Unit 4

Providing Feed and Water for Livestock

171109CH04

Introduction

Feed costs constitute about 70 per cent of the total cost incurred on dairy animal production. A good animal feed is balanced properly with proteins, carbohydrates, fats, minerals and vitamins, and plays a pivotal role in successful dairy farming. A good quality feed is palatable, economical and has such composition that animals feed liberally. It is moderately bulky, laxative and free from toxins (Fig. 4.1).

The selection of percentage of ingredients to be incorporated in the ration is based on their prices in particular seasons to reduce the cost of feeding. The feed ingredients are purchased when they are available at cheaper rate and stored for future use. Storage losses are minimised to provide feed at cheaper rate.

Session 1: Animal Feedstuff, their Characteristics, Composition and Quality

Types and characteristics of animal feedstuff

Animal feedstuff are broadly classified into three categories depending upon percentage of crude fibre (CF), total digestible nutrients (TDN) and crude protein (CP). Depending upon the availability of different items,

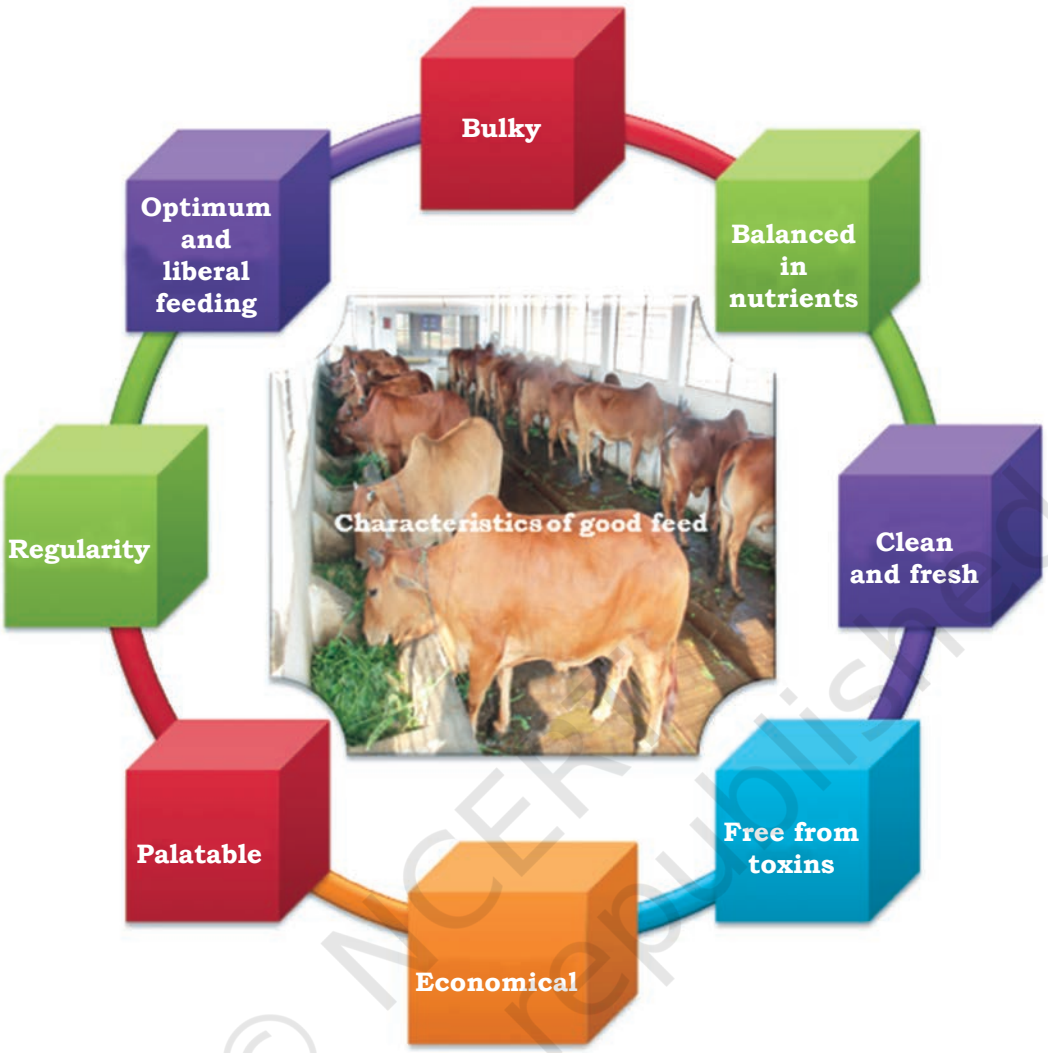


Fig. 4.1: Characteristics of good feedstuff for animal

a dairy farmer can add or delete the nutrient items in various ways to fulfil the dietary needs of the livestock. Fig. 4.2 explains the broad concept of partitioning of feedstuff into CF, TDN and CP.

Feed composition and its quality

The animal feed can be approximately partitioned in six major components, i.e., water, ash, crude protein (CP), ether extract (EE), crude fibre (CF) and nitrogen-free extract (NFE) (Fig. 4.3). An exact measurement of these six components in the feed is required to know the quality of the feed, e.g., if the given feed is fibrous, energy-rich or protein feed.

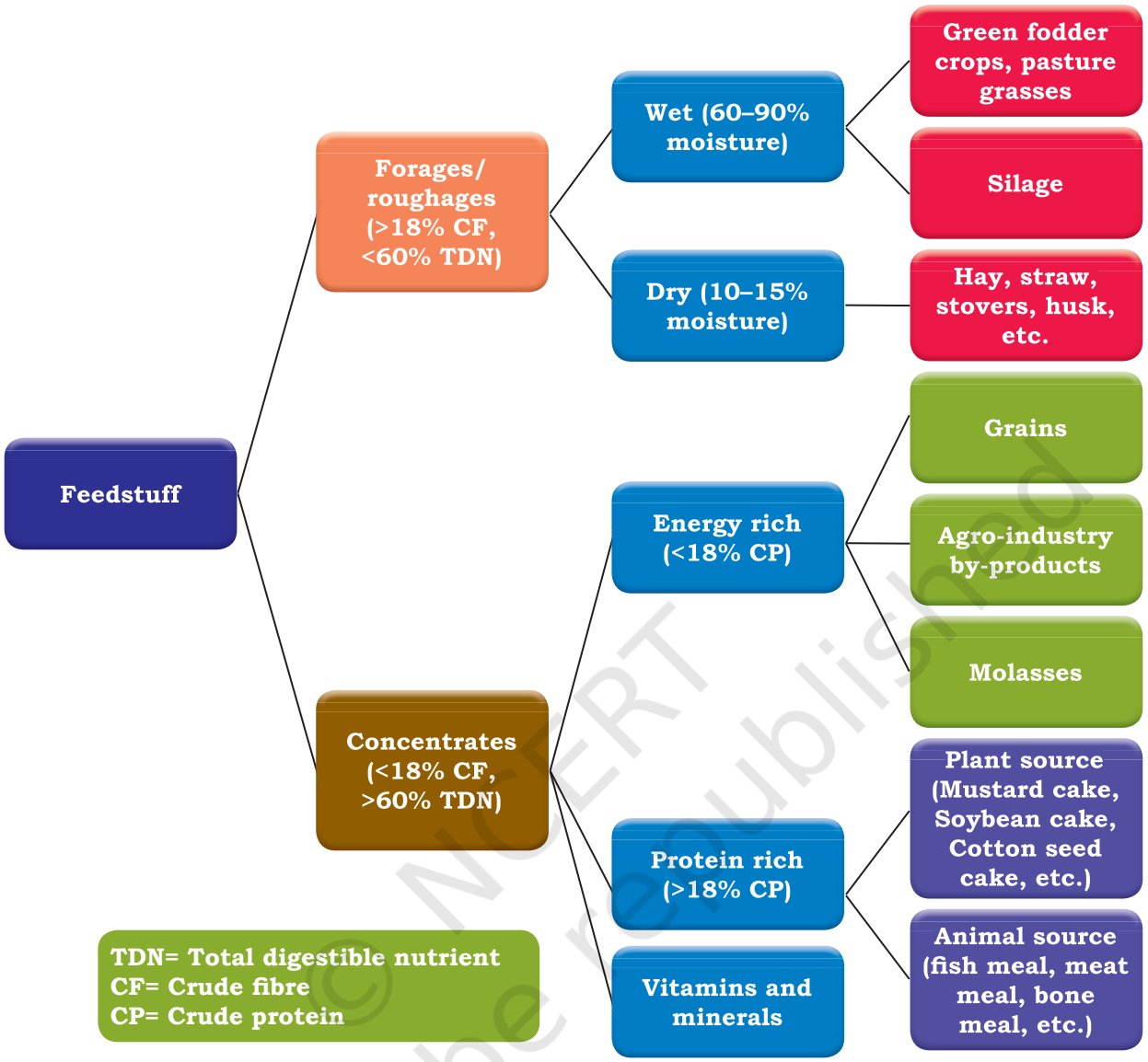


Fig. 4.2: Types of animal feedstuff

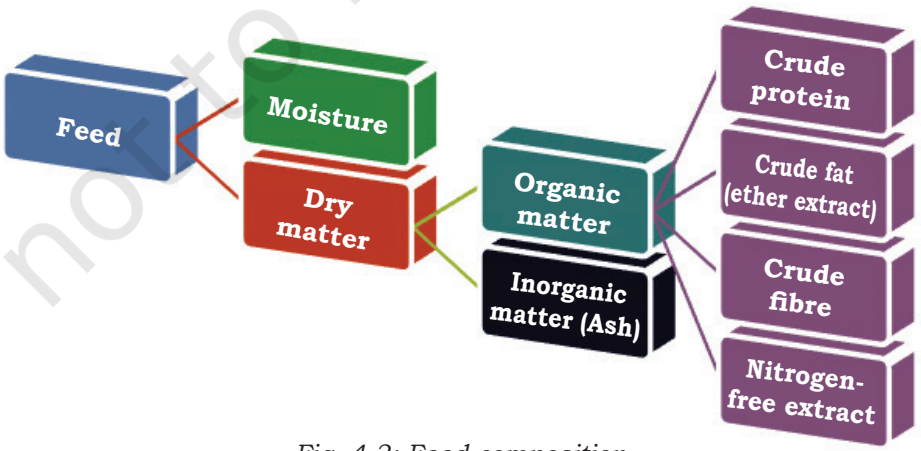


Fig. 4.3: Feed composition

The animal feed consists of six major constituents. The details of the various components found in the feed are given in Table 4.1.

Table 4.1: Components in the six constituents of animal feed

Animal feed constituents			Components
Moisture			Water, volatile substances
Dry matter	Organic matter	Crude protein	Pure protein, amino acids, non-protein nitrogen compounds
		Ether extract (crude fat)	Fat, complex lipid, sterols, fatty acids, fat soluble dyes
		Crude fibre	Cellulose, hemicelluloses, lignin
		Nitrogen-free extract	Soluble carbohydrate, hemicelluloses, lignin, pectin, organic acids, tannin, water-soluble dyes
	Inorganic matter	Crude ash	Pure ash, organic residue

Standard values on six major components of the feed and the various substances contained in that component are widely available.

Assessing the overall quality of the animal feed

An ideal animal feed is supposed to supply animals' full requirements for energy and proteins. The ultimate quality of feed is determined by the ability of the feed to supply energy and/or protein.

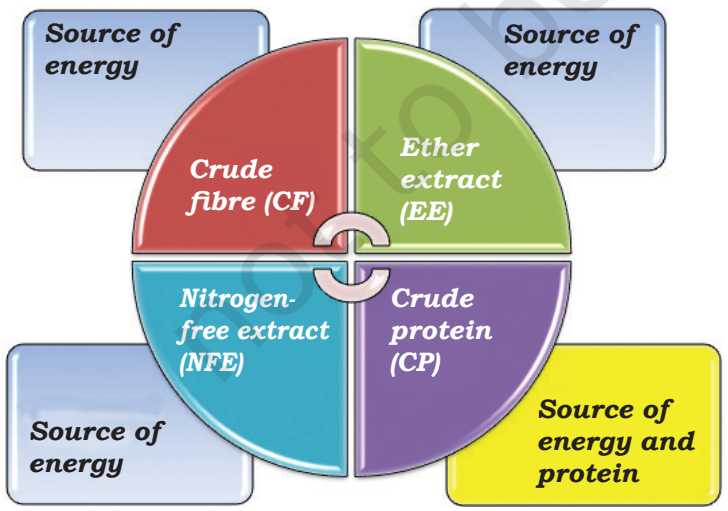


Fig. 4.4: Source of energy and protein in animal feed

It is important to note that an animal can draw energy from CF, EE, NFE and CP, however the protein part of the diet is only derived from CP content of the feedstuff (Fig. 4.4).

After consuming the feed, the animal digests and metabolises the nutrients present in the feed. Like in humans, the health of an

individual depends not upon the total food consumed but on the digestibility of the consumed food, similar is the case with farm animals.

In farm animals, the digestible part of the feed/ nutrient is that proportion which is metabolised and utilised by the animal and not excreted in the faeces. Therefore, the digestible part of the feed determines the availability of nutrients available to the animals for various functions like maintenance, growth, reproduction, production and work (draft).

Measurement of energy quality in animal feed

Concept of Total Digestible Nutrients (TDN)

Not all feed and fodder have equal nutritional profiles. Some feeds fully fill the animal's gut but provide small amount of actual nutrients for health, growth and production. There are some feeds which are extremely useful from the angle of utilisation of nutrients contained in them, and are usually more expensive. A high percentage of nutrients in these feeds help in digestion and provide energy to the animals.

TDN requirement of the animal changes according to the stage of the animal's life. For example, dry (out of milk) cows have much lower energy needs than lactating cows. Exotic and crossbred young heifers need more TDN than indigenous heifers. A calf eats less amount of TDN as compared to an adult cattle.

Calculating TDN in animal feed may look complicated at first, but it is a very useful tool for the dairy entrepreneur as knowledge of peak requirements of TDN of the animals is matched with peaks in fodder quality (leafiness or matured stem) to achieve lower cost of feeding. Besides energy, animals have other nutritional needs. TDN is just one aspect of animal feeding programme.

When we add digestible proportions of crude fibre (CF), crude protein (CP), ether extract (EE) and nitrogen-free extract (NFE) of a feedstuff, we get TDN value of the feedstuff. TDN is expressed as a percentage value and calculated as mentioned next.

TDN (%) = digestible CF (%) + digestible CP (%) + (digestible EE (%) x 2.25) + digestible NFE (%)

In the above formula for calculating TDN, the multiplier of 2.25 is used with digestible EE because fat, i.e., EE has 2.25 times greater energy density per unit weight as compared to per unit of carbohydrate or protein.

When the amount of nutrients of any feedstuff is multiplied with its digestibility value, we get an idea of the actual quantity of nutrients that might be absorbed from that feedstuff. TDN is a bit different concept as it indicates the relative energy value of feed to an animal.

Measurement of protein quality in animal feed

Crude protein

The crude protein content of the feed is determined with the basic assumption that all the nitrogen present in a feedstuff is contained in the form of different proteins and all such proteins contain about 16 per cent nitrogen. Ruminants (like cow, buffalo, goat, sheep, etc.) have the ability to utilise and convert all the plant nitrogen into animal protein for different bodily functions.

The moisture, crude protein and total digestible nutrients found in different feed and fodder are given in Table 4.2.

Table 4.2: Average nutritive value of common feeds/ fodders on fresh weight basis

Kind of feeds	Name	Moisture (%)	CP (%)	TDN (%)
Concentrate feeds				
Grains	Maize	10	9.0	82
	Barley	10	9.5	75
	Jowar	10	7.2	70
	Bajra	10	6.6	65
	Gram	10	14.4	80
	Wheat	10	12.8	80
	Oats	10	10.4	75

Oilseed cakes	Groundnut cake	10	45.0	75
	Mustard cake	10	36.0	74
	Cotton seed cake	10	21.6	70
	Sesame (Til) cake	10	45.6	78
Agro-industry by-products	Wheat bran	10	15.0	60
	Rice bran	10	9.6	65
	Rice polish	10	12.0	67
	Arhar Chuni	10	17.0	68
Animal by-products	Fish meal	7	55.0	65
	Meat and bone meal	5	40.0	69
Roughage				
Green fodders	Berseem	85	2.4	13
	Jowar	75	0.7	16
	Maize	75	1.6	17
	Oats	75	1.8	17
	Bajra	75	1.2	15
	Hybrid napier	75	1.5	15
Straws and crop residues	Wheat straw	10	3	40
	Rice straw	10	2	40
	Oat straw	10	7.2	55
	Maize Kadbi	10	1.8	40
	Jowar Kadbi	10	1.2	40
	Bajra Kadbi	10	1.2	40
	Sugarcane tops	30	1.2	42
Hay	Dub hay	15	4.5	45
	Berseem hay	10	15	60
Silage	Maize silage	70	1.2	18
	Oat silage	70	1.4	18

Practical Exercise

Activity 1: Make a list of the feed ingredients and fodder in a dairy farm.

Material required
Feed ingredients, Fodder

Procedure

1. Visit a dairy farm.
2. Enlist the feed ingredients and fodder available in the dairy farm.

Check Your Progress

A. Multiple choice questions

1. Why do animals need feed?
   (a) Maintenance (b) Growth
   (c) Lactation (d) All of these
2. Which of the following is not considered under crude protein?
   (a) Pure protein
   (b) Non-protein nitrogen compounds
   (c) Amino acids
   (d) Lignin
3. In TDN estimation, which one of the following components is not included?
   (a) Crude fibre (b) Ether extract
   (c) Minerals (d) Crude protein
4. Which of the following is a characteristic of good feed?
   (a) Bulky (b) Rich in protein
   (c) Free from toxins (d) All of these

B. Fill in the blanks

1. Feed constitutes about _____ per cent of the total cost of animal production.
2. Wheat straw contains TDN of about _____ per cent.
3. In calculation of TDN, digestible EE is multiplied with a figure of _____.
4. EE has _____ times greater energy density per unit weight as compared to per unit of carbohydrate or protein.
5. The crude protein content of the feed is determined with the basic assumption that proteins contain approximately _____ per cent nitrogen.

C. Mark true or false

1. The TDN requirements change according to the stages of animal's life.

2. Silage is considered as concentrate feed.
3. A good animal feed has high carbohydrate content.
4. Concentrate feed is more expensive than roughage.
5. Inorganic matter present in the feed is categorised as minerals.

D. Match the following

A	B
1. Ether extract	(a) Amino acid
2. Crude fibre	(b) Hemicelluloses
3. Ash	(c) Fat
4. Crude protein	(d) Cellulose
5. NFE	(e) Minerals

E. Crossword

	[1]H	[2]L		[3]B
[4]M			Z	
	Y	G		
				E
[5]T		N		
				M

Across

4. Grain commonly used in concentrate mixture
5. Total digestible nutrients

Down

1. Process of conservation of green fodder
2. Major portion of crude fibre consist of
3. Popular leguminous fodder cultivated in rabi season

Session 2: Feeding of Dairy Animals

Dairy animals consume mainly two types of feed—concentrates and fodder (Fig. 4.5). Fodder may be either in green form or dry form. It is always better to meet an animal's nutrient requirement from good quality green fodder, as its nutritive value is equivalent to concentrate mixture. The concentrate requirements can be replaced by good quality green fodder to a certain extent.

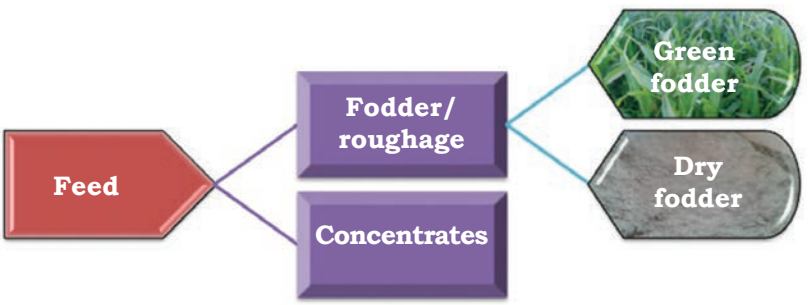


Fig. 4.5: Broad classification of feed

Animals require feed for various purposes such as maintenance, growth, lactation, pregnancy and work, i.e., draft. The major purposes for which feed is uniquely needed for special function in the animal are explained in Fig. 4.6.

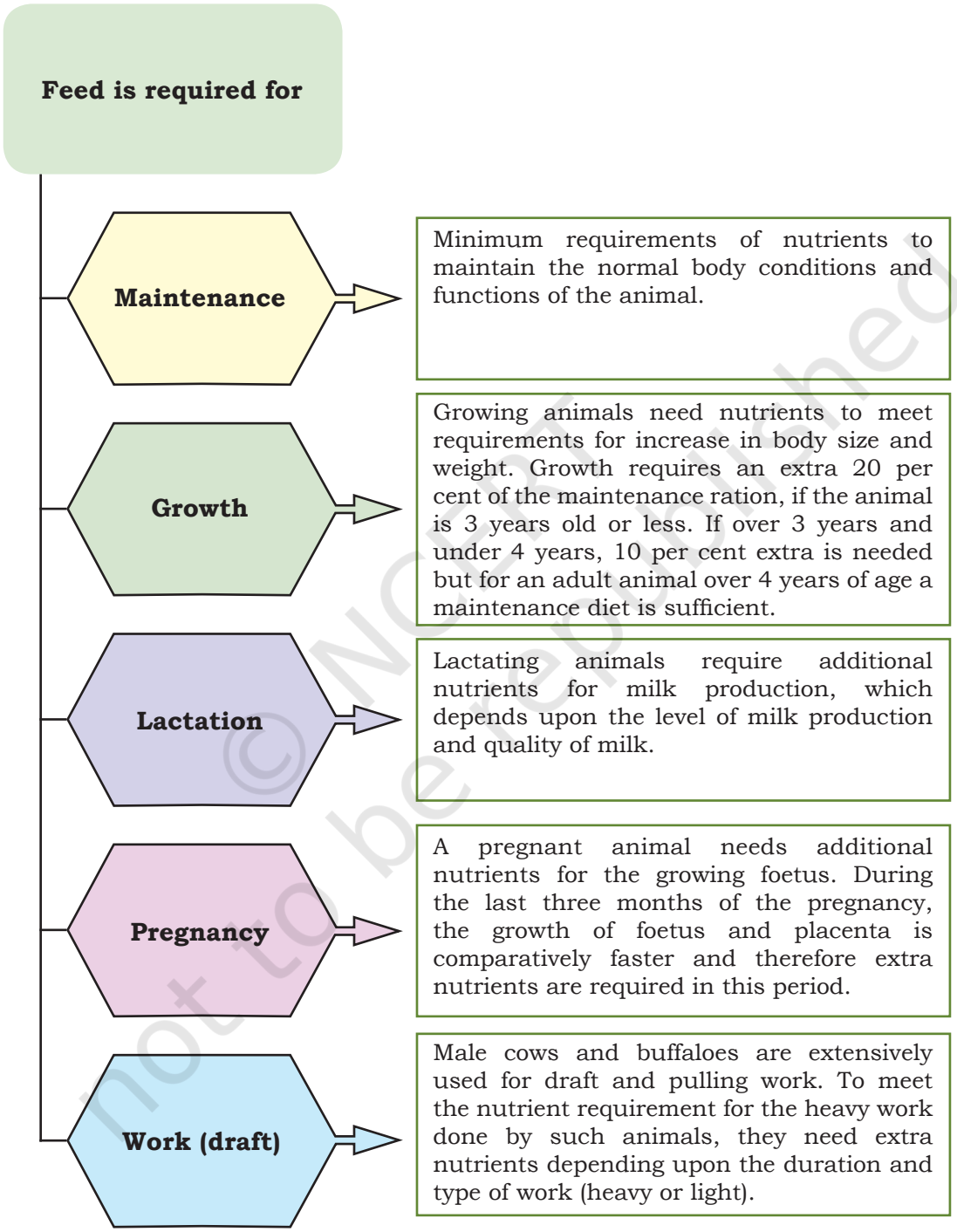


Fig. 4.6: Purposes for which feed is required by the animals

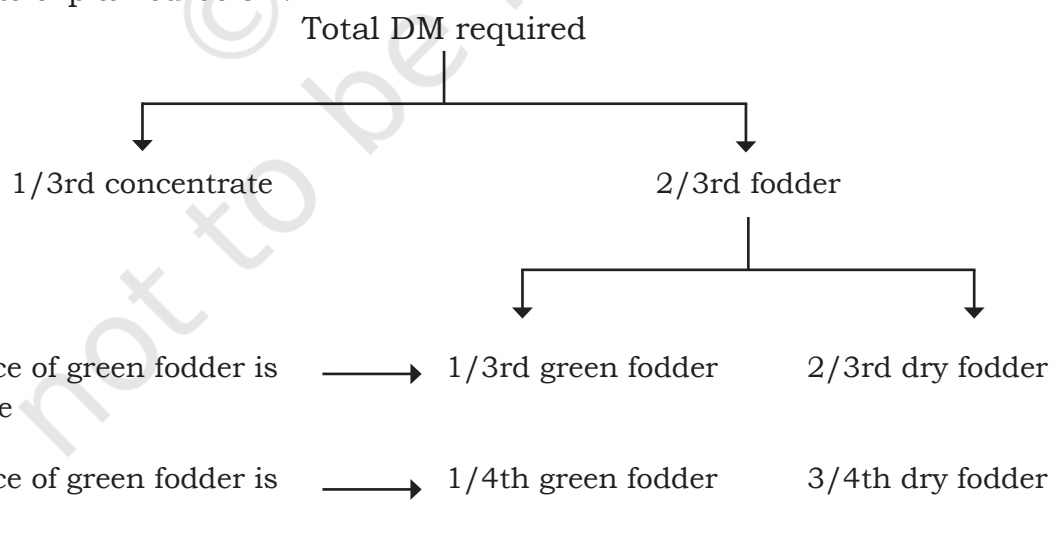
Feed requirements based on thumb rule methods

The following two thumb rules are followed to calculate the feed requirement of cattle.

Feed requirements for maintenance based on dry matter

All feeds contain some amount of water. If all the water of a feed is taken out, the remaining content of the feed is termed as dry matter (DM). DM intake is the amount of feed the animal consumes per day less the moisture content in that feed. Animals need to consume a certain amount of DM per day to maintain health and production. Daily DM requirements of indigenous breeds of cattle are about 2.0–2.5 per cent of their body weight. Crossbred cows and buffaloes daily consume higher DM, i.e., 2.5–3.0 per cent of their body weight.

Another largely followed simple thumb rule of animal feeding followed by majority of farmers is to meet the total DM requirement of the animal in such a way that one-third of the DM is met from the concentrate and the remaining two-third from fodder (green and dry). Availability of leguminous green fodder which is rich in protein, however significantly reduces the requirement of green fodder to fulfil the nutrient requirement of the animals, as explained below.



Feed requirements on the basis of various stages of production

Considering the stages of production of the animal and to meet its nutritional needs completely, a more refined rule of thumb is followed (Table 4.3).

Table 4.3: Straw/dry fodder and concentrate requirement for various stages of production

Category of animals	Stages of production				
	Maintenance		Milk production	Pregnancy (extra feed for pregnant animal over 5 months)	Growth (extra feed for growth)
	Straw/dry fodder (kg)	Concentrate (kg)	Concentrate	Concentrate (kg)	Concentrate (kg)
Indigenous cattle	4–5	1.25	0.4 kg / litre milk yield	1.25	1.00
Crossbred cattle	4–6	2.00	0.4 kg / litre milk yield	1.75	1.00
Buffaloes	4–6	2.00	0.5 kg / litre milk yield	1.75	1.00
Breeding bull	As per free choice of the animal	2.50	–	–	–
Bullock (working over 4 hrs daily)	As per free choice of the animal	3.00	–	–	–

Besides the quantity of straw/dry fodder and concentrate as shown in Table 4.3, about 15–20 kg green fodder is provided to the animals to meet their total nutritional requirements.

Feed requirements based on scientific feeding standards

Feeding standards are a description of the exact quantity of all the nutrients required by the animals for maintaining their health and production. In calculating these standards, the body weight of the animal is the primary criterion. Besides this, for every litre of milk production, the corresponding requirement values are given. Feeding standards have been developed through

experimentation, and have been modified and upgraded from time to time and contain the requirements of nutrients in tabular form.

Some of the popular feeding standards are NRC (National Research Council)—the feeding standard of America, ARC (Agricultural Research Council)—the feeding standard of UK, and ICAR (Indian Council of Agricultural Research)—the feeding standard of India.

Feed supplements for optimum growth and production

Feed supplements are substances which are added in small quantities to a ration to stimulate growth, production and improve efficiency of feed utilisation in the animals. Feed supplements are non-nutritive in nature and added for:

(i) preserving nutritional properties of stored feeds (i.e., antioxidants and mould inhibitors);
(ii) facilitating feed pelleting (i.e., in their action as emulsifiers, stabilisers and binders);
(iii) facilitating growth (i.e., antibiotics and hormones);
(iv) facilitating feed ingestion and consumer acceptance of the product (i.e., colours); and
(v) supplying essential nutrients in purified form (i.e., vitamins, minerals, amino acids, cholesterol and phospholipids).

Major ingredients for feed preparation

Like humans, animals need a balanced diet for the maintenance of body and production of milk. A single feed ingredient cannot meet the total nutrient requirement of animals, and therefore, various ingredients are mixed for a well-balanced ration. The major categories of feed ingredients used for preparation of rations for dairy animals are given in Table 4.4.

Table 4.4: Major categories of feed ingredients used for preparation of rations

Categories	Common ingredients
Cereals	Maize, wheat, barley, sorghum, millet, etc.
Oil cakes	Soybean, groundnut, rapeseed, cotton seed, sesame, mustard, etc.

Agro-industry by-products	Wheat bran, rice bran, rice polish, broken rice, dal chunnies, etc.
Animal proteins	Fish meal, meat and bone meal, blood meal, etc.
Mineral sources	Di-calcium phosphate (DCP), limestone, oyster shells, dolomite stone, etc.
Other items	Molasses, vegetable oils, jaggery, etc.

Various feed ingredients have been shown in Fig. 4.7 (a–f).

Fig. 4.7 (a) Maize

Fig. 4.7 (b) Wheat bran

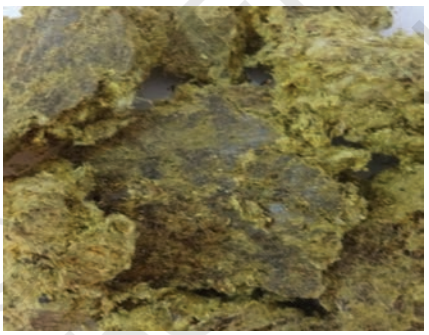


Fig. 4.7 (c) Cotton seed cake

Fig. 4.7 (d) Rice polish

Fig. 4.7 (e) Mustard cake

Fig. 4.7 (f) Soybean meal cake

Fig. 4.7 (a–f): Various feed ingredients used for preparation of concentrate mixture

Check Your Progress

A. Multiple choice questions

1. Daily DM requirements of indigenous breeds of cattle are about _____ of their body weight.
   (a) 0–1.5% (b) 2.0–2.5%
   (c) 3.0–3.5% (d) 4.0–4.5%
2. Which of the following is not considered a cereal?
   (a) Maize (b) Wheat
   (c) Barley (d) Mustard cake
3. Which of the following is considered an agriculture by-product?
   (a) Rice polish (b) Soybean cake
   (c) Groundnut cake (d) Rapeseed cake
4. Which of the following is the Indian feeding standard?
   (a) ARC (b) NRC
   (c) ICAR (d) ICMR

B. Fill in the blanks

1. Dairy animals consume mainly two types of feeds—concentrate and _____.
2. Minimum nutrients required to maintain the normal body conditions and functions of the animal are known as _____.
3. When water is taken out from the feed, then the remaining part is termed as _____.
4. _____ are substances which are added in small quantities to a ration to stimulate growth, improve efficiency of feed utilisation and overall health of the animals.
5. As per rule of thumb, in buffaloes one kg concentrate is required for every _____ kg/litre milk production.

C. Mark true or false

1. Fodder is always available in green form.
2. Nutritive value of good quality green fodder is equivalent to concentrate mixture.
3. All feeds contain some amount of water.
4. In young animal, a single feed ingredient can meet the total nutrient requirement.
5. Feed supplements are non-nutritive in nature.

D. Match the following

A	B
1. Cereals	(a) Fish meal
2. Oil cakes	(b) Di-calcium phosphate
3. Animal proteins	(c) Rice polish
4. Mineral sources	(d) Maize
5. Agro by-products	(e) Mustard

E. Crossword

	[1]M	[2]S			
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	T				
D	A	E			
[5]		A	F		
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R					

Across

5. Another term used for animal power

Down

1. Type of oil cake
2. Oil cake which contains high percentage of crude protein
3. Nutrient requirement of young animals other than maintenance
4. Feedstuff used specifically to feed domesticated livestock such as cattle

Fig. 4.8: Electrically operated chaff cutter

Session 3: Preparation of Animal Feed

Equipment used in chaffing of green fodder

Dry fodder like wheat straw can be fed to the animals as such without any preparation and therefore does not require machines. However, green fodder requires chaffing before feeding to the animals. Chaff cutter (Fig. 4.8) is used to chaff the green fodder, which cuts the fodder into very small pieces. Chaffed fodder is more palatable and reduces fodder wastage from the manger. Two types of chaff cutter are available in the market—manual and electrically operated.

Basic equipment/machines required for the preparation of concentrate mixture

Concentrate is the mixture of various feed ingredients, and can be prepared in the farm itself. Feed ingredients like grains, cake flakes are grounded with the help of a feed grinder to get a uniform mixture of feed items (Fig. 4.9). Afterwards, all the feed ingredients and feed supplements are added and mixed as per the feed formula. Mixing can be done manually on the mixing floor or through an electrically operated mixer (Fig. 4.10).

Fig. 4.9: Electrical feed grinder

Maintenance of equipment/machinery

Machines are cleaned regularly and kept in safe and working condition. The different devices used in the manufacture of feed and feed ingredients are periodically tested for accuracy. Records of all maintenance works carried out on equipment and machinery are kept for future reference.

Preparation of feed at the farm

Ingredients used for preparation of concentrate mixture

In order to get a balanced feed, different feed ingredients are mixed in suitable proportion. This type of mixture is known as concentrate mixture or compound cattle feed. The composition of cattle feed depends on the

Fig. 4.10 (a)

Fig. 4.10 (b)

Fig. 4.10 (a–b): Semi-automatic vertical feed mixer

type of animals, milk production, season, etc. This concentrate mixture is fed to the animals along with roughages (green and/or dry). Concentrate mixture is fed to animals in the form of mash, pellets, crumbles or cubes. Various feed items included for preparation of concentrate mixture are given in Table 4.5.

Table 4.5: Various feed items included in the concentrate mixture

Grains	Maize, sorghum, wheat, oat, barley, millets, etc.
Brans	Rice bran, wheat bran, de-oiled rice bran, rice polish
Oil cakes	Cakes of mustard, cotton seed, groundnut, soybean, rapeseed, sunflower, linseed
Animal protein source	Fish meal, bone meal, meat meal
Chunnies	Moong, arhar, gram, guar, tur and other locally available pulses
Agro-industry by-products	Molasses, tamarind seed powder, tapioca waste, etc.
Minerals and vitamins	Mineral mixture, Di-calcium phosphate, common salt, Vitamin A, Vitamin D3 and Vitamin E

Composition of concentrate mixture

Since animal feed alone accounts for about 70 per cent of the total cost of milk production, balanced and economical feeding of dairy animals plays a pivotal role in successful dairy farming. Good quality animal ration is balanced in all nutrients and simultaneously economical. The proportion of ingredients to be incorporated in the ration are selected on the basis of their prices in particular seasons. The usual proportion of various ingredients in daily concentrate mixtures in medium yielding dairy cattle are given in Table 4.6.

Table 4.6: Ingredients in daily concentrate mixtures of medium yielding dairy cattle

Ingredients	Proportion (%)
Grain	35–40
Oil cakes	32–35

Agricultural by-products (brans, chunnies, agro-industrial by-products, etc.)	25–28
Mineral mixture and vitamins	2
Salt	1

Steps in preparing concentrate mixture at farm level

Fig. 4.11 shows the various stages in the preparation of concentrate mixture at the farm level undertaken by a dairy farmer. Various steps carried out for preparation of concentrate mixture are shown in Fig. 4.12.

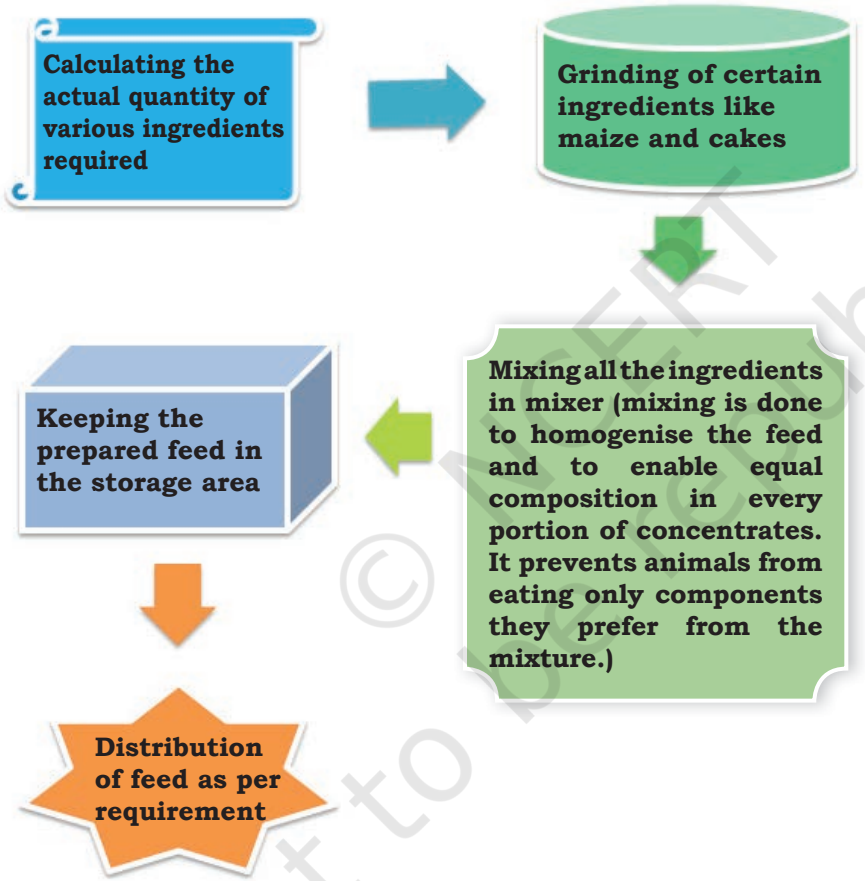

Fig. 4.11: Various stages in the preparation of concentrate mixture at the farm level

Following precautions are taken during concentrate mixture preparation.

(i) Grind maize and other grains shortly before use.

(ii) The grinding process releases the oils in the germs of the grains which are grinded for preparation of

Fig. 4.12: Steps of preparation of concentrate mixture

concentrate mixture. The released oil contains poly-unsaturated fats and some amount of natural antioxidants. Rancidity can occur within days or weeks after grinding, necessitating inclusion of ground grain in the concentrate mixture only at the time of feeding to the animals.

(iii) Separate storage areas for raw material and finished products are provided to prevent cross-contamination.

(iv) The feed is kept dry (less than 12 per cent) to prevent fungal or bacterial growth.

(v) Store feed in closed bags in a cool dry place.

(vi) Prevent rodent and insect infestation.

(vii) Stock inventory is properly managed to ensure that neither raw material nor finished feeds deteriorate prior to use or during storage.

Maintaining feed inventory

Periodic actual counting of different feed items in storage area is termed as feed inventory. As already explained, the feed cost is one of the largest expenditure in dairy farming. Careful monitoring of feed inventory helps the dairy entrepreneur in controlling the feed costs and maximising profitability. Feed inventory is a valuable tool for determining available feed supply and estimating future needs of total feedstuff for the herd. The inventory is adjusted for losses caused on account of storage and losses during feeding animals. A simple feed inventory for the incoming feed is shown in Table 4.7 for the beginners in dairy farming business.

Table 4.7: A sample feed inventory

S. No.	Date of receipt of feed	Source/ supplier of feed	Description	Quantity	Storage area	Sampled (Yes/No)	Signature of the person handling the feed

Benefits of concentrate mixture prepared at the farm

Underfeeding of animals can lead to low productivity and poor health condition. Overfeeding causes loss of nutrients and increased expenditure on feed. Hence, animals are fed as per their exact feed requirement. Many dairy entrepreneurs choose to manufacture concentrate mixture at the farm itself to control feed costs. In order to produce concentrate mixture of high quality, good quality feed ingredients are purchased from the market and concentrate mixture is prepared as per the feed formulation formula.

Farmers often have little or no control over the quality of feeds that they purchase from the market. The use of sub-standard feed ingredients results in low production and poor returns to the farmer. In many instances, adulterants are used in the concentrate procured from the market to satisfy the laboratory

testing. Farm-made concentrate mixture is a cheaper option compared to the concentrate mixtures available in the market. Therefore, if possible, it is better to prepare concentrate feed at the farm itself.

Procurement, checking and receiving of animal feed

You have so far learnt that for calculation of feed requirements of the animals, the following factors are given due consideration.

(i) Protein content and protein quality of feedstuff
(ii) TDN content of feedstuff
(iii) Feed requirement of different categories of animals
(iv) Major feed ingredients required to formulate a given concentrate

Based on an understanding of the above-mentioned factors, requirement of animals' feed is calculated on daily or monthly basis. Attention is also given to the following factors while making supply order for feed items (Fig. 4.13).

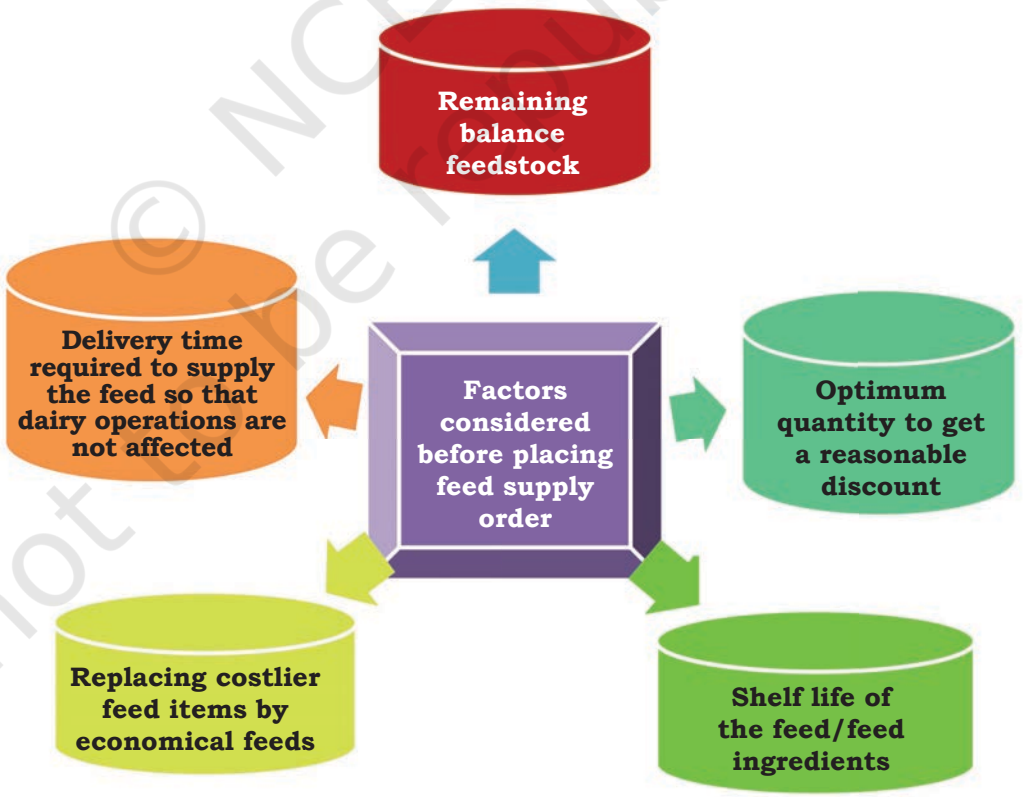

Fig. 4.13: Factors considered before placing feed supply order

The various activities included in procurement, checking and receiving of animal feed in a dairy farm are explained in Fig. 4.14.

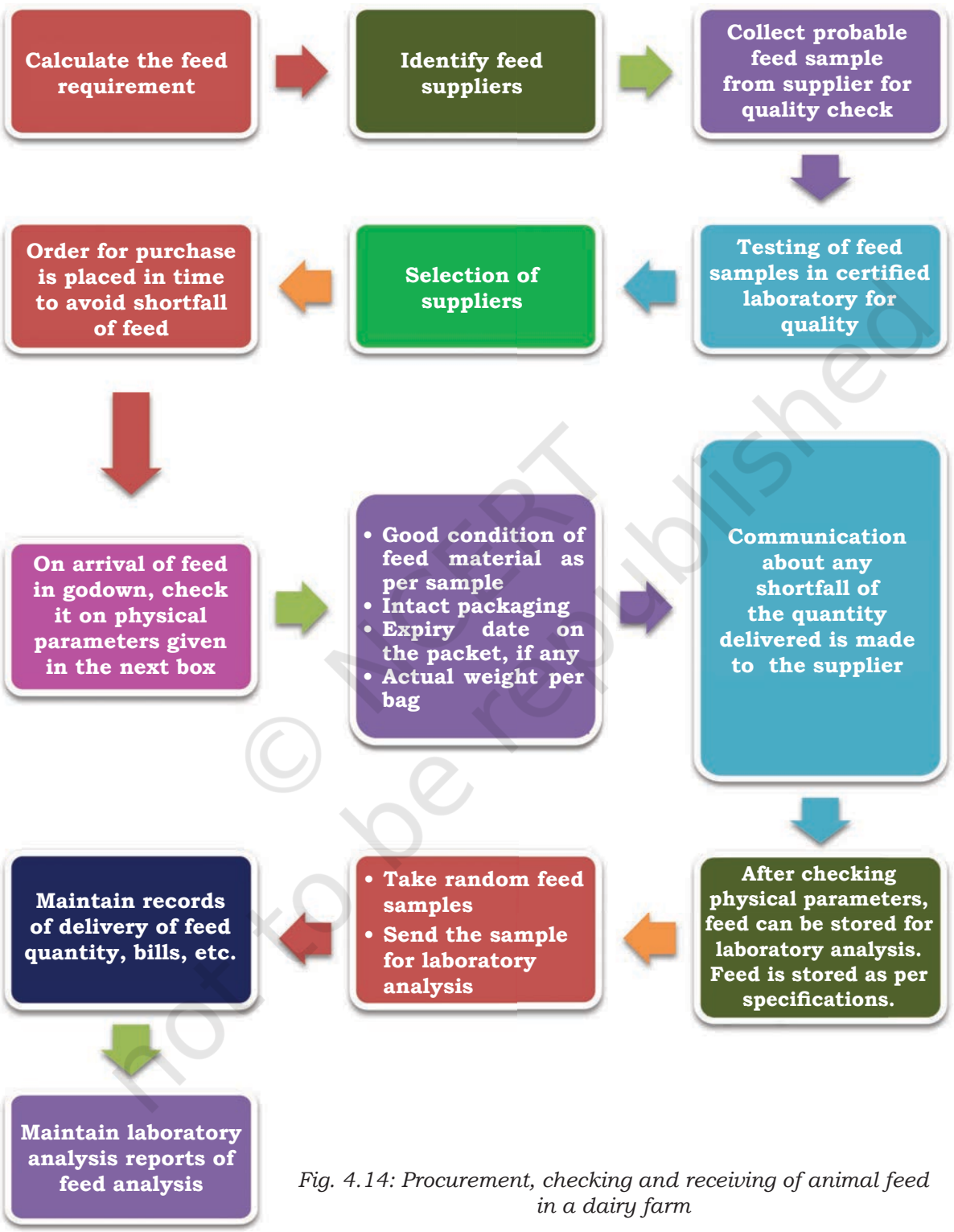

Fig. 4.14: Procurement, checking and receiving of animal feed in a dairy farm

Storage of animal feed

Large amounts of stored feed are usually damaged by rodents and insects, which leads to substantial losses of nutrients and their palatability decreases. It also leads to mould and other harmful growth and accumulation of harmful toxins in the feedstuff. Therefore, it is essential to store the feed properly for efficient dairy farm management.

Safe and scientific storage of animal feed

The following factors are considered for safe and scientific storage of animal feed.

Site selection

The storage structure is located on a raised and well-drained site. Accessibility is also an important factor kept into consideration. The site must be free from dampness, excessive heat, insects, rodents, termites, etc.

Selection of proper structure for storage

The structure for storage of feed depends on the quantity of feed to be stored and the period of storage. In case of godown storage and CAP (cover and plinth) storage, sufficient space is provided between two stacks, between stacks and the walls, to ensure proper aeration.

Cleaning of bags

New gunny bags are preferred. Second-hand gunny bags disinfested by boiling them in disinfectant solution and fully dried before filling the feed in them, could also be used.

Cleaning and fumigation of storage structure

It is important to clean and fumigate the feed storage structure before storing the feed in it. Storage structure must not have cracks, holes or crevices.

Drying of feed

Feed ingredients are properly dried to avoid quality deterioration before storing them.

Height of the platform

The storage platform is sufficiently high so that the store is free from moisture/water seepage (Fig. 4.15).

Fig. 4.15: Feed godown on raised platform

Proper aeration

Proper aeration is provided during dry and clean weather and care is taken to avoid the aeration in rainy seasons to protect the stock from infections due to excess moisture.

Height of the stored material

On concrete floor the feed material may be stored up to a height of 5 meters only, as shown in Fig. 4.16.

Fig. 4.16: Feed ingredients stored in bags and arranged in stacks

Separate storage for new and old stock

To prevent contamination in new stock from the old stock, it is advised to store them separately.

Regular inspection

To maintain proper health and hygiene of stock, regular inspection of stored feed ingredients is necessary. Periodic fumigation is carried out in case of storage for long duration.

Common structure for storage of feedstuff

Storage structure is selected based on the available structural material and type of feedstuff to be stored. Traditionally, feed ingredients are stored in country-made storage structures prepared from the locally available material. Nowadays, improved storage structures are available with more storage capacity and with proper protection to prevent storage losses. Fig. 4.17 shows various structures used for storing the feed ingredients.

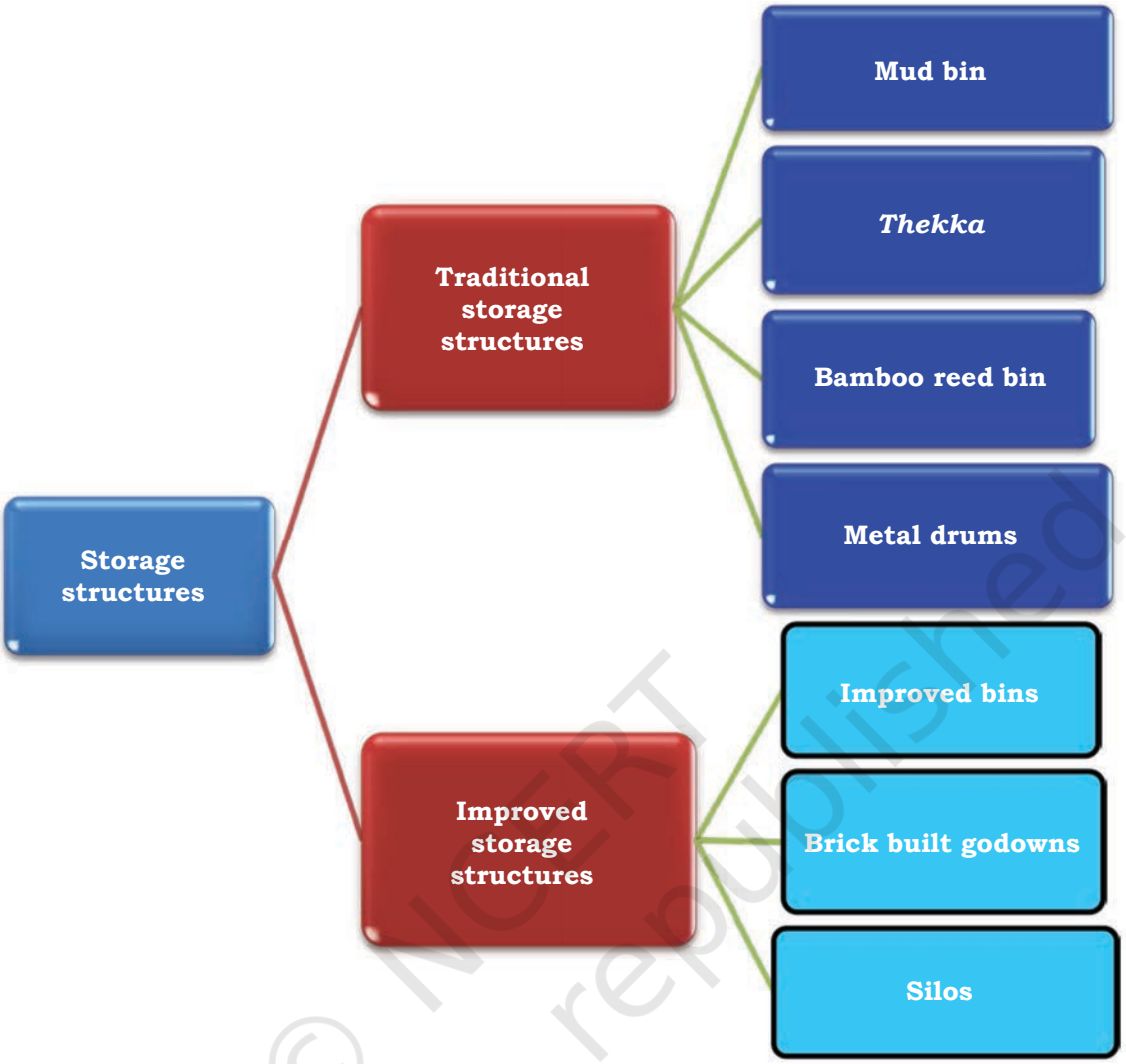

Fig. 4.17: Various structures for the storage of animal feeds

Practical Exercise

Activity 1: Prepare concentrate mixture in a nearby cattle feed mill.

Material required
Feed ingredients, Feed grinder, Feed mixer

Procedure
1. Visit a nearby cattle feed mill.
2. Grind ingredients like maize and cakes in a feed grinder.
3. Mix all the ingredients in a feed mixer.
4. Keep the prepared feed in the storage area.

Check Your Progress

A. Multiple choice questions

1. Which of the following is considered a traditional storage structure?
   (a) Silo (b) Brick built godowns
   (c) Improved bins (d) Mud bin
2. In which form can the concentrate mixture be offered to animals?
   (a) Mash (b) Pellets
   (c) Crumbles (d) All of these
3. What type of ingredients are commonly used for the preparation of concentrate mixture?
   (a) Grain (b) Oil cakes
   (c) Mineral mixture (d) All of these
4. Feed supplements are used in the animal feed to _____.
   (a) facilitate feed pelleting
   (b) preserve nutritional properties of stored feeds
   (c) facilitate growth
   (d) All of the above

B. Fill in the blanks

1. _____ is used to grind the feed items.
2. To get a balanced feed, _____ is mixed in suitable proportion.
3. For the storage of the feed, the moisture content of feed must be less than _____ per cent.
4. Proper aeration is provided during dry and clean weather but care is taken to avoid aeration in _____ season to protect the feed stock from moisture.
5. Large quantities of stored feed are usually damaged by _____.

C. Mark true or false

1. Rice polish and wheat bran are used in concentrate mixture as a source of protein.
2. All feed ingredients used in the concentrate mixture need to be grinded before mixing.
3. Chaffed fodder is less palatable to the animals.
4. Good ration for animals is balanced and economical.
5. The feed storage platform is sufficiently high to avoid theft.

D. Match the following

A	B
1. Silo	(a) Mix the feed after grinding
2. Mud bin	(b) Grind the feed ingredients
3. Mixer	(c) Improved feed storage structure
4. Grinder	(d) Traditional feed storage structure
5. Chaff cutter	(e) Chaffing of green fodder

E. Crossword

[1]G				D		R
O						
[2]	R		[3]M			
		[4]S			O	
			X			
N						
			R			

Across

1. Machine for grinding grains
2. Traditional method of storing feed
4. Large feed storage structure usually maintaining anaerobic condition

Down

1. In a farm, feeds are temporarily stored in a place before offering to the animals
3. After grinding of the feed ingredients, the machine used to mix the feed ingredients uniformly

SESSION 4: MAINTAINING FEED AND WATER SUPPLY

Cattle require regular supply of feed and fresh water. Systematic planning is required to ensure that uninterrupted feed and water is available to the animals. Following three components are involved in planning regular feed and water supply to the animals.

(i) Material (feedstuff and water)
(ii) Man (labour)
(iii) Machinery (such as water pump, feed grinder and mixer, etc.)

If any one component gets disturbed, the supply of feed and water gets hampered. Table 4.8 shows the broad plan to ensure the availability of feed and fodder and Table 4.9 shows the broad plan to ensure availability of water in the dairy farm.

Table 4.8: Broad plan to ensure availability of feed and fodder

Type of feedstuff	Planning
Concentrate mixture	Most of the ingredients used for the preparation of concentrate mixture are available at reasonable prices during the harvesting season. However, long-term storage of these items may lead to infestation and damage by insects and rodents. Therefore, these losses can be kept into consideration before storing the ingredients for longer period.
Feed supplements	Feed supplements are regularly added to the ration of the animals. After evaluation of the price and quality, these feed supplements can be purchased and stocked, if necessary.
Dry fodder (wheat straw, etc.)	During harvesting season, wheat straw is readily available at discounted prices. Once stored properly, it can be used for a longer period. Quantity of straw required for the whole year is estimated in advance. Accordingly straw is stored in the farm in such a way that it can be used till the next harvesting or procurement season.
Hay and Silage	These are usually prepared on the farm itself. When the green fodder is scarce, hay and silage are usually fed to the animals.
Cultivating forage for feeding of animals	Green fodder crops can be easily grown throughout the year. Cultivation, harvesting and supply of green fodder to the animals is planned in advance.

Table 4.9: Broad plan to ensure regular supply of water

Water required for	Planning
Drinking	Watering points are constructed in such a way that each animal has free access to water throughout the day and night. The quality of drinking water for animals is assured. In summer months, animals need more water, therefore sufficient water supply is made available.
Cleaning of sheds and surrounding	Daily cleaning of the sheds and surrounding is quite important, otherwise chances of disease incidence will be higher.
Washing of animals	Milking animals are regularly washed just before milking. Other categories of animals may be washed daily. In summer, at least two times washing is required to avoid stress due to extreme heat.

Water requirement of dairy animal

Water is the major constituent in the animal body. Adult animal body contains about 65 per cent water. While deprivation of food for a short period is not fatal to the animal, the deprivation of water can prove fatal. Water is regularly lost from the animal body through urine, faeces, exhaled air and skin. In addition, milking cows lose water through milk (contain about 87% water). The requirement of water increases along with milk yield, high protein diet, non-availability of succulent green fodder and climatic condition (hot summer months). Preferably water is made available to the animals throughout the day and night. Besides drinking water, a large amount of water is also required in a dairy farm for washing of animals and cleaning of animal shed. Various factors which affect the water requirement of dairy animals are given in Fig. 4.18.

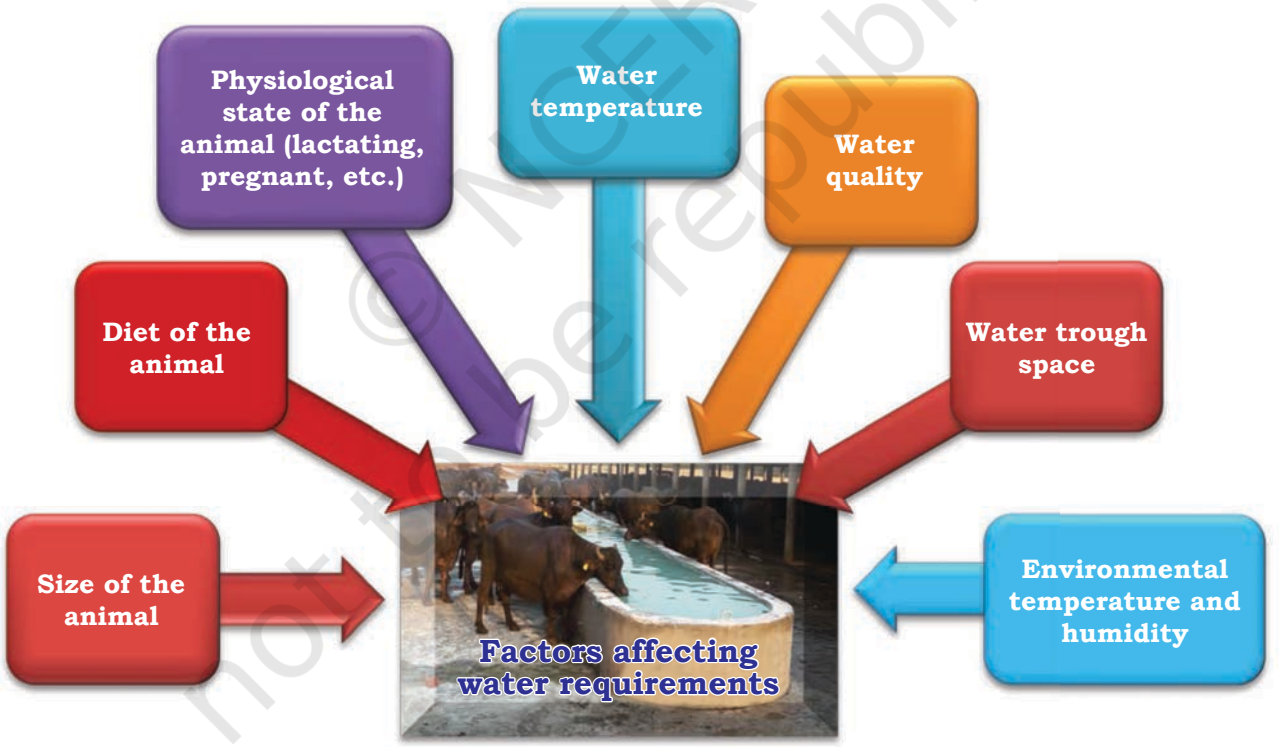

Fig. 4.18: Factors affecting water requirement of cattle

Salient points regarding watering of dairy animals

(i) Dairy animal drinks water several times in a day. Total water intake in a day depends upon the type of feed available to the animals and milking status of the animal (milking or dry).

(ii) Cattle generally drink 30 to 40 per cent of daily water requirement within 1 hour of milking.

(iii) Temperature of drinking water: Cattle like to drink water in the range of 17–27°C rather than very cold or hot water.

(v) Minimum water depth in the water trough: Water depth of a minimum of 3 inches is maintained to allow the animals to submerge their muzzles 1 to 2 inches deep in water.

(v) Watering point: For each group of animals, at least two watering points (water troughs) are required in a paddock (Fig. 4.19). It facilitates water intake by all the animals as per requirement without disturbance of dominant animals in the group.

Fig. 4.19: Watering points for a group of buffaloes

As a rule of thumb, water intake is about 8–10 per cent of body weight during favourable environmental conditions. It may reach to 13–14 per cent of body weight during hot weather.

Thus, a 400 kg cow producing 10 litres of milk is provided with {[(400×10%) + (1.5×10)] litres= [40+15]

litres= 55 litres} 55 litres of drinking water. In addition to this, about 70–75 litres of water is required for washing of animals and cleaning of shed. Thus, the minimum daily water requirement for a cow is about 55+75= 130 litres.

Salient aspects of planning feed and water supply to animals

(i) The dairy entrepreneur understands the basic behaviour of the animals and treats them accordingly. The farm workers need to be trained on the importance of maintaining cleanliness and hygiene.

(ii) Feed and fodder are supplied at least twice daily. Therefore, total required daily quantity of feed and fodder is divided into two parts and supplied to the animals at regular intervals.

(iii) It is better to mix chopped green fodder, straw and concentrate mixture to increase the feed intake and better utilisation of feed by the animals (Fig. 4.20).

(iv) Feed is given to sick animals as per veterinarian's recommendations.

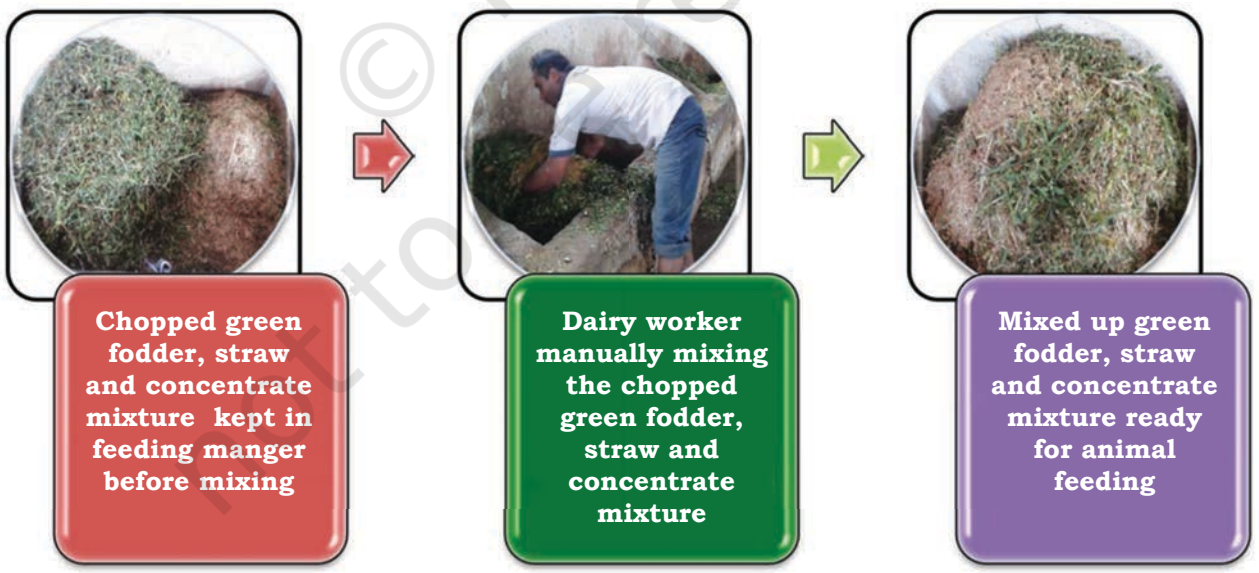

Fig. 4.20: Mixing chopped green fodder, straw and concentrate mixture for better utilisation of feed by the animals

(v) In extreme summer months, major quantity of feed is preferably supplied during night.

(vi) Regular observations on feeding and drinking habits of animals are made. Marked changes in feeding and drinking pattern of particular animal is an indication of adverse health conditions.

(vii) Feeding manger is cleaned daily. Any leftover and stale feed is discarded as per standard waste disposal methods.

(viii) The equipment and machinery used for feed and water supply are cleaned regularly and maintained properly.

(viii) Water troughs are cleaned and dried every fortnight and lime is painted on the inner walls of the water troughs to check the growth of algae.

(ix) Special attention is given to the young, sick, injured animals, and animals in advanced pregnancy.

(x) The workers serving feed to the animal are expected to have a compassionate approach towards the animals.

Causes of feed wastage and measures to minimise it

In every farm some amount of loss of feed in inevitable. Feed losses on farm occur during the following stages.

(a) Storage of feed: During storage of feed a major amount of feed is wasted due to the infestation of insects, rodents, etc.

(b) Preparation of feed: During grinding and mixing, some amount of feed is liable to be wasted.

(c) Feeding of animals: Animals generally spill and waste feed. Such a wasted feed is wet and covered with saliva of the animal, and is susceptible to spoilage. If this feed is left in manger, animals do not consume it. This wasted feed is a breeding ground for flies and attracts rodents, etc.

Following efforts are undertaken to minimise feed wastage.

(i) Choose an appropriate storage container.

(ii) Proper rodent control programme is ensured.

(iii) Feed are stored in cool and dark place.

(iv) At the time of purchase of feed ingredients, it is ensured that the feed ingredients contain only acceptable level of moisture.

Fig. 4.21: Animals offered fodder in a continuous manger

(v) Manger is designed to reduce feed wastage.

(vi) Manger is cleaned on regular basis so that spoiled or rotten feed can be removed.

(vii) Feed is offered to the animals strictly as per requirement.

(viii) In case of group feeding in continuous manger (Fig. 4.21), proper grouping of animals (on the basis of body size or age) is ensured.

Practical Exercise

Activity 1: Calculate the total water requirement for a lactating cattle during summer, in a dairy farm.

Procedure

1. Visit a nearby dairy farm.
2. Measure the body weight of the cattle by taking the cattle to the animal weigh bridge.
3. Note down the average daily milk yield of the cattle from the records of the farm.
4. Calculate water requirement for the maintenance and milk production as per the given formula.
5. Calculate water requirement for washing of shed.
6. Calculate extra water requirement during summer season.
7. Add up all the requirements.

Check Your Progress

A. Multiple choice questions

1. Which of the following animal feed is chopped before feeding?
   (a) Wheat straw (b) Green fodder
   (c) Concentrate (d) None of these
2. Continuous manger is suitable for _____.
   (a) group feeding (b) individual feeding
   (c) both (a) and (b) (d) None of these

3. Water requirement of the animals depends upon _____.
   (a) body weight
   (b) diet
   (c) environmental temperature
   (d) All of the above
4. Long-term storage of ingredients (for concentrate mixture) could lead to _____.
   (a) insect infestation (b) damage by rodents
   (c) loss of moisture (d) All of these
5. Which of the following is important in planning regular feed and water supply to the animals?
   (a) labour (b) machinery
   (c) feedstuff (d) All of these

B. Fill in the blanks

1. About _____ litres of water is required daily for adult cattle.
2. Water troughs are cleaned every _____ days to check the growth of algae.
3. Water depth of minimum _____ inches is provided to the livestock to submerge their muzzle 1 to 2 inches deep in water.
4. As a rule of thumb, water intake by the cattle is about _____ per cent of body weight during favourable environmental condition.

C. Mark true or false

1. Hay contains more moisture than silage.
2. Feed and fodder are supplied at least twice daily.
3. Leftover feed is susceptible to spoilage.
4. During storage of feed, some amount of feed is wasted due to the infestation of insects, rodents, etc.

D. Match the following

A	B
1. Grinder and mixer	(a) Wastage of feed during storage
2. Insects and rodents	(b) Leftover feed
3. Manger	(c) Usually feed supplied in night
4. Summer	(d) Provide drinking water
5. Waterer	(e) Preparation of concentrate mixture

E. Crossword

[1]W		[2]	H			G	
		U					
		M					
[3]C			A			N	G
[4]S		R		W			

Across

1. Process of cleaning of shed by flushing of water
3. It is done regularly within the shed to make the animal healthy
4. Type of dry fodder offered to the animals

Down

2. During this season water requirement of the animal increases

GLOSSARY

Concentrate: *Feeds that are generally high in energy, low in fibre, and are usually highly digestible.*

Feed/Feedstuff: *Food for livestock.*

Fodder: *Plants or parts of the plant eaten by livestock. A plant purposely grown for livestock feeding.*

Fumigation: *The method of killing insects and pests of a godown by the release of gaseous pesticides or fumigants.*

Rancidity: *When feed becomes spoilt and unsafe for animal consumption.*

Ration: *It is the feed allowed for a given animal during a day of 24 hours. The feed may be given at a time or in portion at intervals.*

Records: *Information or data collected and preserved on a particular subject.*