to influence the risk of such infections
   D. all

Part II. Answer all the questions listed below

1. Mention at least 4 importance to identify and separate the animal suspected before mixing with other farm animals. (4pts)

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

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

Operation sheet	Identifying animals physiological and production status

Procedure

Step 1 Wear personal protective cloth

Step 2 Identify materials, tools and equipment used for determining

Step 3 Categorize animals according to their status

Step 4 Restrain animals

Step 5 Mention and describe each animal for its body condition and status

Step 6 Take all necessary information

Step 7 see materials about their feeding requirement

Step 8 Develop your report and report to your supervisor/instructor

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.

Task. Perform Identification of animals physiological and production status

LG # 34	LO2- Determine supplementary feeding program

Instruction sheet

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

- Identifying and determining types of supplementary feed
- Determining economic basis to supplementary feeding system.
- Determining supplementary feeding program
- Determining feeding requirements of livestock.
- Introducing supplementary feeding
- identifying suitable feed conservation methods

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 determine types of supplementary feed
- Determine economic basis to supplementary feeding system.
- Determine supplementary feeding program
- Determine feeding requirements of livestock
- Introduce supplementary feeding
- identify suitable feed conservation methods

Learning Instructions:

Read the specific objectives of this Learning Guide.

Follow the instructions described below.

1. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
2. Accomplish the “Self-checks” which are placed following all information sheets.
3. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
4. If you earned a satisfactory evaluation proceed to “Operation sheets
5. Perform “the Learning activity performance test” which is placed following “Operation sheets”
6. If your performance is satisfactory proceed to the next learning guide
7. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information sheet 1- Identifying and determining types of supplementary feed

1.1. Types of supplementary feed

1. Protein supplement

On most grazing lands dry standing forage does not constitute a balanced livestock diet. The amount of protein supplement required per animal each season varies tremendously. Once protein supplemental feeding is initiated, the feeding rate must be sufficient to meet most of the animal's requirements and it must be continued until protein levels of available forage become adequate to meet the requirements of the animal. Insufficient amounts of protein supplement may be more detrimental to the animal's performance than no protein supplement. The micro-organisms in the stomach of a ruminant adjust to break down the low-quality proteins in dry mature forage. Introducing insufficient amounts of a supplement containing highly soluble protein alters the kinds and numbers of rumen micro flora, so they become less effective in utilizing the less soluble protein of mature forage. The total amount of digestible protein used by an animal may thus be less than if no supplement had been fed. An example for feeding protein to cattle is 41 percent crude protein (CP) cottonseed cubes or 43 to 48 percent CP soybean meal. Feeding these protein supplements, coupled with adequate amounts of dormant vegetation, is generally an efficient method of providing supplements to cattle. If any supplement mixture other than the two mentioned is fed, consideration should be given to the following:

- Cost per pound of digestible protein in mixtures, compared with that of cottonseed or soybean derivatives.
- Quality of the product.
- Effectiveness of mixture in balancing the needs of the animal with the kind of

vegetation grazed.

- Possible detrimental effects of the mixture to domestic animals and big game animals.
- Value of added trace elements and vitamins in mixture.
- Labor requirements.

2. Feed additives

A feed additive is an ingredient or combination of ingredients added to the basic feed mix or parts thereof to fulfill a specific need. Additives are used to stimulate growth or other types of performance or to improve the efficiency of feed utilization or be beneficial to the animal's health or metabolism. The various groups of additives classified as drugs include: antibiotics, nitro furans, sulfa compounds, coccidiostats, wormers, and hormone-like compounds.

1.1. Antibiotics—these compounds are produced by micro-organisms that have the properties of inhibiting the growth or metabolism of organisms that may be toxic to animals. Two antibiotics approved in recent years are Monessen and lasalocid, which are rumen additives. These additives shift the rumen volatile fatty acid production to propionic acid and a reduction of methane production, which results in more efficient and improved gain in growing and adult animals on pasture or forage.

1.2. Feeding protein supplements Methods of feeding protein supplements include:

- Mixing salt with protein supplement to control intake.
- Blending urea with molasses.
- Use of protein blocks.
- Use of range cubes or pellets (soybean or cottonseed).
- Use of cottonseed or soybean meal.

General feeding rules are:

- Substitute 3 pounds of corn silage for 1 pound of alfalfa-grass hay.
- Substitute 3 pounds of alfalfa-grass hay for 1 pound of grain.
- During winter feeding, provide warm drinking water in cold areas so that energy

from the animal's body is not needed to warm the water. Livestock will then drink more water, which improves general health and performance.

- Provide sheds or windbreaks in cold regions to keep livestock from expending energy to maintain body temperature.
- If riparian areas are used for winter protection, exercise caution or install measures to avoid excessive.

2. Minerals and vitamins

In some areas livestock may need minerals, such as phosphorus, calcium, or magnesium, and trace elements including manganese, selenium, molybdenum, copper, and iodine. To be effective, the minerals should be made available to both mother and offspring. Phosphorus supplements include di calcium phosphate, steamed bone meal, or polyphosphate mixtures. They are normally fed in a mixture of one part of salt to two parts of supplement. If phosphorus is supplemented, calcium needs of the animals are generally satisfied. The calcium to phosphorus ratio needed by cattle is 2 parts calcium to 1 part phosphorus. Calcium is usually readily available, and supplemental minerals being fed should be at a 1 to 1 or 1.5 to 1 ratio. Magnesium is very unpalatable and must be mixed with an enticer for animals to consume it. Copper is often needed as a trace mineral in peat soils, as found in some marsh rangelands. Vitamin A is often needed if animals graze mostly dormant, dry vegetation. The intramuscular injection is effective in providing sufficient amounts of vitamin A. It generally provides sufficient vitamin A for a 3-month period.

Local needs should be established, as applicable, relative to the kinds and amounts of minerals required.

Self-Check -1	Written Test

Name _____ **Date** _____

Directions: Part I. Choose the best answer (2pts each).

1. Magnesium is very unpalatable and must be mixed with an enticer for animals to consume

   A.True B. False

2. Which one is not the types of supplementary feed?

   A. As a form of protein

   B. As a form of additives

   C. As a form of mineral

   D. all

Part II. Answer all the questions listed below

1, Mention the methods of feeding protein supplements. (4pts)

2. The calcium to phosphorus ratio needed by cattle is ____ parts calcium to _____ part phosphorus (2pts)

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

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

Information sheet 2- Determining economic basis to supplementary feeding system

2.1. Determination of the economic basis to supplementary feeding

Early in a drought there is usually plenty of poor quality dry feed, which animals cannot use efficiently. Supplementary feeding at this stage aims to make better use of this feed by supplying those nutrients that the pasture is deficient in, so that animals can be cheaply maintained while decisions are being made.

- **Supplementary feeding**

This is an option only when there is paddock feed available. When availability of paddock feed becomes limited, survival feeding or production feeding must be implemented.

- **Survival feeding**

  Survival feeding means providing an animal with the minimum feed it needs to stay alive

- **Production feeding**

  Production feeding means, for adult stock, sufficient food for successful breeding or, for younger animals, sufficient food to meet growth and/or market targets.

Supplementary feeding principles

To be effective, the supplement you choose must make up for the main nutrient deficiencies in the paddock feed. Dry feed is often deficient in protein and sulphur. In cases where the feed is green but very short, it is the low energy intake which limits production. The following principles for efficient use of supplements should be followed. Identify the most limiting components, usually protein, sulphur and/or metabolisable energy.

Self-Check -2	Written Test

Name _____ **Date**_____

Directions: Part I. Answer all the questions listed below.

1. _____is the feeding means providing an animal with the minimum feed it needs to stay alive (2pts)

2. The most limiting components, usually are _____, _____ and/or _____ (3pts)

Note: **Satisfactory rating – 5 points** **Unsatisfactory - below 5 points**

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

Information sheet 3- Determining supplementary feeding program

3.1. Determining supplementary feeding program to satisfy deficiencies in pasture feed or animal condition.

When supplements are fed to stock, there are three possible outcomes, depending on whether energy supplements or protein supplements are used and on how the pasture and supplement interact during digestion:

- **Supplementation**. The supplement is eaten and pasture intake is unchanged. This is a rare event.
- **Substitution**. The supplement eaten causes reduced pasture intake. This usually occurs when pasture is supplemented with a high-energy feed.
- **Complementation**. The supplement is eaten and pasture intake increases. This occurs when stock is grazing on dry pasture or crop stubble and the supplement improves the animal's ability to utilize the feed.

2.1. Frequency feeding

Non-protein nitrogen sources – such as urea and sulfate of ammonia – dissolve quickly in the rumen, and any surplus nitrogen is wastefully excreted. To be effective, the non-protein supplements must be fed little and often.

Protein meals, such as cottonseed meal or linseed meal, release their protein differently, allowing cattle to use the protein efficiently over a longer period. Twice-weekly feeding is as effective as daily feeding.

High-protein grains (e.g. lupines or peas) are more degradable, with a higher protein release rate, and should be fed every second or third day.

Protein meals and seeds

Protein meals and high-protein seeds are excellent supplements when pasture digestibility is falling.

Protein meals are oilseed crop by-products. The most common high-protein seeds are

white (‘fuzzy’) cottonseed and lupines.

Both protein meals and seeds can be fed twice weekly in daily amount multiples. They are safe feeds and do not cause acidosis (grain poisoning).

Block licks

Although commercial urea and protein blocks are convenient and can be used with moderate success as supplements to abundant dry feed (over 2500 kg dry matter/ha), they cost three to four times as much as high quality protein feed. Better results can be achieved at a fraction of the cost by using legume grains or protein meals.

Block licks are best used in the early drought phase.

Roller drums

Roller drums supply nitrogen from the urea in a molasses, urea and water mix. They are useful only when dry standing feed exists, and they are an alternative choice to protein block licks. Their ‘window of usefulness’ is when you want to maintain live weight in a dry spell, and dry feed is plentiful. They work best with ‘dry’ cattle.

Each mix should last about 30 head for 10 days. To decrease the rate of consumption, reduce the proportion of molasses.

WARNING: Urea can be poisonous to stock.

Grain and hay

In the early drought phase (dry standing feed), grains and hays tend to act as a substitute for paddock feed rather than a supplement. Supplements encourage the use of standing dry feed.

Cereal grains (such as oats or wheat) are not efficient supplements when paddock feed is dry. They produce lactic acid in the rumen, which slows down the digestion and consumption of fibrous paddock feed. You can reduce this effect by feeding small

amounts every 3 days and by adding protein meals, grain legumes or white cottonseed. This will fill the gap between the protein level in the grain and the animal's need for 15% protein. In practice the high protein alternatives, such as lupins, peas, or cottonseed meal, will give better results while paddock feed lasts.

Grains are more useful when feed is short and green. This is particularly so for dry cattle, which need less roughage. Hay is best for lactating cows on short green feed, particularly in the colder months. The main role of grains is in full feeding when available pasture is low, and cattle should be removed from paddocks to reduce the likelihood of erosion.

White cottonseed

White cottonseed is an excellent supplementary feed for all cattle except calves under 4 months of age.

White cottonseed mixes well with grain and protein meals. It is high in energy and protein, but because its high oil content may cause digestive upsets, it should make up no more than a third of maximum potential feed intake (i.e. two-thirds of intake should be from pasture).

- White cottonseed fed as a supplement to pasture is an excellent complete supplement.
- It can be fed whole, in dumps in the paddock, twice a week.
- Intake should be kept to a safe 2.5 kg/day for adult cattle.
- Do not feed where no roughage is available.

Molasses

Cattle can be fed molasses-based diets fortified with protein meal and urea, provided there is roughage in the paddocks.

Molasses-based diets are versatile and can be used in the early drought stage as a production feed as well as being used in full feeding recommended for use as stock feed sources of phosphorus. These products now contain fluorine at levels that can cause fluorosis if fed for an extended period.

The new sources of phosphorus are monocalcium and dicalcium phosphates that are low in fluorine and cadmium

2.2. Assessing pasture Quantity

- Good forage quantity is described as a condition where there is readily available amount material for grazing (proper plant height and plant spacing). The height of the forage is maintained between **3 and 8 inches** during the pasture season.
- High quality forage is described as being high in protein and energy, and is easily digested by the animals.
- High quality forage is actively growing, lush forage (that is, it is in a vegetative phase of growth and has lot of green, leafy material).
- Low quality forage is slow growing, dry forage (that is, it is in a reproductive phase of growth, has mature seed heads, and contains a lot of stems compared with leaves). It is low in protein and energy, and is not very digestible - like straw).

The role of the legume in a mixed pasture sward

- legume have high protein content .they improve the palatability of a mixed grass-legume pasture by keeping the CP level above the critical level (7% of tropical species, 8.5% of temperate species) below which voluntary intake declines.
- Dry matter digestibility and voluntary intake of legume is generally higher than the grasses
- Legumes have high content of the mineral: calicum, sulphate, and phosphures , thus they provide stock with more balanced diet
- Legumes play an important role through symbiotic N fixation and the cycling of this nitrogen in to the pasture system

Self-Check -3	Written Test

Name _____ Date_____

Directions

Part I. Answer all the questions listed below.

1. Mention the role of the legume in a mixed pasture sward (3pts)
2. High quality forage is described as being high in _____ and _____, and is easily digested by the animals? (2pts)

Part II. Choose the best answer.

1. The type of supplementation when supplement is eaten and pasture intake increases(2pts):
   A. Supplementation
   B. substitution
   C. complementation
   D. All
2. The supplement feeding recommended for use as stock feed sources of phosphorus.. (2pts)
   A. .Molasses
   B. Pasture
   C. legumes
   D. Block licks
   E. None

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

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

Information sheet 4- Determining feeding requirements of livestock

4.1. Benefits and timing of strategic feed supplementation

I. Why supplement grazing animals?

Feed supplementation is an integral part of good animal husbandry practices. Feed supplements are put into use to achieve the following objectives:

- **Bridge or meet deficient nutrient(s)**

Feed that constitute the bulk of grazing animals' diet, namely range forages and crop residues, oftentimes are deficient in one or more essential nutrients. Failure to supplement deficient nutrient(s) severely suppresses rumen functions, DM digestibility and hence animal performance. Deficient nutrient(s) are administered in a variety of way, for minerals and vitamins through a drench, rumen bolus or injection, and as part of the ration for protein and energy related deficiencies.

- **Improve the utilization of feed in relative abundance**

Here, the objective is to create a rumen environment that enhances microbial degradation of the abundantly available fibrous feed. In this circumstance, feed supplements help maintain optimum rumen environment for increased utilization of the poor quality fibrous feed.

- **Prevent scouring**

Using dry roughage as a supplement could become necessary when animals graze on lush grass commonly high in moisture. Feeding dry forage reduces scouring and slows the passage of forage through the rumen thereby increasing nutrient uptake and pasture utilization. Feeding animals with dry roughage also reduces the risks of bloating in places and times such incidences are high.

- **Speed recovery from nutritional stress**

During drought or periods of extended dry spell, the quality and quantity of feed decreases thereby limiting animal nutrient intake and causing substantial loss of tissues or body condition. The body tissues reduced during these eriods are deposited when adequate animal feed intake is restored. Rapid recovery of the undernourished livestock and resumption of production and reproduction would require a feed supplement with sufficient digestible nutrients. Legume-based forage are ideal supplements.

- **Increase production and reproduction**

Growing, breeding, pregnant, lactating or working animals require the consumption of feed over and above the maintenance requirement. When animals in such physiological states are not given supplementary feed, production and reproduction drops, and in the extreme cases vulnerability to diseases increases. In lactating cows, for instance, the ad-lib supply of good quality forage could support 2 to 5 litres of milk production. For higher production, it is advisable to provide concentrate-based feed supplements. As a thumb rule, it is required to provide 1 kg of good quality concentrate feed for every 2 litres of milk produced.

Self-Check -4	Written Test

Name _____ Date _____

Directions

Part I. Answer all the questions listed below.

1. Mention the objectives supplementing grazing animals (5pts)

Part II. Choose the best answer.

1. During drought or periods of extended dry spell which one of the following is true? (2pts):

A. the quality and quantity of feed decreases

B. .thereby limiting animal nutrient intake

C. causing substantial loss of tissues or body condition

D. All

2. The supplement feeding recommended for use as stock feed sources of phosphorus.. (2pts)

A..Molasses

B.Pasture

C. legumes

D. Block licks

E.None

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

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

Information sheet 5- Introducing supplementary feeding

2.2.1. When to provide animals with feed supplements?

The timing of feed supplements depends on the objective. Otherwise, it occurs both in normal and periods of livestock feed crises. In normal times, feed supplements are used to increase livestock production and ensure the economic viability of livestock operations. The main purpose of providing supplement feed in periods of feed crises and during post-stress periods is to save the lives of animals and encourage rapid recovery of body condition.

Providing grazing animals with supplemental feed is part of improved livestock management practice. Feed supplements are necessary to: Ensure animals get enough amount of nutrients required to maintain desirable level of production and reproduction. Enhance intake and rumen degradability of fibrous feed. Avoid loss of condition and mortality of livestock during extreme feed crises. Encourage post-feed-stress period recovery of grazing animals

2.2.2. Characteristics of supplemental feeds

Desired characteristics of feed supplements

In ruminant animals' diets, feed supplements require to fulfil three conditions. These include:

• **Feed supplements should supply nutrients that further improve the rumen fermentation process**.

Under smallholder conditions, the ideal feed supplements constitute good quality forage, preferably forage legumes. For best effect, it is necessary to maintain the inclusion level of good quality forage between 10 and 30 percent of the total ration. Higher levels educe the

utilization of the poor quality basal diet.

- **Supplemental feed should supply by-pass protein**.

This is a protein source, which is required to pass the rumen intact and reach the small intestine in order to support high livestock production performance. A wide array of feed supplements serves this purpose. These include whole cottonseeds, oil seed cakes, fishmeal and leaf meals of browse shrubs and trees high in poly phenolics (tannins). In order to avoid the depression effect of the by-pass protein sources on the low quality basal diet and for economic reasons, these forms of feed supplements should not exceed a 30 percent level of inclusion.

- **Supplements should provide most deficient nutrient(s).** An ideal rumen function requires an adequate supply of rumen soluble protein or more specifically a protein source with fermentable Nitrogen (N). This is particularly vital for a basal diet (cereal residue/mature grass) whose crude protein content is less than 7 percent. Fertilizer grade urea or poultry manure are good sources of rumen soluble N. Treating cereal residues with rumen fermentable N (e.g. fertilizer grade urea) increase DM intake, digestibility and animal growth rate or milk production.

3.1. Introducing supplementary feed to livestock based on basis of supplementation

As mentioned in the previous topic, Supplementary feeding at important stage aims to make better use of this feed by supplying those nutrients that the feed is deficient in, so that animals can be cheaply maintained while decisions are being made. Supplementary feeding is an option only when there is some feed available When availability of paddock feed becomes limited, survival feeding or production feeding must be implemented. ‘Survival feeding’ means providing an animal with the minimum feed it needs to stay alive; ‘Production feeding’ means, for adult stock, sufficient food for successful breeding or, for

younger animals, sufficient food to meet growth and/or market targets.

Energy is the fuel that keeps all body functions going. Just as petrol powers the car, energy in feed powers the dairy cow. Milk production requires a lot of energy.

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.

Sources of energy are explained briefly in the previous topic.

Fats: Fats are energy-rich feedstuffs. Soon after calving, when cows are not able to eat as much feed as their bodies require, fats can be added to their rations. This is only necessary in the highest producing dairy cows. Good sources of fat for dairy cows are oilseed meals. However, too much fat in the diet can prevent cattle from digesting fibre and so no more than five per cent of the dry matter of a ration should be provided by fat. Expert advice should be obtained before fat is included in the ration of cattle. Local needs should be established, as applicable, relative to the kinds and amounts of minerals required

Protein

Proteins provide the essential chemical building blocks for all the body's cells and tissues, including muscles, blood, skin, internal organs, and also to make milk.

People and animals such as pigs and dogs need to eat high quality protein in their diets, for

example meat, fish, milk, eggs and pulses. But cattle and other ruminants can also make protein from cheap, nitrogen-containing materials such as the chemical urea and poultry litter as well as digesting the protein contained in their feed.

Milk production and protein

One litter of cross-bred cows' milk usually contains about 35 g of protein (35 g of protein per litter of milk can also be expressed as 3.5% protein content). This means that a cow producing 25 litre of milk per day loses close to one kilogram (actually 25 litters x 35 g per litre = 875 g) of protein in the milk each day. Cows cannot store much protein in their bodies and so it must be supplied in the daily ration in order to maintain high milk production.

Dairy cows can also make protein from materials that contain nitrogen - such as the chemical urea and litter from poultry houses - through the action of micro-organisms in the rumen. However, feeding urea to dairy cattle is potentially dangerous and expert advice should be obtained before introducing urea into a ration

Minerals

Minerals are a small but important component of feeds. They are essential for cattle to remain healthy and for the body to function properly, for the development and maintenance of strong bones and for successful reproduction and production of milk.

The amount of minerals needed by cattle can vary, such as:

- Mineral requirements of young, growing animals are higher than for adults
- Pregnant and milking cows require more minerals
- High yielding cows require especially large quantities of calcium.
- Calcium deficiency is most likely to occur in early lactation.

Macro- and micro-minerals

Minerals are required in much smaller amounts than other nutrients, such as energy or protein. But dairy cattle need more of some types of minerals, called macro-minerals, than they do of others, known as micro-minerals which they require in only very small amounts. On average, about one thousand times more of the macro-minerals are required in the

ration as compared to the micro-minerals.

Mineral supplements

Although forages and concentrates contain some minerals, the types and amounts vary widely and not all minerals naturally present in feeds are available to cattle. Since feeds cannot be relied upon to supply all the required minerals, extra supplementation should be provided in the form of a mineral mixture, to which cattle should have regular access. A good quality mineral supplement will contain all the micro-minerals and most of the macro-minerals a dairy animal will require to remain healthy and productive.

It is recommended to construct a box to hold the mineral mix and place it in the housing unit or at a convenient place in the grazing area. Ideally, the box should be raised from the ground with a roof to protect it from rain so the minerals are not washed away.

There are many cheap salts and mineral mixtures for sale but their quality is often doubtful so:

- Purchase mineral supplements from well known manufacturers
- Make sure the package has a label clearly indicating the mineral content and the identity of the manufacturer
- Ask your feed or agro-vet supplier or animal health adviser about mineral mixtures specially made for your local conditions.

Calcium and phosphorus

Two macro-minerals are of particular importance. These are calcium and phosphorus and special attention needs to be given to them when formulating rations. Calcium and phosphorus are naturally found in grasses, legumes, cereals and concentrates and are added to commercially produced dairy meals, but:

- Most tropical soils are deficient in phosphorus and forages grown on them will also be low in phosphorus
- Pastures grown on acid, sandy or peaty soils in humid areas tend to be low in calcium

- During prolonged dry seasons, when there is a shortage of green leafy material, the amount of phosphorus in forages decrease
- Legumes tend to be have more calcium and phosphorus than grasses
- Grains are low in calcium
- Calcium deficiency is most likely to occur in early lactation (milk fever)
- Young, dark green forage tends to contain more minerals than old, dry, yellowing forage

Extra calcium and phosphorus usually need to be provided in the ration over and above that naturally present in the feed and mineral mix, especially for high yielding animals. Good sources of calcium and phosphorous include:

- Steamed bone meal
- Mono calcium phosphate
- Calcium chloride.

Other macro-minerals

Common salt (sodium chloride) should also be given to provide sodium and chlorine. Magnesium is also required in relatively large quantities by high yielding dairy cows. Good sources of magnesium include magnesium oxide and magnesium sulphate. Forages will usually supply enough potassium.

Mineral feeding methods

A. **Force-feeding**

Force-feeding is recommended for feeding minerals to dairy cows as it eliminates palatability problems, daily and cow-to-cow variation in intake, and over-consumption of minerals. The best method of force-feeding is in a total mixed ration. Another commonly used method is to use a grain carrier. This method is suitable where the requirements can be predicted fairly accurately.

B. **Free choice**

The free choice method is not as accurate as force-feeding but is very practical. The mineral supplement, which is usually in powder or block form, is purchased and placed in a mineral box. Construct a mineral box and place it in the housing unit or at a strategic place in the grazing area. The box should be raised from the ground and covered with a roof to protect the mineral from the rains. Animals consume the mineral ad libitum (as much and as often as desired).

C. Topdressing

The topdressing method is often used for stall-fed cows where individual feeding is practised. The mineral mixture in powder form is sprinkled on the chopped material and the animal consumes it as it feeds. The problem is the minerals may separate and settle at the bottom of the trough.

Water

All animals need water for their bodies to function normally. Without water animals die quickly, within a day or two– much more quickly than they would without food. Water is needed to make saliva to enable feed to be swallowed and for chewing the cud, for food to be digested, to cool the body when it is too hot and to remove waste materials from the body in the urine and faeces. In addition a milking cow needs water for milk production: it takes about five litres of water to produce each litre of milk.

Cross-bred dairy cattle are not well adapted to heat stress and it is therefore especially important to make sure that water is available to them at all times. The amount of water a dairy animal drinks per day depends on many factors, including how much milk is produced, how hot it is, the amount of feed eaten and the water content of that feed.

Select supplementary feeds based on cost.

Productive dairy cows simply cannot eat enough bulk forage to supply all their nutritional requirements. They need to be fed high quality nutrient-rich feeds in addition to the bulk forages that form the largest part of their rations. These nutrient- rich feeds are called supplements and there are two types:

- Supplementary forages
- Concentrates

Supplementary forages

Supplementary forages are fibrous plants similar to bulk forages but they have higher level of protein and energy than ordinary bulk forages. Most supplementary forages are legumes crops, especially grown on the farm to feed dairy cattle.

Supplementary forages can be used in two ways: either to compensate for poor quality bulk forages or to substitute for concentrates: for example three kilograms of fresh calliandra can replace one kilogram of commercial dairy meal.

Supplementary forages can be fed fresh, dried as hay, for leaves of shrub and tree legumes as dry leaf meal, or preserved as silage. But they should be fed with caution as feeding large amounts of some supplementary forages can cause bloat and other problems. Usually supplementary forages should not make up more than 25 to 30 per cent of the ration on an as-fed basis.

CONCENTRATES

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

Economics of feeding concentrates

Failure to feed enough supplements, especially early in the lactation, is the main reason why many cows give much less milk than they are capable of, which reduces the profit the farmer could have made. Also, soon after calving cows cannot eat enough bulk to provide all the nutrients they need and supplements, including concentrates, are especially needed at this time.

As much forage as possible should be fed before supplementing the ration with concentrates. Too little forage in the ration can also lead to a decrease in milk fat content. Concentrates are expensive – more expensive than forages - and they should therefore be used to support additional milk production. This means that the farmer will get a return on the money spent on concentrates. If the rules of concentrate feeding are followed (see below), money spent on concentrates will lead tohigher milk yields and higher profits.

How to feed concentrates

The type and amount of concentrate to feed an individual cow will depend on the quality of forage the cow is given and the level of milk production. Forages vary in quality: generally legumes are of high quality, fresh grasses medium and crop residues, such as straw, low quality, containing high, medium and low levels of protein, respectively.

If the milking cow is fed on forage with a low protein content, such as tall, overgrown Napier grass or dry maize stalks, then concentrates with a high protein content need to be given to provide a balanced diet and support a high milk yield. If the cow is fed on high protein

forages, such as good quality pasture, or also receives supplementary forages, such as lucerne, lower protein concentrates can be used – or no concentrates may be needed, depending on the cows' milk yield.

How much to feed?

Concentrates are expensive and therefore should be fed carefully to get the best return on your investment. The amount of concentrates fed should depend on the level of milk production and the quality of forage. The most economical level of feeding concentrates is the point at which the last amount of additional concentrate added to the ration is just paid for by the extra milk produced by that unit of concentrate. But this point may be difficult to determine for individual cows

- it requires careful measurement of the amount of concentrate given and milk produced. Also, it is influenced by changes in milk and feed prices
- if the milk price drops, it may no longer be economical to feed as much concentrates.

Alternative approaches to feeding concentrates

Challenge feeding: This method of concentrate feeding is traditionally recommended for cows in early lactation. Begin with a low level of concentrates, such as four kilograms of dairy meal per day, and gradually increase the amount of concentrates fed each day until the point is reached when adding more concentrate does not result in an increase in the next day's milk production. Continue with this level of feeding for the first 12 weeks of the lactation. After 12 weeks, the amount of concentrates fed should depend on the milk yield. If the cow is fed on good quality forage it should be able to produce five to ten litres of milk per day on forage alone. For every litre of milk produced over and above five litres, feed half to one kilogram of concentrate. So, for a cow producing eight litres of milk per day after 12 weeks, feed one to two kilograms of concentrate per day.

Flat rate feeding: Feeding a constant amount of concentrates, for example two kilograms

per day, throughout the entire lactation is not recommended. During early lactation the concentrate fed is insufficient, while during late lactation it will be too much.

Targeted concentrate feeding: If financial constraints mean it is not possible to feed as much concentrates as would be ideal, then it is best to feed all the concentrates available during early lactation. Cows produce more milk during early lactation and they need plenty of nutrients to support this. Also, the amount of milk they produce during this period influences the amount of milk they will produce later in the lactation - the more milk they produce in early lactation, the more milk they will give in late lactation.

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Self-Check -5	Written Test

Name _____ Date _____

Directions

Part I. Answer all the questions listed below.

1. Write the advantages and dis advantages of concentrate feed supplementation?(5points)
2. What is the impact of too little energy and too much energy in the diet? (4 points)
3. Mention 4 energy source concentrates of dairy animal feed (4 points)

Part II. Choose the best answer.

1. For every litter of milk produced over and above five litters, feed half to one kilogram of con cent rate is recommended (2pts):
   A. True
   B. False
2. The Mineral feeding methods which is often used for stall-fed cows where individual feeding is practised.. (2pts)
   A. .Forced feeding
   B. Top dressing
   C. Free choice
   D. All

Note: **Satisfactory rating – 17 points** **Unsatisfactory - below 17 points**

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

Information sheet 6 - identifying suitable feed conservation methods

6.1. Feed conservation

Feed conservation is useful to stabilize the year-round supply of livestock feed. It eases storage, minimizes wastage, maintains feed quality and diversifies the sources of supplemental feed. The stable supply of feed, particularly during the peak dry season, prevents loss of livestock body weight and sharp drop in milk production and increased vulnerability to diseases and parasites.

There are several methods, which producers could use to efficiently store and preserve forages for lean periods. It is also important to recognize the fact that conserved materials do not match the nutritive value of fresh forage. This is so because conserved feed looses part of its digestible nutrients (proteins, sugar and fat) in the course of storage and conservation. Proper feed conservation and storage, however, can minimize such nutrient losses.

6.2. Timing forage harvesting for hay or silage

Appropriate decisions on the forage harvesting time help conserve forage DM biomass with reasonable quality. Harvesting forage at vegetative stage of growth produces biomass with high crude protein, intake and digestibility values but severely compromise DM yield. As a thumb rule, it is good to harvest grass and leguminous forage as soon as the floral parts start to emerge. This is a period where one notices visible signs of change in plant growth from vegetative to reproductive stage.

6.3. Suitability of conservation techniques

The suitability of conservation techniques is dependent on a number of conditions. Among others, these include forage morphological characteristics, storage facilities, weather condition and the intended use of the conserved forage material. Irrespective of the

weather condition, rangeland forages, improved fodder crops and crop residues with thick stocks and high moisture content suit the silage-based feed conservation. Cactus (Opuntia ficus indica), elephant grass, and any succulent freshly harvested fibrous feed fall under this category. On the contrary, fine-stalked forages can ideally be conserved as hay. Forage sources that suit haymaking are native and improved grasses, legume leaf meals and shrub/tree pods.

6.3.1. Hay preparation

In contrast to silage production, haymaking requires aerobic and dry conditions. It is a practice where moisture is removed quickly from the forage material to less than 15 percent. Such low moisture content prevents plant respiration and helps conserve forage for a long period. The process of haymaking or curing normally takes place during dry weather. Dry air temperature and low relative humidity, wind speed and soil moisture are conditions that allow the rapid removal of moisture from the cured material. In light of this fact, it is recommended to set the timing of haymaking based on local weather forecast.

The other important condition for haymaking is the morphological difference of the various forage species. Forage physical characteristic of the plant such as stem thickness affects the speed of the process. In thick stemmed forages, the speed of the drying process is slow since the removal of moisture from the stem core to the epidermis takes a long time. Similarly, forage species whose leaf epidermis are covered with waxy substances require an extended curing time. As a group, grasses dry much faster than legumes, although the variation among grass species is considerably high. Within a group (grass or legumes), forage species with high leaf to stem ratio would be cured faster since leaves dry faster than stems.

What are the processes strictly observed while haymaking?

Adequate awareness and understanding of the basics of haymaking are useful for

producing good quality hay. The key haymaking processes are:

- Start harvesting the forage during the week when the weather is conducive (sunny days, low relative humidity and dry soil surface). Where feasible it is recommended to set the conducive time based on local weather forecast.
- Harvest forage at the stage of maturity where the DM yield and nutritive value are optimized, i.e. at pre-flowering stage (boot to early heading stage for grasses) and late bud to early bloom (10 percent flowering) for leguminous forages.
- Reduce nutrient loss due to plant respiration and microbial degradation through spreading and frequent turning of the harvested forage, which help rapidly decrease the moisture content.
- Rake or turn legumes in the morning to avoid shattering**.**
- Speed up the drying of thick stem forages by chaffing and conditioning.
- Complete the field curing process within three to five days to prevent bleaching (loss of carotene), leaf shattering and decline in hay nutritional value.
- Check the adequate drying of the hay by twisting (well-dried swaths tend to be brittle or inelastic) and stem pilling techniques. Final product moisture content of less than 15 percent is necessary to avoid spontaneous hay combustion and the risks of mycotoxin production.
- Use baler or manual hay box to make bales.
- Store bales under shades. Beds raised from the ground could become necessary when the floor of the shades is not concrete.

How to speed-up drying of succulent forages?

Conditioning of forage conserved as hay: The speed and the evenness of the drying process affects the quality and safety of forage material conserved in the form of hay. Leguminous forages (including freshly harvested groundnut and cowpea biomass) and relatively thick and succulent stemmed grasses will take longer time to dry. Crushing or

bruising the stems of such forages using hammer, machete or any other suitable tool would facilitate rapid moisture removal and even drying.

Characteristics of good quality hay

- Where laboratory analysis is possible, reasonably high crude protein and total digestible nutrients (values considered good varies with species).
- Leafiness: leaves contain three times more nutrients than stems, and much higher digestibility.
- Less proportion of coarse stems.
- Green colour: green colored hay is rich in protein, vitamins (especially vitamin A) and imply proper curing.
- Agreeable smell: fresh or sweet smell indicate fast and proper curing.
- Absence of foreign materials (weeds).
- Absence of mould and dust

Figure 2. Good quality hay

6.3.2. Silage preparation

Silage is the final product achieved following the anaerobic conservation of high moisture forage material. In the silage making process, the anaerobic condition encourages the fermentation of sugar into organic acids (e.g. lactic acid) that give the ensiled material the desired smell and prevents the development of spoilage microorganisms.

Silage making processes

There are a number of critical issues to be considered while making silage and utilizing the ensiled material. These include:

1. Harvest the forage to be ensiled at the stage of maturity where DM yield and nutrient content are optimized (milk stage for maize, 25–50 percent heading for grasses and 10 percent flowering for leguminous forage crops).
2. Wilt forage materials with excess moisture in order to minimize seepage loss of nutrients and undesirable secondary fermentation (i.e. butyric acid production resulting in foul smell). For leguminous forage wilt until the material DM reaches 40–45 percent but for grasses at biomass DM content of 30 percent
3. Use fermentation accelerating additives where it is available. Ensure the forage material to be ensiled has adequate water-soluble carbohydrate to be fermented into lactic acid. Where possible, add additives (5 percent molasses or 5 percent maize or sorghum flour or 10 percent chopped sweet sorghum) in forages low in water-soluble carbohydrate.
4. Reduce particle size using manual or power operated choppers, preferable at 30 cm or less particle size. This is useful for all kinds of forage materials ensiled but particularly so for forages with thicker stems. Chopping (chaffing) eases compaction and air removal.
5. Rapid removal air (create an oxygen free condition) through adequate packing and sealing. The silo filling and packing should last from a few hours to about half a day (large-scale operation).
6. Fill silo layer by layer (not more than 50 cm at a time) and packing to avoid the trapping of air.
7. Finish filling with the top appearing dome shaped.
8. Facilitate the fermentation process, which encourages lactic acid producing bacteria, eventually lowering the pH (3.8–5.0) of the ensiled material.

9. Depending on the weather condition and the nature of the forage material, the fermentation process completes in two to four weeks' time.
10. Use of ensiled materials once the silos or bags are opened. Longer exposure to air (oxygen) will lead to the deterioration and spoilage of the ensiled materials.
11. Maintain silos or bags airtight. As long as the anaerobic conditions are maintained, the ensiled material can stay safe for a year or more. In big silos, plastic sheets and concrete barriers provide the required level of sealing. In the small-scale pastoral or agro pastoral condition, earth-pits lined with heavy duty plastic sheets (5 mm thick and UV resistant) and covered on top with soil mass serve the same purpose
12. Where the silage is intended for milking animals, feed them after milking to avoid the milk from taking the smell of the silage.

Characteristics of good silage

- Smell: pleasant acid smell
- Colour: yellowish green
- Wholesomeness: absence of mould

Self-Check -6	Written Test

Name_____ Date _____

Directions

Part I. Answer all the questions listed below.

1. What are the characteristics of good silage? (3 point)
4. Mention the uses feed conservation (4 points)

Part II. Choose the best answer.

1. One of the following is critical issues to be considered while making silage and utilizing the ensiled material (2pts):
   A. Use fermentation accelerating additives
   B. Reduce particle size using manual or power operated choppers
   C. Fill silo layer by layer
   D. All

2. The speed and the evenness of the drying process affects the quality and safety of forage material conserved in the form of ha.. (2pts)
   A. True
   B. False

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

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

Operation Sheet-1	Feed conservation

Silage preparation

Step 1. Prepare necessary equipments
Step 2. Chaffed fodder
Step 3. Ensiling in clean day
Step 4. Filed the chaffed crops quickly
Step 5. Compact properly to eliminate air
Step 6. Placed the mass properly in the silo
Step 7. Trampled dawn compact with tractor/ bullocks
Step 8. Properly sealed the materials with mud or straw or polyethylene sheets
Step 9. Report your finding and observation to the supervisor/trainer

Sheet-2	Feed conservation

Hay preparation

Steps to be followed

1. Select suitable personal protective equipment (PPE) and wear it
2. Harvest at optimum stages of flowering as dew evaporated
3. Turn the harvested grass two to three days daily until comptelty dried
4. Hip into small pieces as it suitable for collecting
5. Store it at the storage site at optimum moisture content
6. prepare a report on the task and submit to your instructor
7. Provide it for the livestock's as it required

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 10 hours.

Task 1. Perform hay preparation

Task 2.Perform silage making

LG# 35	LO3- Apply ration formulation techniques

Instruction sheet

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

- Calibrating scales and containers.
- Identifying methods of ration balancing
- Identifying ingredients
- Measuring ingredients in the specified ratios and quantities.
- Blending ingredients adequately and hygienically.
- Milling ingredients
- Identifying OHS hazards, assessing risk and implementing suitable controls
- Selecting, using and maintaining suitable PPE

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 –

- Calibrate scales and containers.
- Identify methods of ration balancing
- Identify ingredients
- Measure ingredients in the specified ratios and quantities.
- Blend ingredients adequately and hygienically.
- Mill ingredients
- Identify OHS hazards, assessing risk and implementing suitable controls
- Select, use and maintaine suitable PPE

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information sheet 1 - Calibrating scales and containers

1.1. Introduction

Calibration is a process of ensuring and maintaining the accuracy of a weighing instrument in alignment with a standard or accepted range of results. Therefore weighing scale calibration is considered the process of correcting, determining and checking the scale is meeting its known or assigned accuracy. Even though; the comparison between the output of a scale or balance against a standard value. Usually done with a standard known weight and adjusted so the instrument gives a reading in agreement**.**

Then scales are practically used everywhere for ingredient measure based on weight measurements. There are many reasons (health, safety, invoicing, etc.) that require a proper calibration of weighing scales. Some weighing instruments are small laboratory instruments measuring a few grams and are very accurate.

While some industrial weighing instruments are very large ones that measure, for example, mass of trucks. Then; scale calibration is a procedure that ensures a weighing scale or balance delivers correct, accurate weighing results to the degree specified on the scale. The accuracy of weighing scales can diminish over time through regular use, dust build-up or age; a process often referred to as 'drift'.

Therefore; as any accurate measuring instruments, also weighing scales needs to be calibrated regularly using reference weights that are accurate, calibrated and traceable.

1.2. Calibrating preconditions

Typically, the whole measurement range is calibrated and the calibration is performed in the location where the instrument is being used. Even though there so many weighing scales for different measuring purposes. But, for these information sheet there only

discussed common weighing scales or measurement. Before calibrating the weighing scale or instruments different groundwork and tests were discussed as below.

1.2.1. Calibration steps before preparations

- The whole measurement range is calibrated and the calibration is performed in the location where the instrument is being used
- The temperature of the weights should be stabilized to the same temperature where the calibration is to be done
- The weighing instrument should be at a horizontal level, especially for small and accurate weighing instruments.
- Perform a few pre-tests by placing weights close to the maximum of the range on the instrument and to ensure it works normally

Note: - Each mixer should be calibrated for its mixing time and capacity by volume for best results.

Self-Check -1	Written Test

Name _____ **Date** _____

Directions

Part I. Answer all the questions listed below.

1. _____ is a process of ensuring and maintaining the accuracy of a weighing instrument in alignment with a standard or accepted range of results (2 point)

2. Mention the Calibration steps before preparations (5 points)

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

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

Information sheet 2 - Identifying methods of ration balancing

2.1. Introduction

What is ration formulation/ balancing?

Ration/feed formulation involves the quantification of feed ingredients mixed to supply all the nutritional requirements for the maintenance and desired production of a specified animal at the lowest cost. The formulator develops a nutritionally adequate ration that is consumed in sufficient amounts to provide the desired level of production.

Prior to the initiation of a feed formulation, the following information is required:

Nutrient requirements of the animal.

This information is obtained from animal feed standards which have been developed by legally mandated institutions in different countries. During formulation, it may not be necessary to consider micronutrients (trace elements and vitamins) as these can be supplied through premixes. The macro nutrients (energy, protein), amino acids and macro minerals are considered.

In formulating ration for cattle and providing, the prime consideration is to ascertain & meet up the total requirement in terms of:-

- Dry matter (DM)
- Digestible crude protein (DCP)
- Energy i.e. Total digestible nutrient (TDN) for 24 hours.

The most basic ones are:

✓ High energy roughage—To provide higher concentration, and possibility of higher feed intake.

- ✓ High-energy concentrates—Concentrates should contain a lot of energy and should be chosen based on structure and primary product. Fat is a good energy feedstuff in this phase of lactation

Requirement of Dry matter-

Total DM ----- 2/3 (as roughage) - 2/3 dry roughage or 3/4 if sufficient legume is available

- 1/3 Green roughages or if green fodder is legume, this Proportion may be only 1/4 of the total roughage ration

---- 1/3 (as concentrate)

Example - 1. Calculate DM requirement for a dairy cow weighing 400 kg, the dry matter requirement will be provided as indicated below.

- Total DM requirement (kg) = 400kg * 3% = 12kg
- DM as concentrate (kg) - 12kg * 1/3 = 4kg
- DM as roughage (kg) - 12kg * 3/4 = 8kg
- DM as dry roughage (kg - 8kg * 3/4 = 6kg
- DM as green roughage (kg) - 8kg * 1/4 = 2kg

Example 2. Calculate the feed requirement on DM% bases of a 500kg live body wt dairy cow yeilding 15 liter milk daily. Then the daily feed requirement of a cow will be 3% * BWt + 10 % M. yield

3/100* 500kg +10/100 * 15 lt

15 +1.5 = 16.5 kg/day/cow

Then, calculate

A. Feed requirement for one cow per year

B. Daily feed requirement for 50 cows/day.

C. Feed requirement for 50 cows/year.

Availability of feedstuffs

For homemade rations, locally available material should be used as much as possible. For commercial feeds, a wider range can be used. Nutrient content of each feedstuff.

This should be obtained through i) direct laboratory analysis, ii) analysis results from reliable suppliers, or iii) feed stuffs that have a relatively uniform composition (e.g. whole cereals) from published sources (textbook values). Published values however can be misleading, especially for by-products, as local processing may affect outcomes. Whenever possible, laboratory analysis of by-product-based ingredients should be made for a more accurate formulation.

Cost of ingredients delivered to the farm/plant

Cost considerations should be based on the value of the nutrients being supplied by an ingredient i.e. following the concept of purchasing nutrients, not ingredients. The quality of the nutrient should be considered (e.g. proteins in terms of amino acid quality)

.**Limitations of inclusion for each ingredient and livestock species**.

The use of fish meal for example as broiler feed can taint the meat. Feeding CSC to chicken layers causes egg spoilage. During feed formulation, it should be noted that

i.) simple nutrient needs can be met adequately by simple feed formulas (complexity does not necessarily improve performance);

ii.) an individual feedstuff will rarely supply all nutrient needs;

iii.) trace minerals and vitamins are added as premixes (as per manufacturer recommendations); and

iv.) Feed additives are added as per supplier instructions.

2.2. Methods of ration balancing

Three common methods to ration balancing include the Pearson Square, substitution formulation and computer-assisted formulation based on substitution or linear programming for least-cost formulation. The following example will help in understanding the first method used.

Simple Techniques in Ration Formulation

The techniques presented here will allow formulation of simple mixtures on the basis of a single nutrient (protein). These techniques can also be used with other procedures to accomplish more complex formulations of complete rations. Our approach shall be to first learn the techniques as applied to simple formulations and then apply variations that will allow their application to more complex formulations.

A. **Using Two Feed Sources**

Formulate 100 lbs. of a complete swine diet containing 16% crude protein (CP). The feeds to be used are corn (8.9% CP) and a commercial supplement containing 36% CP.

1. **Algebraic equations** - a system of two equations in two unknowns

A. Mathematical procedure

X = lbs. corn

Y = lbs. supplement

Equation (1) X + Y = 100 lbs. diet

Equation (2) 0.089X + 0.360Y = 16.0 lbs. Protein (16% of 100 lbs.)

A third equation is developed to subtract from equation (2) in order to cancel either X or Y; equation (3) is developed by multiplying everything in equation (1) by a factor of 0.089, thus

Equation (2) 0.089X + 0.360Y = 16.0

(Subtract) equation (3) - -0,089X - 0.089Y = - 8.9

0 0.271Y = 7.1

Y = 7.1/0.271 = 26.2(lbs. supplement)

Replace Y with 26.2 in equation 1: X = 100 – 26.2 = 73.8(lbs. corn)

b. Check

73.8 lbs. corn 3 8.9% CP = 6.57 lbs. CP

26.2 lbs. supplement 3 36.0% CP 5 = 9.43 lbs. CP

100.0 lbs. diet **16.00 lbs. CP**

2. Pearson square—another technique to accomplish the same objective

A. Place the percent protein desired in the combination of the two feeds in the center of a square and the percent protein content of each feed at the left corners.

Corn	8.9%		20.0 parts corn
		16%	
Supplement	36.0%		7.1 parts supplement
			27.1 total parts

a. Subtract diagonally across the square, the smaller number from the larger without regard to sign and record the difference at the right corners.

b. The parts of each feed can be expressed as a percent of the total, and these per centages can be applied to any quantity.

20.0 parts corn / 27.1. total parts * 100 = 73.8 lbs. corn
7.1. parts supplement / 27.1. total parts * 100 = 26.2 supplement

73.8 % * 100lb = 73.8% corn and
26.2 %* 2100lb = 26.2 supplement

D. Check

73. 8% corn * 8.9 % corn CP = 6.57 lb CP
26.2 lbs. supplement * 36% CP = 9.43 lbs. CP
100.0 lbs. diet 16.00 lbs. CP

E. Precautions about using the Pearson square

1. It can only be used for two feed materials; however, either or both of these can be mixtures as long as the percentage of the nutrient of interest has been determined for the mix.
2. The number in the center of the square must be intermediate to the two numbers at the left corners. For example, any combination of a 8.9% protein corn and a 36% protein supplement would have to have a protein content between 8.9% and 36%. Always check this because the Pearson square will give an answer if the number in the center is not in-

termediate to the other two even though such an answer is incorrect. This precautionalso a pplies to algebraic equations.

3. The requirement must be expressed as a percent or proportion and can be used f or any nutrient or expression of energy, e.g., percent protein, percent Ca, percent TDN, Mcal/lb., etc.

B. Using Three or More Feed Sources

Prepare 100 lbs. of diet containing 12% protein from a mixture of soybean meal (SBM) and tankage (3 parts SBM and 1 part tankage) with corn. Assume corn to contain 9.0% protein, SBM to contain 44% protein and tankage to contain 60% protein.

1. First, we must arrive at a weighted average protein percent for those ingredients that are most similar in protein content. In this case, the 3:1 mixture of SBM and tankage.

3 parts SBM X 44% prot.	1.32 parts protein
1 part tankage X 60% prot.	0.60 parts protein
4 parts mix	1.92 parts protein

1.92 parts protein/4 parts mix X100 = 48 % protein

2. Now, the Pearson square can be used as before

$36.0 \quad \frac{36}{39}(100) = 92.31\%$ corn

$\frac{3.0}{39.0} \quad \frac{3}{39}(100) = 7.69\%$ mix

a. In 100 lbs. this means

92.31% X 100 lbs. = 92.31 lbs. corn

7.69% X 100 lbs. = 7.69 lbs. mix

b..The 7.69 lbs. mix must be divided into **¾** (75%) SBM and **¼** (25%) tankage, which complies with the initial proportions of each feed. Thus

c. Check

92.31 lbs. corn	X 0.09 = 8.31 lbs. protein
5.77 lbs. SBM	X 0.44 = 2.54 lbs. protein
1.92 lbs. tankage	X 0.60 = 1.15 lbs. protein
100.00 lbs. diet	12.00 lbs. protein

3. Algebraic equations could also be used to solve this problem

X = lbs. corn
Y = lbs. mix (3:1 mixture of SBM:tankage)

1) X + Y = 100.0
2) 0.09X + 0.48Y = 12.0
3) 0.09X _ 0.09Y = -9.0
0 0.39Y = 3.0

Y= 3.0/0.39 = 7.69 lbs. mix

X= 100 - 7, 69 = 92.31 lbs. corn

C. *Using Fixed Ingredients*

Prepare 1000 lbs. of diet from corn (8.9% CP), SBM (46% CP) and fixed ingredients totaling 10% of the diet (e.g., salt, limestone, dicalcium phosphate, trace mineral premix, vitamin premix, etc.).The final diet should contain 14% CP. Assume no protein content in the fixed ingredients.

1. Use of Pearson square

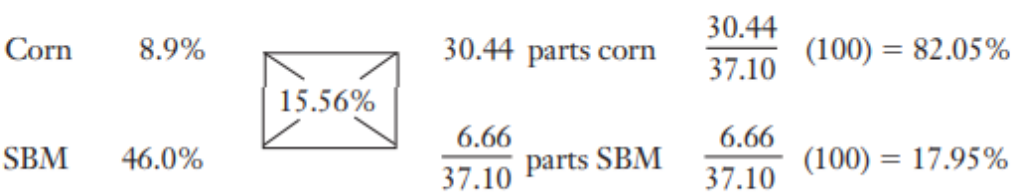
a. Find percent protein to use in center of square

(1) The nonfixed portion (corn-SBM combination) is 900 lbs. (1000 lbs. 3 90%) and will have to supply all the protein (1000 3 14% 5 140 lbs. protein).

2) To do this by the Pearson square method, it is first necessary to calculate what percent protein will be needed in the corn-SBM combination to provide 140 lbs. of protein per 900 lbs., as follows

140/900 X 100 = 15.56% CP

b. This figure (15.56%) is then used in conjunction with the Pearson square as follows



900 lbs. × 82.05% = 738.45 lbs. corn
900 lbs. × 17.95% = 161.55 lbs. SBM

c. Check

738.45 lbs. corn X 8.9% = 65.72 lbs. protein

161.55 lbs. SBM X 46.0% = 74.31 lbs. protein

100.00 lbs. fixed X 0 = 0

1000.00 lbs. ration = 140.03 lbs. protein

2. Use of algebraic equations for the same problem

X = lbs. corn

Y = lbs. SBM

1) X + Y = 900.0 lbs. corn-SBM

2) 0.089X + 0.460Y = 140.0 lbs. CP

3) 0.089X - 0.089Y = 280.1

0 0.371Y = 59.9

Y= 59.9/ 0.371 =161.5 lbs-SBM

X= 900 – 161.5 = 738.6 lbs corn

3. If any of the fixed ingredients contain protein, the amount contributed to the diet is calculated and then subtracted from total quantity needed before formulation by either Pearson square or algebra. Assume the following example. Formulate 1 ton (2000 lbs.) of broiler diet to contain 20.0% crude protein using the following ingredients

Feedstuff	Amount, lbs.
Ground corn (9.0% CP)	?
SBM (44% CP)	?
Meat and bone meal (50% CP)	100.0
Fish meal (65% CP)	40.0
Alfalfa meal, dehydrated (17.5% CP)	40.0
Mineral premix (0% CP)	30.0
Vitamin premix (0% CP)	20.0
TOTAL	2000.0

i. Determine the total amount of crude protein needed in the formulation.

1. lbs. diet X 0.20 = 400 lbs. CP needed

ii. Determine the amount of ingredients fixed and the amount of crude protein they contribute.

Fixed ingredients

Meat and bone meal	100.0 lbs.	X 0.50	=	50.0 lbs. CP fixed
Fish meal	40.0 lbs.	X 0.65	=	26.0 lbs. CP fixed
Alfalfa meal, dehydrated	40.0 lbs.	X 0.175	=	7.0 lbs. CP fixed
Mineral premix	30.0 lbs.	X 0	=	0
Vitamin premix	20.0 lbs.	X 0	=	0
	230.0 lbs. feed			83.0 lbs. CP

Thus, 2000.0 lbs. - 230.0 lbs. fixed = 1770.0 lbs. nonfixed (corn-SBM).

400.0 lbs. - 83.0 lbs. fixed = 317.0 lbs. CP needed from nonfixed.

iii. Solve by algebra.

X = lbs. corn

Y = lbs. SBM

1) X + Y = 1770.0 lbs. corn-SBM

2) 0.09X + 0.44Y = 317.0 lbs. CP

3) - 0.09X - 0.09Y = 2159.3

0 0.35Y = 157.7

Y= 157.7 /0.35 =450.6 lbs.SBM

X= 1770.0 - 450.6 = 1319.4 lbs. corn

C. Computer Assisted Formulation

Most spreadsheet based computer programs that are used to formulate rations use the substitution methodology. There are several advantages to utilizing a computer program for ration balancing. Some programs generate the nutrient requirements after entering the animal description; therefore, looking up nutrient requirements from a table is not required. Computer programs also provide a list of feed ingredients and standard values for nutrient composition. Computer programs show the balance of all nutrients simultaneously. This eliminates the additional time involved in balancing and rechecking each individual nutrient, and allows for easier balancing of rations containing several feed ingredients. Formulas are built into the program, so mathematical mistakes are also eliminated. The acceptance of linear programming (LP) in the formulation of least-cost diets for livestock and poultry feeds is almost universal in its usage in the feed industry. The development of the microcomputer has placed the capabilities of least-cost programming within the range of small to medium-sizedmills and individual producers who could not previously afford such a service. Recent additions of the NRC for many species contain software used to determine dietary requirements.

A. Linear Programming Defined

1. Linear programming is a mathematical technique for determining the optimum allocation of re-sources (different feedstuffs) to obtain a particular objective (meeting nutrient requirements, reducing costs, optimizing profits or exploring changes in nutrient specifications of the diet or in the nutrient content of feedstuffs).

2. Basically, LP is a system by which a number of linear equations are solved on a simultaneous basis. One must establish a series of equations that describe in mathematical terms the conditions or requirements of the formula. These requirements must be measurable in numerical terms.

B. Equipment and Programs Needed

1. Access to a computer. Most desktop computers are capable of running formulation software**.**

2. Many excellent programs are available. It is recommended that at least 640K total memory be available to provide for adequate matrix size.

C. Information Needed In order to formulate a diet one must supply the following information to the computer.

1. A list of feed ingredients available for use in the diet and their present cost. Often the prices of feed ingredients fluctuate enough from week to week to greatly influence the ingredients selected by a computer in a least-cost formulation. These marked ration ingredient changes may affect animal performance. Most software allows the user to manually change prices of feedstuffs according to market fluctuations.

Therefore, it should be pointed out that only ingredients known to be palatable and biologically available to the animal should be included.

2. The nutrient content of each ingredient. There are many sources of information on average nutrient content of ingredients, and these may serve as a starting point for establishing matrix values. However, it must be emphasized that these values usually represent an average nutrient

content; one should always strive to have values that accurately reflect the composition of ingredients actually available for use.

3. The nutrient requirements of the animal in terms of minimum, maximum or exact quantities needed. There are several basic sources of information on nutrient requirements (NRC, university bulletins, feed company brochures, etc.). When using any of these recommendations, know that they represent average ingredient values and feeding standards for average or better growing conditions. Each user must make proper adjustments for local conditions and quality of management.

There is often a tendency for persons starting to use LP to attempt to include specifications for nearly every known nutrient. For most situations it is not necessary to

include more than a dozen or so in the requirements table. This number will depend a great deal upon the quality and variety of ingredients available, and through experience the nutritionist will learn which nutrients must have minimum values expressed in the computer.

4. Physical, nonnutritive or nutritive usage limitations on certain ingredients. Some examples may include

a. Toxic properties in certain ingredients allow only limited usage in a diet.
b. Limitation of feeds containing undesirable properties that may reduce palatability or impart undesirable odors to the carcass, milk or egg.
c. Limitation on quantity available in inventory.
d. Adverse effects on physical texture and storage ability. Ingredients such as fats or molasses may be good sources of energy, but if fed at excessive levels may cause problems with briding of feed in bins, ability of the feed to flow and other such problems.
e. Excessive levels of certain nutrients in the feed. In swine or poultry diets, ingredients such as dried bakery product containing large quantities of salt or dehydrated alfalfa meal's high fiber content may impair performance if fed at higher levels.

f. Variation in nutrient content of certain ingredients. Limitations are often placed on the amount of some ingredients because of a high degree of variability. Animal byproducts are an example of this limitation.

g. The role of the nutritionist has changed markedly as a result of the increased speed and capacity of the computer. Where once the nutritionist spent many hours daily in the routine of formulating or revising feed mixes, this task can now be accomplished in a fraction of the time. This should allow the nutritionist to concentrate upon other aspects of feed formulation and manufacturing such as ingredient evaluation, establishing nutrient requirements and quality control.

Self-Check -2	Written Test

Name _____ Date_____

Directions

Part I. Answer all the questions listed below.

1. Write the Precautions about using the Pearson square (3points)
2. Mention the three methods of ration formulation (3 points)
3. Prepare 1000 lbs. of diet from corn (8.9% CP), SBM (46% CP)

   and fixed ingredients totaling 10%of the diet (e.g., salt, limestone, dicalcium phosphate, tra

   ce mineral premix, vitamin premix, etc.).The final diet should contain 14% CP. Assume n

   o protein content in the fixed ingredients.(6points)
4. Mention the important information required prior to the initiation of a feed formulation,: (3points)

Note: **Satisfactory rating – 15 points** **Unsatisfactory - below 15 points**

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

Information sheet 3 - Identifying ingredients

1.1. Introduction

I**ngredient** is a substance that forms part of a mixture which used in formulation in different systems. The ingredients may be existing in the form plant origin or animal/ minerals and vitamins may be used in the formulation of Animal feed.

Prior to production, specific time must be given to product formulation. Some ingredients are specifically regulated by the countries food and drug admiration authority (FDA). Therefore, In this section selecting quality and safety criteria with accordance of national and international food safety standard and regulations, type and effect of the ingredients, and other additives will be discussed based on the specific objectives of formulation.

1.2. General food safety and quality requirements

Feed safety implies absence or acceptable and safe level of contaminants, adulterants, or any other substances that may make food injurious to animals (WHO, 2004). This means that feed safety is related with the absence or acceptable and safe level of harmful substances present in the feed and concerned with whether the feed has been prepared, handled, and stored under controlled and sanitary conditions in conformance with practice prescribed by government regulations.
Therefore; during selecting the ingredients the following safety standard requirements should be into consideration;

- The ingredient should be free from hazard that harm human being health
- The ingredient should be safe and health
- The ingredient should be not out of usable date or in the range of usable period
- The ingredient should be safe and well stored and hygienically handled
- The ingredient should be fulfill feed graded requirements

- The ingredient should be categorized in intended lists by safety regulations
- The ingredients should be used in recommended amounts in case of composition
- The ingredient should have recommended moisture contents

Self-Check -3	Written Test

Directions

Part I. Answer all the questions listed below.

1. Mention the safety standard requirements that should be taken in to consideration during selecting the ingredients (7points)

2. _____is a substance that forms part of a mixture which used in formulation in different systems. (2 points)

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

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

Information sheet 4. Measuring ingredients in the specified ratios and quantities.

The measurnment of feed ingrident is one of the important concept to know the quantities of the feed ingridente to be mixied in the specified ratios. these can be done using weighing scales and sensetive balances.

weighing ingredients advantages

- Creating easiest condition to use the relative accurate composition of ingredients
- Supportng to balance the ingredient ratio for speciefic products
- Initiate good environment for inventory purposes
- Improve the accuracy of the ingredient composition for certain products
- Enabling for transportation, storage and using activity

Weighing procedures

- Identifying and preparing the type and size of weighing balances
- Arranging the weighing balance on the perfect ground
- Check ing and arranging the scale reading on zero accuracy
- Loading the ingredients on the balance as necessery
- Reading the accurate scales
- Recording the accurete scale reader

The Ratio of requirement of Dry matter for dairy Animals as an example

- Total DM ----- 2;3 (as roughage) – 2 3 dry roughage or
- 3 :4 if sufficient legume is available
- 1 :3 Green roughages or if green fodder is legume, this
- Proportion may be only 1 :4 of the total roughage ration
- 1 :3 (as concentrate)

Self-Check -4	Written Test

Directions: Answer all the questions listed below.

1. List the ingredients weighing procedures? (3 points)
2. describe the ratio of roughage to concentrate(2 points)
3. dry and green feeds are equal/ TRUE/False(2 points)

-

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

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

Information sheet 5 - Blending ingredients adequately and hygienically

4.1. Introduction

The objective of feed mixing is to start with a certain assortment of ingredients called a "formula", totalling some definite weight. This is processed so that each small unit of the whole, either a mouthful or a day's feeding, is the same proportion as the original formula. Mixing is recognized as an empirical unit operation, which means that it is more of an art than a science and must be learned by experience.

Feed mixing may include all possible combinations of solids and liquids. Within each ingredient are differences in physical properties. For solids there are differences in particle size, shape, density, electostatic charge, coefficient of friction as represented by the angle of repose, elasticity or resilience and, of course, colour, odour, and taste. For liquids there are differences in viscosity and density

4.2. Mixing/ Blending

Mixing is the process of combining different materials to produce a homogeneous product. Homogeneous can be defined as “Uniform in structure or Composition” Why mix or blend? A homogeneous mixture may be mixed to a certain weight (batch size) with:

- Consistent particle size distribution
- Consistent colour
- Consistent texture
- Specific ratios of components

Blends which are very concentrated are often termed “Pre-mixes” or “Master batches”. Mixing and blending are terms which are often interchanged but there are differences.

Blending is often a gentle process combining materials whereas mixing often involves a more vigorous combination. Poor mixing can affect the quality of the product resulting in non-homogeneous product which can affect chemical composition, colour, reactivity and particle size. Over blending can lead to separation, aeration and with liquids also viscosity increases.

4.3. Available types of mixers/blenders

The three main classifications include:

4.3.1. **Blenders:**

Generally for Solid-Solid blending or the addition of small amounts of liquid with solids. For solids both the vessel shape and agitator define the mixer. Examples of Industrial Blenders include:

a. Convection Blenders such as Ribbon Blenders, Paddle Blenders, Vertical Screw Blenders, Plough Sheer mixers
b. Tumble Blenders such as Drum Blenders, Double Cone Blenders, V-Blenders
c. Fluidization Blenders/ Mixers
d. High Sheer mixers
e. Static/in-line mixers

4.3.2. **Agitators**:

Typically used for Liquid-Liquid mixing and solid suspensions in liquids and use rotating impellers. For liquids the agitator type defines the mixer and agitator types include Gate, Propeller, Saw Type, and Paddle.

4.3.3. **Heavy Duty Mixers**:

Generally used for high viscosity materials such as putty.

4.4. **Which Industries are blending and milling required**?

Used extensively in specialty Chemical sectors such as:

- Biocides Water treatment
- Animal Feed Additives
- Crop Protection
- Plastics & Polymers
- Detergents
- Oilfield Chemical

Self-Check -5	Written Test

Name _____ **Date**_____

Directions

Part I. Answer all the questions listed below.

.1. Mention the five examples of Industrial Blenders (5pts)

2. Mention the three available main classifications of mixers/blenders (3 points)

3. What is mixing or blending ?(2pts)

Part II. Choose the best answer.

1. Which one is typically used for Liquid-Liquid mixing and solid suspensions in liquids and use rotating impellers? (2pts):

   A. Agitator**s**:
   B. Blenders
   C. Heavy duty mixers
   D. None

2. A homogeneous mixture may be mixed to a certain weight (batch size) with:___ (2pts):

   A. Consistent particle size distribution
   B. Consistent colour
   C. Consistent texture
   D. Specific ratios of components
   E. All

Note: **Satisfactory rating – 14 points** **Unsatisfactory - below 14 points**

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

Information sheet -6 Milling ingredients

6.1. Introduction

Dry feeds may be ground, sifted, screened, mixed, compressed, expanded, texturized, colored and flavored. By one or more of these processes, a wide variety of ingredients can be prepared into a standardized product. Since most fish have size and texture preferences and often react to colour, odor, and flavor, processing research is an integral part of fish culture.

6.2. Grinding /milling

Grinding or particle-size reduction is a major function of feed manufacturing. Many feed mills pass all incoming ingredients through a grinder for several reasons:

- Clumps and large fragments are reduced in size,
- Some moisture is removed due to aeration, and
- Additives such as antioxidants may be blended.

All of these improve the ease of handling ingredients and their storability.

There are other reasons for grinding and the associated sieving of ingredients in formula feeds before further processing. Small fish and fry require plankton-size feeds available in dry form as a meal or granule. Extremes in particle sizes are wasteful and often dangerous.

The grinding of ingredients generally improves feed digestibility, acceptability, mixing properties, pelletability, and increases the bulk density of some ingredients. It is accomplished by many types of manual and mechanical operations involving impact, attrition, and cutting.

6.3. Hammer mills

Hammer mills are mostly impact grinders with swinging or stationary steel bars forcing ingredients against a circular screen or solid serrated section designated as a striking plate (Figure 1). Material is held in the grinding chamber until it is reduced to the size of the openings in the screen. The number of hammers on a rotating shaft, their size, arrangement, and sharpness, the speed of rotation, wear patterns, and clearance at the tip relative to the screen or striking plate are important variables in grinding capacity and the appearance of the product. Heat imparted to the material, due to the work of grinding, is related to the time it is held within the chamber and the air flow characteristics. Impact grinding is most efficient with dry, low-fat ingredients, although many other materials may be reduced in size by proper screen selection and regulated intake.

Most hammermills have a horizontal drive shaft which suspends vertical hammers but for some ingredients, such as dried animal byproducts, a "vertical" hammermill is more efficient. In this mill, the drive shaft is positioned vertically and screens and hammers are positioned horizontally. Material successfully reduced in size to the diameter of screen holes or smaller, are carried by gravity outside the mill and thence by air or conveyor to storage in "make-up" bins. Over-size particles, not easily broken, drop through the mill and may be re-cycled or discarded. Thus foreign materials, such as metal and stones, are discharged before they are forced through the screen causing damage.

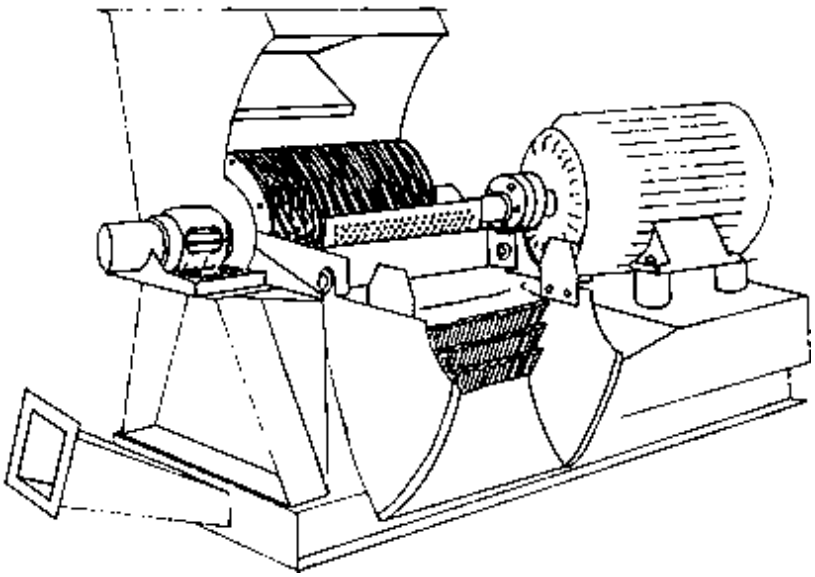


Figure 1. Hammer Mill

6.3. Attrition Mills

Attrition mills use the hammermill principle to a certain extent; i.e., shattering by/impact. However, they also impart a shearing and cutting action. Grinding is done between two discs equipped with replaceable wearing surfaces. One or both of these discs is rotated; if both, they rotate in opposite directions. When one disc is rotated, and the other stationary, the assembly is used for shredding and deferring. Often materials which have been coarsely ground by other mills, are passed through an attrition mill for blending or smoothing out an ingredient or mixture containing liquids which may have clumps. The discs of an attrition mill are generally in a vertical position so that materials not capable of reduction can pass by gravity out of the grinding area.

6.4. Roller Mills

A combination of cutting, attrition, and crushing occurs in roller mills. These are smooth or corrugated rolls rotating at the same speed set at a pre-determined distance apart with material passing between the two. A tearing action may be added by operating the rolls at different speeds and by corrugations which are different for each roll; i.e., the top roll may have off-radial spiral corrugations and the bottom roll lateral corrugations. This last type, called a "Le Page cut" is used in making granules from hard pellets, as it provides a breaking surface without much impact to cause dust. Roll grinding is economical but limited to materials which are fairly dry and low in fat.

6.5. Cutters

Rotary cutters are a type of grinder which reduces dry particle solids mainly by shearing with knife edges against a striking plate. The mill also includes the processes of attrition and impact, although these actions are limited if the material is easily reduced by cutting and the screen limiting discharge has large perforations. The mill consists of a rotating shaft with four attached parallel knives and a screen occupying one fourth of the 360

degree rotation. The mill is best used to crack whole grains with a minimum of "fines". It is not used as a final process for reducing the size of ingredients used in fish feeds.

The problem of excess dust formed by grinding feeds may be partly alleviated by adding a spray of oil or a semi-moist ingredient, such as condensed fish soluble or fermentation solubles, on feeds entering the grinder. Dehydrated alfalfa is prepared as a dust-free meal, similar in texture to a sifted crumblized pellet, by spraying mineral oil into a hammermill chamber during grinding.

Self-Check -6	Written Test

Name _____ **Date**_____

Directions

Part I. Answer all the questions listed below.

1. Mention the reasons: why many feed mills pass all incoming ingredients through a grinder? (3pts)

2. Mention the types of grinders (4 points)

3. -____ is particle-size reduction is a major function of feed manufacturing (2pts)

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

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

Information sheet 7. Identifying OHS hazards, assessing risk and implementing suitable controls

7.1. Identifying OHS hazards

There are different occupational hazards. Some of the hazards are**:**

7.1.1. **Physical hazards**

Physical hazards include stones, glass, metal, wood, plastic, or any physical object that could enter the feed and cause harm. The process of harvesting and processing cattle feed requires machinery, equipment, and processes that can unintentionally introduce physical hazards. Broken parts and shards of metal could be mixed into feed ingredients. A poorly located and unprotected light bulb has a risk of shattering. Tools, cell phones, glasses and other objects may be misplaced or fall into processing equipment and become physical hazards in the feed.

The frequency and severity of a physical hazard depend on each facility and process. A facility might choose to utilize a magnet or a screen to remove contaminants as part of their SOPs to reduce the frequency of the hazard. In addition, shatterproof bulbs can be strategically located to reduce the risk of glass contamination.

Standard Operating Procedures for handling tools and personal effects can mitigate risk of those objects becoming physical hazards. Each facility should take into account the source of ingredients, product flow, equipment, storage, and packaging to determine the points where physical hazards could enter the product as well as the appropriate measures to prevent them

7.1.2. Biological hazards

The biological hazards of concern in cattle feed are relatively few in comparison to those in human and pet food. Cattle are more resilient to biological hazards than humans due to the huge population of microorganisms in the rumen that can detoxify some hazards. In addition, cattle feed often comes in less direct contact with humans than pet food and

poses less of a risk to human health. Salmonella is the most likely biological hazard that is targeted for prevention in cattle feed because it poses the most significant risk to human and animal health.

Bovine spongiform encephalopathy (BSE) is a neurological disease that can be transmitted through the nervous tissues of ruminants to other animals.

7.1.3. Common chemical Hazards

The list of chemical hazards affecting cattle feed is longer and more complex than the lists of physical and biological hazards. In addition, there are differences in the risks associated with beef and dairy cattle. For example, due to the high risk for aflatoxins, the FDA has set a default action level for Aflatoxins in Animal Feeds at 20 parts per billion (ppb) .

The risks of chemical hazards are unique to each facility. Chemical hazards in animal feed can be broken down into three categories: naturally occurring, unintentionally introduced, and intentionally introduced. While not a comprehensive review of all the chemical hazards that may occur, this section highlights the major chemical hazards associated with cattle feeds. It is important to recognize that chemical hazards that could affect animal feeds vary widely and must be detected through a thorough hazard analysis.

Unintentionally introduced chemicals like pesticides and other chemical residues, drug carryover, and nutrient deficiencies or toxicities.

7.2. Ways of preventing hazards from occurring

There are multiple ways of preventing hazards from occurring in cattle feed. Appropriate methods of prevention depend on the hazard, its severity, and its likelihood of occurring. Robust CGMPs and SOPs are in practice in most facilities, and many already work to prevent hazards. However, there are some hazards that require more intense methods of prevention due to their severity or frequency. Some facilities implement preventive controls, or additional actions taken to ensure the prevention of certain hazards, and their required components. There are four forms of preventive controls: process controls,

sanitation controls, supply-chain or supplier controls, and other controls. Process controls are the most prevalent in a livestock feed facility. They may include batching and sequencing procedures and daily reconciliation of specific ingredients, such as monensin and other antibiotics.

Self-check 7	Written test

Name…_____ Date_____

Directions: Answer the following questions listed below.

Part I: Choose the best answer (2 point)

1. Appropriate methods of prevention hazards depend on

   A, the hazard type

B. its severity

C. its likelihood of occurring

D. All.

Part I. Answer all the questions listed below.

1. Mention the types of hazards in feed manufacturing (3pts)

2. Mention the types of hazards in feed manufacturing(3pts)

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

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

Information sheet – 8 selecting, using and maintaining suitable PPE

8.1. Introduction

Personal protective equipment, commonly referred to as "PPE", is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses. These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards. Personal protective equipment may include items such as gloves, safety glasses and shoes, earplugs or muffs, hard hats, respirators, or coveralls, vests and full body suits. Insure that all signs and caution labels are in good condition and visible.

8.2 Personal Protective Equipment

In addition to being aware of the mechanical hazards in the work place, it is important that you use the correct protective clothing and equipment. Wearing personal protective equipment (PPE) can prevent accidents from happening. As a worker, you are responsible for the following: Making sure your uniform is well fitted. Keeping all uniforms clean and in good condition, not frayed or badly worn. Making sure sleeves are kept buttoned at the wrist, cuffs on overalls and trousers are be eliminated, and trouser legs are long enough to hang outside boots. Wearing specific personal safety equipment such as goggles, hearing protection, gloves, and aprons when required. To ensure that you are protecting yourself, your personal protective equipment (PPE) list should include the following items.

A. Clothing

This includes well-fitted pants and jackets with all buttons fastened. Sleeves should be close fitting because sleeves that are loose and flowing are potential fire hazards when working over open gas burners. Health regulations require that all food handlers wear hair nets or use other approved methods for keeping hair under control. Aprons should be made of non-combustible and flame-resistant materials that do not melt under heat.

B. Footwear

The OHS Regulation requires that approved footwear must be worn by employees in all industrial occupations. Ensure your footwear is sturdy and provides enough back support to not cause future back problems. Footwear suitable for commercial foodservice establishments must have a non-slip sole and a closed toe and closed back. Your footwear should be sturdy and comfortable, and if the environment you work requires steeled toes, such footwear should be worn. High leather tops on shoes are a good idea as they will protect your feet from hot grease or liquids.

C. Hand protection

The most common type of gloves used in food service establishments are natural rubber latex gloves, synthetic rubber gloves, and vinyl gloves. As it is impossible to distinguish between natural and synthetic rubber gloves simply by looking at them, you should read the label on the box to determine what they are made of. Some people may have an allergic reaction (known as dermatitis) or a more serious reaction known as anaphylaxis to the natural latex glove, and for this reason natural latex gloves are not recommended for use when preparing food. Mesh gloves should be used when cleaning the meat slicer. Thick plastic, gloves should be used when handling cleaning products.

D. Eye protection

Eye protection in the form of safety goggles or masks should be worn whenever there is a chance of eye injury. Particles flying through the air can easily land in your eye and possibly do permanent damage. Eye protection is important, for example, when working with the band saw cutting through bone or when working with corrosive cleansers that could splash into your face.

E. Hearing protection

Approved hearing protection must be worn when high-level noise conditions exist. These conditions are not common in commercial kitchens but may be present in food manufacturing operations.

F. Respirators

Respirators should be used to protect yourself from inhaling harmful fumes or vapours such as those that often come from concentrated kitchen cleaning liquids. The respirator unit should be properly fitted to provide the best protection. Check the components to ensure they are not broken, cracked, or torn and that they do not have holes. Replace faulty components before use. Each unit will have a filter that should be checked regularly and replaced before the expiration date.

All personal protective equipment should be safely designed and constructed, and should be maintained in a clean and reliable fashion. It should fit comfortably, encouraging worker use. If the personal protective equipment does not fit properly, it can make the difference between being safely covered or dangerously exposed. When engineering, work practice, and administrative controls are not feasible or do not provide sufficient protection, employers must provide personal protective equipment to their workers and ensure its proper use. Employers are also required to train each worker required to use personal protective equipment to know:

- What kind is necessary
- How to properly put it on, adjust, wear and take it off
- The limitations of the equipment
- Proper care, maintenance, useful life, and disposal of the equipment
- If PPE is to be used, a PPE program should be implemented.

This program should address the hazards present; the selection, maintenance, and use of PPE; the training of employees; and monitoring of the program to ensure its ongoing effectiveness.

There are many serious safety and health hazards in Feed processing industry. These hazards include exposure to high noise levels, dangerous equipment, slippery floors, musculoskeletal disorders, and hazardous chemicals (including ammonia that is used as a refrigerant). Musculoskeletal disorders comprise a large part of these serious injuries and continue to be common among meat packing workers..

Self-check 8	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below.

Part I: Choose the best answer (4 point)

1____ is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses.

F. Accident B. Damage C. Personal protective equipment

2. From the given choose which one is personal protective equipment.

A. Safety goggles

B. Safety shoes

C. Clothes

D. Gloves

E. Ear protection

F. All

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

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

Operation sheet	Using a Pearson's square method allows blending of two feedstuffs or two mixtures

Following steps listed below mix the given feed stuff ingredients

Step 1: Set up and label your square: the labels stay the same going across

Step 2: Subtract going ACROSS the square

Step 3: Get your total parts

Step 4: Find the % of each feed required

Step 5: Find the total pounds needed of each feed

Step 6. Check your answer!!

Step 7. Show your finding to your supervisor/instructor

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 of feed ingredients using person square method.

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LG# 36	LO4. Develop animal feeding plans

Instruction sheet

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

- Confirming and adjusting feeding plan.
- Developing and monitoring feeding plan
- Selecting a feeding method options to meet condition, growth and production needs
- Determining a feed budget
- Undertaking costs benefit analysis
- Documenting data for continual assessment and effective management planning
- Monitoring and controlling workplace safety and positive environmental practices

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 –**

- Confirm and adjust feeding plan.
- Develop and monitor feeding plan
- Select a feeding method options to meet condition, growth and production needs
- Determine a feed budget
- Undertake costs benefit analysis
- Document data for continual assessment and effective management planning
- Monitor and control workplace safety and positive environmental practices

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.

4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guideIf your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information sheet- 1 Confirming and adjusting feeding plan

1.1. Adjustment of feeding plan

Some rules of adjusting and confirming good feeding plan

Rule 1: Water is always available

- Cows need a lot of water.
- It should be available at all time, clean, tasty and fresh

Rule 2: Feed forages *ad libitum*

- Forages should always be available in the feeding trough
- If there is no feed, dry matter intake is low and they produce less milk

Rule 3: Provide concentrate in small amounts

- Too much concentrate at one time is not healthy for a cow
- Concentrate should be provided at least 3 times per day
- It is best way to mix forages and concentrate

Rule 4: Always provide a mineral block

- Cows know when they need more minerals
- A mineral block guarantees that cows take up sufficient minerals

Rule 5: Increase forage intake as much as possible

- The more they eat, the more they produce
- Forage are cheap, concentrates expensive
- WHAT you give and HOW you give it will largely determine the feed intake!

Rule 6: New feedstuff or ration should always be introduced gradually

- The rumen bacteria change according to the diet
- New feeds need to be introduced step by step, a little bit more every day for 7 to 10 days

1.2. Preparation of feeding budget

In preparing feeding budget developing action plan is also important. No two periods of feed shortage are the same or the choice of the course of action will depend on

1. Current price for stock
2. Amount of fodder on hand
3. Funds available for purchase of fodder
4. Availability and reliability of sock water

1.3. Courses of action

Action has to be taken in the face of drought to prevent cruelty to animals and promoted accepted farming practices for the welfare of livestock. Cattle must not be left to strive to death or die to thrust. The following CA are open to producer

- Move stock
- Sell stock
- Feed stock

1.3.1. Moving stock - on contract grazing area. This is the cheapest solution

Before moving to the new contracted pasture area, check the following

- Secured fencing and handling facilities
- Good quality and quantity feed is available or not
- Availability of good water supply.
- Supervision to minimize death and theft
- Stock need to be identified

1.3.2. Sell stock - if this CA is chosen, crucial management decision will be:

- Timing of the sale
- Type and number of cattle to be sold. The best policy is sale the less productive and care of high producing ones

1.3.3. Feed stock - according to their nutritional requirement

Feed budgets may include pasture-based farms as well as housed livestock. Feed quantities could be described in units relevant for the system being budgeted, and may include dry weight of feed (for example, kilograms of dry matter or kg DM), energy content (for example, estimated metabolisable energy or MJME). etc

:

Self-Check -1	Written Test

Name _____ **Date** _____

Directions:

Answer all the questions listed below.

1. Mention some of rules followed while adjusting and confirming good feeding plan (6 points)

2. Before moving the animals to the new contracted pasture area mention the important points to be checked. (5points)

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

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

Information – 2 Developing and monitoring feeding plan

2.3. introduction and purposes

This is an understanding of the principles of animal feeding and how these can be applied in practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or further education and training. Learners will be able to describe the requirements for a balanced animal diet, provide the appropriate food to animals and monitor and record the effects of feeding and watering animals. Learners will understand how different feeding and watering regimes affect animals.

of animals, from companion animals and pets, to zoo animals and wildlife. Feeding animals is a vital husbandry skill when caring for all types of animals. Learners will develop the skills needed to provide food to animals safely, in a way that adheres to animal welfare and health and safety requirements, and to plan and monitor animal feeding regimes. With animal nutrition being at the forefront of media concerns over welfare, for example issues such as obesity, it is very important for those working in the animal care industry to know the correct way to feed a variety of animals. This unit relates to working with all different species

2.4. The outcome of developing and monitoring feeding plan

2.4.1. Be able to plan diets and feeding regimes for animals

Plan diets and feeding regimes: types of foods for different herbivore, carnivore and omnivore species; major nutrients and their sources; nutritional sources of different feeds; selection of suitable food; preparation of diets; amount of food; alternatives; timing and frequency of feeding; feeding animals in a group or individually; ways to present foods eg enrichment; planning for species and life stage eg young, old, ill, working, pregnant; cost of feeding

2.4.2. Be able to monitor the feeding of animals

Monitoring feeding: amount of food eaten; weight of animals; type of food eaten eg selective feeders; water intake; change in feeding patterns including feeding behaviours; timing between monitoring; feeding requirements in relation to animal work load/uses; recommendations for changes in feeding

2.4.3. Understand the planning and monitoring of animal feeding regimes

Planning and monitoring regimes: usability of feeding plans and regimes; evaluation of plans and regimes and suggestions for improvement including influences on animal health and welfare; analysis of wastage and how to prevent this; effectiveness of plans against a budget; cost of feeding over time; feeding and feed quality in relation to animal work load/uses

Self-Check -2	Written Test

Name _____ Date _____

Directions:

Answer all the questions listed below.

1. What does we mean planning and monitoring of animal feeding regimes (4points)

2. Mention the outcome of developing and monitoring feeding plan . (4points)

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

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

Information sheet 3. Selecting a feeding method options to meet condition, growth and production needs

3.1. Selecting a feeding method options

There are different methods of feeding depending on the condition and type of animal, physiological conditions and production status. These feeding methods includes:

- Staged introduction of grain feeding, feeding grain on the ground or in troughs
- Access to water
- Allowing adequate time to change over feedstuffs
- Ad lib feeding
- Restriction of movement
- Gradual introduction to feedstuffs, and strip grazing and etc

3.1.1. Staged introduction of grain feeding, feeding grain on the ground or in troughs

As described in information sheet 1. in this learning outcome above**,**

- Too much concentrate provision at one time is not healthy
- Concentrate should be provided at least 3 times per day
- It is best way to mix forages and concentrate and

In addition to this, 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

3.1.2. Access to water

All animals need water for their bodies to function normally. Without water animals die quickly, within a day or two– much more quickly than they would without food. Water is needed to make saliva to enable feed to be swallowed and for chewing the cud, for food to be digested, to cool the body when it is too hot and to remove waste materials from the body in the urine and faeces. In addition a milking cow needs water for milk production: it takes about five litres of water to produce each litre of milk.so clean and fresh water should be provided to animals freely.

3.1.3. Ad lib feeding

Forages should always be available in the feeding trough and water and minerals should be *ad libitum*

3.1.4. Restriction of movement

Selective intake may require 10-35% extra feeding to allow for refusal. If the product is chopped (<5 cm), no selective intake can take place. In this case, the average quality is lower resulting in lower DMI and the need for more and better quality concentrates (Balancing a ration).

3.1.5. Allowing adequate time to change over feedstuffs and Gradual introduction to feedstuffs, and strip grazing land for Adaptation

Ruminants must always be adapted to a new feeding regime. Adaptation allows the micro flora in the rumen to adapt to the new substrate they must grow on. This usually takes up to three weeks. When adapting livestock to high concentrate diets, this process is best done by a gradual increase in energy content of a diet. This is called an adaptation ration. With modern additives, such as the ionophores, the adaptation period is not as critical as it used to be. However, although most feedlooters no longer make use of an adaptation ration, a good practice is to place animals on hay for a day or two before supplying the high energy ration. Initially the intake of the concentrate is best limited to 1 to 2 kg per day before animals are allowed free access. This also assists animals to overcome the stress related to transportation to the feedlot.

Self-check 3	Written test

Name _____Date _____

Directions: Answer all the questions listed below.

Part I: Choose the best answer (4 point)

1. One of the following is true about adaptation of animal to a given feeding regime

   A. allows the micro flora in the rumen to adapt to the new substrate

   B. Usually takes up to three weeks.

   C. adapting livestock to high concentrate diets gradually

   D. All

2. Initially the intake of the concentrate is best limited to _____to _____kg per day before animals are allowed free access..

   A. 1kg to 3kg

   B. 1kg to 2kg

   C. 2 kg to 4kg

   D. above 4kg

3. One of the following do not reduce selective feeding

   A. chopping

   B. Ad lib feeding

   C. restricting movement

   D. none

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

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

Information sheet – 4 determining a feed budget

Feed budgeting is a farm assessment to identify feed requirements based on the number and class of livestock to be fed and the production levels that are targeted. A feed budget is generally used as an outline of the feed supply and demand over a 12-month period—a feed year plan.

How to feed budget

Step 1: Calculate how many tonnes of dry matter your herd requires for the year

Average cow body weight…….....… (kg) × 0.020 A=_____

Target milk production …… (litres/day) × 0.3 kg B= _____

BA + B = C=_____

Total cow number (dry + milkers) …….. × 0.365 D=_____

C x D = E=_____

Calculate home-grown feed

Step 2: How much grain, silage and hay can you produce on your farm over a year?

……..tonnes of grain (as fed) × 0. 9 F =___

…… tonnes of silage (as fed) × 0.35 × 0.85 G =____

…….....bales of round bale silage (as fed) ×… kg weight × 0.5 ÷ 1000 H =___

…….bales of hay ×…… weight (kg) × 0.85 ÷ 1000 I =___

F + G + H + I = J =____

Step 3: How much pasture is grown on your farm?

Include all pasture types grown in a year to determine the total amount of pasture produced (i.e. do this calculation for every different pasture species).

Is this amount of pasture required obtainable on your farm?

- Use pasture meters and photo standards to estimate the amount of feed that is grown on your farm.
- Also remember that pasture growth is not consistent all year round—always take into account when there might be feed gaps (autumn).

Total pasture (add all pasture utilised together) K =_____

Home-grown feed total J + K = L =_____

J is from step 2

Calculate purchased concentrates and by products

Step 4: Concentrates and/or by products purchased on a regular basis and used at a consistent rate/day….

Work out how much is required for a year.

Amount of grain fed……..…kg/cow/day × 0.90 M =_____

(M × D) – F = N =_____

Amount of protein meal fed…….....kg/cow/day × 0.91 O =_____

O × D = P =_____

Amount of whole cottonseed fed…….....kg/cow/day × 0.94 Q =_____

Q × D = R =_____

Regular purchased concentrates and by-products total U=_____

Step 5: Calculate the amount of extra feed you will need to purchase?

Surplus/deficit feed DM V= _____

- If the above calculation is a positive number then this is a deficit and this is the approximate amount of feed DM required to be bought in. If the number is a negative, then there is a surplus feed supply for the year.
- Note: this value is tonnes DM/year and needs to be converted to tonnes feed to be purchased on an as-fed (wet) basis in the table below.

Step 6: Don't forget to check the diet against cow requirements, milk production andcomposition every time there is a change of forage, grazing management or feeding regime. It is important to consider constructing a feed year plan as it becomes extremely beneficial when determining what feeds can be home grown and which feeds are economical to purchase. It does, however, need to take into account a risk analysis, where certain limitations may impact on feed availability.

Step 7: Work out which purchased feeds are most cost effective, and diet mix for optimum supply of nutrients.

See Technical Note #18: Nutritional economics for cost effectiveness and Technical Note #6: Balancing the diet for optimum nutrient supply.

Step 8: Convert the DM required to be purchased to an as-fed (wet) basis to calculate the actual amount of feed to purchase.Amount of wet feed to purchase

With the balanced diet(s), calculate the quantity of each individual feed that is required to be purchased using the following formula and table below.

Tonnes DM required = ……. Kg DM of a feed/cow/ day x no. of cows x no. of days used/year x 1000

After doing the above formula for each individual feed, insert the value calculated in the associative feed listed below and use the conversion factor to determine the tonnes of feed to purchase/year as-fed.

Consider the following factors:

- If there is a deficit in feed supply, then it is recommended to calculate what nutrient(s) are limiting by formulating the diet to determine what feeds are most beneficial. For example, if DM intake and energy is limiting, then purchase silage or grain but if forage is the limitation then always replace with a forage source.
- If there is no limitation of feed supply, but the nutritional composition of the feed does not meet the recommended nutrient requirements, then determine what supplement/s maximise rumen health and production. For example, if protein is most deficient, then the inclusion of a protein meal would be most beneficial.
- Always consider the limitations of certain feeds fed to dairy cows, as excesses of a particular feeds can cause rumen health problems.
- A combination of various supplements may be required to achieve the correct nutritional balance.

Self-check 4	Written test

Name…… Date…….

Directions: Answer all the questions listed below.

Part I: Answer the following question properly

1. Indicate how to calculate how many tonnes of dry matter your herd requires for the year (4 point)
2. Mention at least 3 factors considered in feed budgeting (3 point)
3. Feed budgeting is a farm assessment to identify feed requirements based __(2pts)

.A. the number and class of livestock to be fed

B. the production levels that are targeted.

C. used as an outline of the feed supply

D. All

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

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

Information sheet - 5 undertaking costs benefit analysis

5.1. Introduction

Much has been written about feeding efficiency as a major influence on profits in livestock production. Feed costs are shown to be the largest single item of cost and feeding efficiency to hinge on the twin problems of ascertaining the best level of yield for which to feed and of selecting those, feedstufs that produce the yield at least cost. Having demonstrated the incontrovertible logic of marginal analysis in the solution of these problems, agricultural economists tend to abandon the farmer to the task of putting theory into practice. While it is not disputed that a knowledge of principles may assist producers by delineating the information that is ideally required. The concern of this analysis is determination of optimal levels of output..

Data analysis

Data obtained were subjected to analysis of variance (ANOVA) and net farm income (NFI) analysis as described to carry out the cost-benefit analysis as follows.

NI=TR-(TVC+TFC)

Where

NI, Net Income (Profit of the product)

TR, Total Revenue ;

TVC, Total Variable Costs;

TFC, Total Fixed Costs.

Some economic indicators were also applied to ascertain the economic viability of the study. Hence Operating ratio, gross ratio and fixed ratios were calculated following

OR=TOC/GI

Where

OR, operating ratio;

TOC, Total operating cost;

GI, Gross income;

GR, TFC/GI GR = TFC/GI

Where

GR, Gross ratio;

TFC, Total fixed expenses;

GI, Gross income

FR=TFC/GI

Where

FR, Fixed ratio;

TFC, Total fixed cost;

GI, Gross income

Feed conversion ratio, being total feed intake per unit weight gain was also calculated for each animal in each treatment.

in general cost benefit analysis is obtained from a given farm by considering all costs of production (fixed and variable costs and comparing with the net income obtained

Self-check 5	Written test

Name _____Date _____

Directions: Answer all the questions listed below.

Part I: Answer the following question properly

1. Total operating cost divided by Gross income) will give us _____(3 point)

2. NI, Net Income (Profit of the product) is calculated from _____,_____, _____ and indicate the formula (3 point)

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

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

Information sheet- 6 Documenting data for continual assessment and effective management planning

6.1. Documenting data for continual assessment and planning management

What to measure and when during the time of assessment

- how many tonnes of dry matter your herd requires for the year
- How much grain, silage and hay can you produce on your farm over a year
- Concentrates and/or by products purchased on a regular basis and used at a consistent rate/day….
- Calculate the amount of extra feed you will need to purchase
- regularly check pasture growth and livestock stock class performance and assess against targets set in the grazing plan
- use a rate of pasture assessment techniques
- Aim to balance the level of animal intake (i.e. head/ha* intake /head should be equivalent to pasture growth /ha) in relation to predicted pasture growth rate to get the best pasture e utilization in targeted and longer grazing events.
- review and revise fortnightly or weekly, according to the need of stock class and pasture management

The longer the grazing period, the more critical monitoring becomes as other control, such as grazing duration and manipulation of graized area with temporary fencing decline with effectiveness.

Planning data includes:

- area to be grazed (ha)
- target graze period for the paddocks (days)
- daily pasture growth estimates
- initial pasture herbage mass(kg DM/ha)
- initial pasture quality (MJME/kg DM. or simply M/D)
- predicted pasture growth for the grazed period for the zero period (kg DM/ha/day)

7.2. Monitoring data

Includes:

- **Pasture assessment**
  - ✓ assess pasture mass in paddocks(kg green DM/ha)
  - ✓ estimate pasture energy content (MJ ME/kg DM or simply/d)
- **Animal assessment**
  - ✓ individual and average initial body condition (fat) score
  - ✓ current field estimate of range in condition score
  - ✓ weight of animal at last weighing
  - ✓ current field estimate of weight range
  - ✓ current live weight

Self-check 6	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below.

Part I: Answer the following question properly

1. indicate at least five what to measure and when during the time of assessment and documentation (5 points)
2. In monitoring of data mention important points addressed while assessing animal (5point)

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

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

Information sheet- 7 Monitoring and controlling workplace safety and positive environmental practices

7.1. Environmental safety

Environmental safety has become a high priority issue within the countries around the world. Ensuring the safety of an environment is key to productivity and function in a work or research setting.

Environmental safety is the practice of policies and procedures that ensure that a surrounding environment, including work areas, laboratories or facilities, is free of dangers that could cause harm to a person working in those areas. A safe place to work is the key element of environmental safety.

Enhanced Safety, Health and Environment Outcomes through Improved safety, health and environment outcomes through better design are about eliminating or minimising risks in the preliminary planning stages of a product. Better design provides a foundation for improved outcomes in the development, use and maintenance of a product like plant and equipment or a building. Improved outcomes in design require the many stakeholders who contribute to the design process to critically review its safety, health and environment implications. Therefore, the client, or end user, must be actively involved in the review to ensure that operational requirements and maintenance issues, intrinsically known to the client, are considered by other design stakeholders. For example, safety, health and environment implications inherent in the design of a building project may exist in its construction, use, maintenance and demolition, i.e. its complete lifecycle. Similar implications exist for the design of other products such as plant or equipment, e.g. its manufacture through to decommissioning

What are the environmental management practices?

From a broader viewpoint, the term environmental management practices encompasses those used by firms to reduce environmental impacts in their day-to-day operations: examples may include life cycle analysis, environmental management services (EMS), industrial ecology, and energy management

What is the most important strategy in environmental practices?

Strategies which support **cost reduction**, increase operating and energy efficiency, lower air, water and soil pollution, save natural resources are the most effective strategies of any company.

Self-check 7	Written test

Name _____Date _____

Directions: Answer all the questions listed below.

Part I: Answer the following question properly

1. Environmental safety is the practice of policies and procedures that ensure that a surrounding environment,

   A. True B, False

2. the most effective strategies of environmental practices of any company support

   A. cost reduction,

   B. Increase operating and energy efficiency,

   C. lower air, water and soil pollution,

   D. save natural resources

   E. All

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

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

Operation sheet -	**Determining a feed budget**

Using the following steps determine the feed budget

Prior to conducting this operation the necessary materials and PPEs well prepared

Step 1: Calculate how many tonnes of dry matter your herd requires for the year

Step 2: calculate how much grain, silage and hay can you produce on your farm over a year?

Step 3: calculate how much pasture is grown on your farm

Step 4: Concentrates and/or by products purchased on a regular basis and used at a consistent rate/day…

Step 5**:** Calculate the amount of extra feed you will need to purchase

Step 6**:** Don't forget to check the diet against cow requirements, milk production and composition

Step 7**:** Work out which purchased feeds are most cost effective, and diet mix for optimum supply of nutrients

Step 8: Convert the DM required to be purchased to an as-fed (wet) basis to calculate the actual amount of feed to purchase.

Step 9 report you finding on feed budgeting

Hint. Use assumptions

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.

Task. Perform feed budgeting

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DEEDI website www.deedi.qld.gov.au for the Nutrition Plu$ Technical Note series

Protein Plu$ checkbook (Published 2006 by DPI&F, Queensland)

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The University of Iowa Animal Research Institutional Animal Care and Use Committee: http://research.uiowa.edu/animalExternal

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chrome-extension://mhjfbmdgcfjbbpaeojofohoefgiehjai/index.html

The trainers who developed the curriculum

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