

Feeding and Nutrition Management for Dairy Cattle



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1 Disclaimer

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2 Introduction to SMEDA

Small and Medium Enterprises Development Authority (SMEDA) is an apex SME development agency working under the Ministry of Industries and Production (MoI&P), Government of Pakistan. In pursuit of its mission, SMEDA has adopted an integrated strategy that comprises SME sectors & clusters development, Business Development Services (BDS), and Policy advocacy to protect and promote SME interests.

SMEDA offers a broad spectrum of business development services to SMEs which include prefeasibility studies, identification of experts and consultants, delivery of need based capacity building programs in addition to business guidance through help desk services.

3 Purpose of the Document

This document is a demonstrative set of information in the form of, 'Feeding and Nutrition Management for Dairy Cattle' for new / start-up entrepreneurs who are interested in 'Dairy Farming' particularly businesses categorized as Small & Medium Enterprises (SMEs). Following is a description of best practices for feeding management according to nutritional requirements for dairy cattle. It is designed to help potential investors and SMEs understand the importance of feeding management techniques at dairy farms to make it a profitable enterprise. For more information about dairy farming, please visit www.smeda.org.pk.

4 Good Feeding and Nutrition Management Practices for Dairy Cattle

4.1 General Practices

- Provide animals with 24/7 access to feed and clean drinking water.
- Provide sufficient quantities of green fodder, formulated feed and clean drinking water to dairy animals grouped according to their age, live body weight, stage of lactation, milk production levels, physiological needs such as growth, pregnancy, activity and environment and climatic conditions.
- Daily maintenance and cleaning of feeding mangers and water troughs.
- Prepare feeding plan. The feed requirement of animal is calculated on dry matter basis. On average dairy animals consume 3 to 4 Kg dry matter per 100Kg body weight. Of the total dry matter requirement of the animal, roughages should meet two thirds.
- It can generally be estimated that 1 kg of nutritionally balanced concentrate mix supports the production of 2 kg of milk, but increasing concentrates does not increase milk production at the same rate.
- Offer 70 to 100 grams of mineral mixture daily to animals to avoid mineral deficiency. A piece of common salt should also be placed in the feeding manger.
- Procure feed ingredients from reliable sources.
- Store feed properly to avoid contamination.
- Avoid feeding mouldy feedstuff to dairy animals as fungal toxins such as aflatoxins can be transferred to milk. Monitor feed for other gross contaminants such as plant or animal matter, metal, plastics, string and other undesirable items.
- Get regular proximate analyses of concentrated feed.

4.2 Sources and Types of Feeds

Following types of generic feeds are offered to dairy cattle;

Table 1: Types of Feeds

Roughages			Concentrate		Mineral Supplements
Fresh	Dried	Preserved			
Green fodder	Dried hay	• Silage • Wheat straw • Rice husk	Vegetable origin	Animal origin	• Rock salt • Di-calcium phosphate (DCP) • Limestone

4.2.1 Roughages

Roughages are generally classified into Dry, Green and Preserved. The pictures below represent various types of Dry and Preserved feeds:



Figure 1: Dried Hay



Figure 2: Rice husk



Figure 3: Molasses



Figure 4: Silage

Green fodder constitutes a major part of Roughage and can be classified according to its sowing seasons;

Table 2: Common Green Fodders

Green Fodders	
Kharif	Rabi
• Sorghum • Millet • Maize • Guar • Sorghum-Sudan Grass Hybrid • Mott grass	• Berseem (Egyptian Clover) • Lucerne (Alfalfa) • Shaftal (Persian Clover) • Mustard • Rapeseed



Figure 5: Berseem



Figure 6: Guar



Figure 7: Maize



Figure 8: Sorghum



Figure 9: Mott Grass



Figure 10: Millet



Figure 11: Persian clover

4.2.2 Concentrates

Concentrates are a group of livestock feeds that are characterized by a higher dry matter content and digestibility than roughages and fodders. Concentrates of plant origin can be either energy-rich concentrates or protein-rich concentrates. These are categorized as following;

Table 3: Common Concentrate Ingredients

Concentrate Ingredients		
Plant-Origin		Animal-Origin
Energy Rich	Protein Rich	Protein Rich
• Cereal grains: rice, barley, wheat, maize, millet, sorghum etc. • Agricultural by-products: rice bran, rice polish, wheat bran, molasses etc.	• Oil extraction residues: cakes/meals of cotton seed, sunflower and rapeseed etc., • Cereal by-products: corn gluten feed.	• Skim milk • Whey

Concentrates of animal origin are characterized by the larger amounts of high-quality proteins contained in them. Some examples are the by-products of the milk processing industry e.g. skim milk and whey which can be used in calf feeds. These are too expensive to be given to adult ruminants.



Figure 12: Cottonseed meal



Figure13: Cottonseed Cake



Figure 14: Maize Gluten



Figure 3: Maize Grain



Figure 2: rapeseed Cake



Figure 1: Wheat Grain

4.2.3 Mineral Supplements

Minerals are an essential component in livestock feeding. In dairy cows and buffalo, minerals are required for the maintenance of general health, growth and reproductive functions to meet the quantities of minerals secreted in the milk. The mineral requirements vary with the type of mineral, type of animal and physiological stage of life cycle. Some animals may be able to obtain all mineral requirements from normal feeding regime. On the other hand, most animals may not show any obvious signs of deficiency even if they do not receive adequate quantities of minerals. However, they will be susceptible to diseases, delayed pregnancy, slower growth and lower milk production levels than could have been obtained, had they received an adequate supply of the required minerals. The roughages and concentrates contain **most** of the minerals required by cattle. These are mixed in feed in following form whenever required;

- Vitamin and mineral premix
- Di-calcium phosphate (DCP)
- Limestone/marble chips
- Rock salt



Figure 5: Di-Calcium Phosphate



Figure 4: Rock Salt

4.3 Feed and Water Requirements of Dairy Cattle

Feeding and water intake requirements of dairy cattle may vary from one animal to another and are determined by following factors;

- Age and body weight of cow
- Milk yield and fat percentage
- Stage of lactation and pregnancy and lactation number
- Feeds available and their nutritive values
- Nutrient requirements

4.3.1 Water Intake Requirements

Water is an essential requirement for the proper functioning of animals. Some of its main benefits include;

- Digestion and absorption of food
- Transport of nutrients throughout body and metabolic wastes to the excretory organs
- Control of body temperature (conductive and evaporative cooling)
- Optimal milk secretion

Animals obtain water from three main sources;

- Water content of food
- Water consumed voluntarily
- Water formed through metabolic activities of the body

As a thumb rule, lactating cows require 4 to 6 liters of water per kg of dry matter (DM) consumed. Higher amounts may be required in hot tropical conditions. The ideal is to allow dairy cows and buffalo continuous access to drinking water, which if not possible, they should be offered as much as they can drink i.e. at least twice a day. Dairy animals are very sensitive to the quality of water as availability of inadequate or poor quality water can limit milk production and growth, causing health problems.

4.3.2 Feed Intake and Calculations

A feed has two main components i.e. water and dry matter. It is the dry matter component that supplies nutrients, therefore, feed intake refers to 'Dry Matter Intake (DMI)'. The approximate DMI of cattle can be calculated in different ways:

- 3% of the live body weight
- 2.5-3% of body weight + 10% of milk yield
- 6kg + 1 % of body weight + 20 % of milk yield

Dry Matter Intake (DMI) is the quantity of dry matter in feed consumed by animal in 24 hours. It is usually measured in %age and calculated as 3-4 % of live body weight of animal. The DMI depends on availability of water, type and quality of roughage, feeding frequency, amount of concentrates given, digestibility of the feeds, condition of the animal, weather conditions etc.

Total Digestible Nutrients (TDN) refers to digestible energy content of feed whereas Crude Protein (CP): refers to total protein part of feed. Nutritive values of some common feedstuffs for cattle are given in following table;

Roughages are very important in the diet of ruminants because they supply the crude fiber which is necessary for proper functioning of the rumen. Optimally 18-20 % of the DMI has to be crude fiber. If the crude fiber content is too low, milk fat content in the milk can fall. On the other hand, if the crude fiber content is too high, the animal will not be able to consume sufficient DM. Thus it will not receive all its requirements of energy and proteins, and the milk yield will drop.

Table 4: Nutritive Requirements of Cattle

Feed Ingredient	Nutritive value		
	DM Content %	TDN Content (% of DM)	CP Content (% of DM)
Fresh Grass	20	60	4
Concentrate	90	70	18

Some points to consider while calculating nutritive requirements of cattle are as follow:

- Use ration calculations only as a guideline. The nutritive value and the palatability of the same feedstuff can vary widely depending on a large number of factors. There are differences among individual animals, too, with regard to feed utilization. However, feeding the animals based on a scientific method is definitely better than blindly offering whatever is available.
- Obtain and use actual feedstuff analysis whenever possible for ration formulation. If feedstuff compositional data is impossible to determine, tabulated data is the next best source of information.
- Express feedstuff composition on a dry matter basis since moisture content of feeds can vary greatly.
- Add more concentrate if dairy animals do not eat recommended green fodder or roughages to meet the shortfall in the nutrient supply. It is generally accepted that 1 kg of a good concentrate mixture supports the production of 2 kg of milk. However, when the amount of concentrates offered is increased, the amount of milk produced from each kg of concentrates de-creases (law of diminishing returns).

- Provide a suitable mineral mixture either with the concentrates or as a separate lick. Apart from the energy and protein supplies, mineral requirements also have to be supplied.

4.4 *Balanced Feed Formulation*

A balanced mixture is usually prepared in such a manner that 3.5 to 4 Kg of it may support 10 litres of milk production. Normally in dairy animals this mixture is fed at rate of $\frac{1}{2}$ of the milk yield (one Kg of concentrate mixture for every two litres of milk).

Balanced concentrate mixture feeding is essential for dairy animals because a single concentrate like maize, barley or oat and oilseed cake alone cannot meet the requirements properly. If a single concentrate, such as maize, sorghum, or barley is considered for feeding of 400 kg lactating buffalo yielding 10 litres milk, about 7 Kg grain will be needed to provide the protein requirement. Inferior quality hay or straw roughage is not only costly but also harmful. Similarly, when high protein oilcake like groundnut and till cakes are used as single concentrate, the excess of protein is wasted and the ratio between protein and carbohydrate is also disturbed which affects milk production. The ingredients in concentrate may be used according to following ratio:

Table 5: Feed Ingredients Inclusion Rate

Type	Feed Ingredients	Permissible Inclusion Rate (% of total feed)
Carbohydrates	Wheat grains	15-20
	Maize grains	40-50
	Rice polishing	18-20
	Wheat bran	23-25
	Molasses	10-15
Proteins	Sunflower cake	10-13
	Cotton seed cake	20-25
	Rape seed cake	10-13
	Peanut cake	20-25
	Cotton seed meal	15-20
	Soybean meal	10-15
	Rapeseed meal	15-20
	Maize gluten (20%)	20-30
	Maize gluten (30%)	20-25
	Maize gluten (60%)	5-10
	Urea	1-2
Fat	Oil	2-3
Minerals	Common salt	1-2
	DCP	1-2
	Mineral mixture	2

Some general and simple feed formulations for milking animals are given below;

Table 6: Formula No. 1

Type of Feed	Feed Ingredients	Inclusion Rate (% of total feed)	Total (%)
Carbohydrates	Maize Grains	18	44
	Wheat bran	10	
	Rice bran	6	
	Molasses	10	
Proteins	Cotton seed cake	10	53
	Rape seed cake	12	
	Rice polishing	20	
	Sunflower cake	10	
	Urea	1	
Mineral	Mineral mixture	2	2
	CaCo3	1	1
	Total	100	100
	CP%	18%	
	TDN	76%	

Table 7: Formula No. 2

Type	Feed Ingredients	Inclusion Rate (% of total feed)	Total (%)
Carbohydrates	Maize grains	10	58
	Wheat Bran	18	
	Rice Polishing	15	
	Molasses	15	
	Sunflower meal	5	40
Protein	Cotton seed cake	15	
	Maize Gluten 30%	20	
Mineral	Mineral Mixture	2	2
	Total	100	100
	CP%	17.6%	
	TDN	75.3%	

4.5 Useful Information

Table 8 : Nutritive Value of Feedstuffs used for cattle (Dry Matter Basis)

Sr.	Feedstuff	DM %	CP %	Ca%	P%	TDN %
1	Alfalfa dehydrated 17%	92	19	1.4		61
2	Alfalfa fresh	26	19	1.6		60
3	Alfalfa hay mature	90	14	1.3		50
4	Alfalfa silage	30	18	1.5		54
5	Barley silage mature	40	9	0.2		60
6	Barley grain	89	12	0.1		83
7	Barley feed pearl byproduct	90	15	0		75
8	Brome grass fresh immature	32	15	0.4		64
9	Brome grass hay	89	10	0.5		55
10	Calcium carbonate	99	0	39		0
11	Canary grass hay	91	9	0.4		53
12	Carrot pulp	14	6	–		62
13	Carrot root fresh	12	10	0.4		83
14	Clover ladino fresh	19	25	1.3		69
15	Corn whole plant pelleted	91	9	0.5	0.24	63
16	Corn fodder	80	9	0.3	0.18	67
17	Corn silage mature well eared	36	8	0.3	0.2	69
18	Corn and cob meal	87	9	0.1	0.24	82
19	Corn cobs	90	3	0.1	0.04	48
20	Corn bran	90	10	0	0.17	76
21	Corn gluten feed	90	26	0.4	0.75	82
22	Corn gluten meal	91	45	0.2	0.5	84
23	Di-calcium phosphate	96	0	22	18.65	0
24	Grass silage	26	12	0.8	0.22	61
25	Limestone ground	98	0	38	0.02	0
26	Linseed meal solvent	91	39	0.4	1	76
27	Molasses beet	77	9	0.2	0.03	79
28	Molasses cane	76	5	1.1	0.08	75
29	Molasses cane dried	94	10	1.2	0.15	74
30	Molasses citrus	65	9	2	0.25	75
31	Oat hay	87	9	0.2	0.22	59
32	Oat silage	34	11	0.4	0.25	60
33	Oat straw	90	4	0.3	0.1	50
34	Oats grain	89	13	0.1	0.4	74
35	Oat meal feeding	90	17	0.1	0.46	94
36	Oat mill byproduct	89	9	0.1	0.24	33
37	Oat hulls	93	4	0.2	0.15	37
38	Orange pulp dried	89	9	0.7	0.11	82
39	Orchard grass fresh immature	24	18	0.4	0.4	65
40	Orchard grass hay	88	11	0.3	0.28	59

41	Rapeseed meal solvent	91	41	0.7	1.14	70
42	Rye straw	89	4	0.3	0.1	44
43	Rye grain	89	13	0.1	0.38	81
44	Safflower meal soluble	91	22	0.3	0.73	55
45	Safflower meal dehulled soluble	91	48	0.3	1.83	76
46	Sorghum Stover	85	5	0.4	0.11	54
47	Sorghum silage	28	8	0.3	0.15	58
48	Soybean hay	89	15	1.3	0.32	52
49	Soybean straw	88	5	1.6	0.06	42
50	Soybeans whole	91	42	0.3	0.63	92
51	Soybean meal solvent 44% protein	89	50	0.3	0.75	84
52	Soybean meal solvent 49% protein	90	55	0.3	0.71	87
53	Soybean flake (hull)	91	12	0.6	0.17	71
54	Sudan grass fresh immature	18	17	0.5	0.31	70
55	Sudan grass hay	89	9	0.4	0.3	57
56	Sudan grass silage	23	10	0.4	0.25	55
57	Sunflower meal solvent	93	50	0.5	0.8	65
58	Sunflower meal with hulls	91	32	0.4	0.96	57
59	Sunflower hulls	90	5	0	0.11	40
60	Timothy fresh pre-bloom	26	11	0.4	0.28	64
61	Timothy hay early bloom	88	12	0.5	0.25	59
62	Timothy hay full bloom	88	8	0.4	0.2	57
63	Timothy silage	34	10	0.6	0.29	59
64	Urea 46% N	99	288	0	0	0
65	Wheat fresh pasture	21	28	0.4	0.4	69
66	Wheat silage	28	10	0.3	0.27	60
67	Wheat straw	88	4	0.2	0.08	44
68	Wheat grain	89	13	0	0.35	89
69	Wheat grain hard	89	14	0.1	0.45	89
70	Wheat grain soft	89	12	0.1	0.35	89
71	Wheat bran	89	18	0.1	1.3	70
72	Wheat midds	88	18	0.1	0.9	90
73	Wheat mill run	90	17	0.1	1.1	75
74	Wheat shorts	89	20	0.1	0.99	80
75	Wheatgrass crested fresh early bloom	37	11	0.3	0.3	60
76	Wheatgrass crested fresh full bloom	50	10	0.4	0.28	55
77	Wheatgrass crested hay	92	11	0.3	0.15	54
78	Wheat dried	96	16	1	0.81	82

Note: For more information, you may download pre-feasibility studies and sector information through SMEDA website by visiting and registering yourself free of cost at www.smeda.org.pk.