



Calculation of Nutrient Requirements

▶ Energy requirement of lactating cow

TDN requirement for maintenance = $34 \text{ g/W}^{0.75}$

TDN requirement for milk production = 330 g/Kg FCM

Fat corrected milk (FCM) = $0.4 + 15 (F)$



Energy Requirement of Lactating Cow

- ▶ The nutrient requirement of the dairy cow for milk production depends upon Amount of milk produced and milk composition.
- ▶ The energy requirement for lactation may be calculated using the following formula
$$\text{Kcal per kg milk} = 304.8 + 114.1 \times F$$
- ▶ Assuming fat content of a sample of milk 4.5%, the gross energy content of 1 kg of milk will thus be equivalent to
$$304.8 + (114.1 \times 4.5) = 818.25 \text{ kcal}$$
- ▶ Apart from formula, energy liberated per kg of milk may also be derived by amounts of protein, fat and carbohydrate which are then multiplied by their individual calorific values.
- ▶ Efficiency of conversion of feed ME into energy content of milk is 70%;
- ▶ The calorific value of milk is multiplied by $100/70 = 1.43$.

Protein Requirement for Lactation

- ▶ It has been shown that the lactating animal can efficiently convert food protein into milk protein.
- ▶ DCP requirement for maintenance = $2.84 \text{ g/ } W^{0.75}$
- ▶ Per cent protein in milk = $1.9 + 0.4 (F)$
- ▶ Then the DCP requirement for milk production is calculated by the assumption that the biological value of microbial protein is 70 %.

Mineral Requirement for Milk Production

- ▶ Ca and P content of milk are almost constant and the deficiency will lead to low milk production.
- ▶ Usually in high yielding cows and buffaloes the body is in negative Ca and P balance in early lactation, in equilibrium in mid lactation and positive in the late lactation and in the dry period.
 - ▶ **For maintenance:** 3g Ca/ 100 kg BW and for every 50 Kg 1 g to be added.
 - ▶ **For milk production:** 2g Ca/kg milk and 1.4g P/kg milk.
- ▶ **Requirement: 400 Kg BW, yielding 10 Kg milk with 4.5% fat.**
 - ▶ Ca = 30-35 g/day and P = 25-30 g/day
 - ▶ In the diet Ca = 0.38% and P = 0.30%.



Vitamin Requirement for Milk Production

- ▶ Ruminants require vitamin-A or its precursor
 - ▶ Carotene requirement for milk production = 60 mg/100 Kg BW.
 - For pregnancy = 30 mg/100 Kg BW
 - For growth = 11 mg /Kg BW
 - ▶ Green fodder contains 100 mg carotene per kg.
 - ▶ Silage contains 20 mg/ kg and hay contains 10 mg/kg.
- ▶ Vit-D is not essential as it is synthesized in the skin.
- ▶ B-complex vitamins are synthesized in the rumen.
- ▶ Ascorbic acid is synthesized from glucose.
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Calculation of Nutrient Requirements for A Dairy Cow Weighing 400 Kg Bw and Producing 10 Kg Milk With 5 % Fat

▶ METABOLIC BODY WEIGHT ($W^{0.75}$)

$$= 400 \times 400 \times 400 = \sqrt{64000000} \rightarrow \sqrt{8000} \rightarrow 89.44$$

▶ TDN REQUIREMENT:

For maintenance : 34 g/kg metabolic BW x 89.44 = 3040g

For milk production : 330g TDN/kg FCM (Fat corrected milk)

$$\text{FCM} = 0.4 + 0.15F = 0.4 + (0.15 \times 5) = 1.15$$

1 kg of milk with 5% fat = 1.15 kg of milk with 5% fat.

For 10 kg milk = 10 x 1.15 = 11.5 is the FCM

$$\text{TDN for 11.5 kg milk production} = 11.5 \text{ kg} \times 330 \text{ g/kg} = 3795 \text{ g}$$

▶ Total TDN required =	for maintenance	= 3040 g
	for Lactation	= <u>3795 g</u>
		<u>6835 g</u>

▶ DCP REQUIREMENT:

For maintenance 2.84 g/ g/kg metabolic BW x 89.44 = 254 g.

For milk production: 10 kg of milk with 5% fat.

$$\text{Percentage of protein} = 1.9 + 0.4 F = 1.9 + (0.4 \times 5) = 3.9$$

$$\text{DCP required} = \frac{3.9}{70} \times 100 = 5.6\text{g}/100\text{g} = 56\text{g for 1 kg. milk.}$$

For 10 kg milk production the DCP requirement = 560 g

Total DCP required for Maintenance = 254 g

for milk production = 560 g

Total DCP requirement 814 g



Ration Formulation

▶ Calculation of dry matter (DM) requirement

Indian dairy cow : 2 to 2.5 % of its body weight

Crossbred cow and buffalo : 2.5 to 3.0% of its body weight

For an animal weighing 400 kg.

DM requirement : $400 \times 2.5/100 = 10 \text{ kg}$ or $400 \times 3/100 = 12 \text{ kg}$.

DM requirement : 10 to 12 kg.

▶ Partitioning of dry matter

Total dry matter
(10 kg)

2/3 roughage
(6.67 kg)

1/3
concentrate
(3.33 kg)

2/3 dry roughage
(4.44 kg)

1/3 green roughage
(if green fodder is
legume it may be
restricted to 1/4 of
total roughage
ration).
(2.22 kg)

Nutrient Supplied Through Roughage

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S.No.	Feedstuff	Amount allotted	Nutrient content		Nutrient supplied	
			DCP %	TDN %	DCP (g)	TDN (g)
1	Paddy straw	4 kg	0	45	0	1800
2	CO4/CO5	3 kg	3.5	55	105	1650
					105	3450

DCP (g) deficit = 814 – 105 = 709

TDN (g) deficit = 6835 – 3450 = 3385

► NUTRIENT SUPPLIED THROUGH CONCENTRATE

S.No.	Feedstuff	Amount allotted	Nutrient content		Nutrient supplied	
			DCP %	TDN %	DCP (g)	TDN (g)
1	Maize	3.09	6.5	85	201.5	2626
2	GNC	1.2	42.5	70	510	840
					711.5	3466

► FORMULATED RATION FOR DAIRY CATTLE

S.No.	Feedstuff	On Dry Matter Basis (kg)	On Fresh Matter Basis (kg)
1	Paddy straw	4	4.22
2	CO4/CO5	3	12
3	Maize	3.09	3.43
4	GNC	1.2	1.3

Feeding of Cattle by Thumb Rule Method (Conventional Method) Maintenance Ration

S.No.	Feed stuff (kg on dry matter basis)	For Indian cattle		For crossbred cows and buffaloes	
		300 kg BW	400 kg BW	300 kg BW	400 kg BW
1	Dry matter	6	8	7.5	10
2	Concentrate mixture (14-16% DCP, 68- 72 % TDN)	2	2.67	2.5	3.33
3	Roughages	4	5.33	5.0	6.67
	Paddy straw (dry)	2.67	3.55	3.33	4.45
	Green fodder (succulent)	1.33	1.78	1.67	2.22

Green fodder should be given as 1/3 by legume fodder and 2/3 by non legume fodder (Grasses and cereal grasses)

Extra Allowance for Milk Production

Additional amount of 1 kg concentrate mixture is required for every 2.5 kg of milk production over and above the maintenance requirement

Extra Allowance During Pregnancy

During the last trimester of pregnancy, a quantity of 1.0 - 1.5 kg concentrate is required for growth of foetal growth

Maintenance rations for growing crossbred dairy heifers weighing 200 kg.

OPTION	FEED	QUANTITY (KG)
1.	Green legume	18
	Cereal straw	2.0
2.	Concentrate mixture	2.5
	Cereal straw	4.4

Maintenance ration for an animal weighing 250 kg

OPTION	FEED	QUANTITY(KG)
1.	Green legume	6 – 8
	Paddy straw	4.5
2.	Concentrate mixture	1
	Paddy straw	5

Ration for 250 kg body weight of pregnant animal

	DM (kg)	DCP (kg)	TDN (kg)
Requirement		0.31	2.72
Feedstuff			
Paddy straw	4	0	1.68
Concentrate mixture	2.5	0.35	1.7
(15% DCP and 60-65 % TDN)		0.35	3.38

Some Examples of Concentrate Mixture

Ration 1:

Feedstuff	Quantity in kg
Groundnut cake	35
Wheat bran	20
Maize	15
Oat/barley/sorghum	15
Gram chunnies	15
	100

Ration 2:

Feedstuff	Quantity in kg
GNC	20
Rice bran	25
Wheat bran	10
Gram husk	30
Cotton seed cake	15
	100

Ration 3:

Feedstuff	Quantity in kg
Mustard cake	20
Wheat bran	45
Green gram	35
	100

Ration 4:

Feedstuff	Quantity in kg
Tapioca chips	20
GNC	30
Gram chuni	25
Rice bran	25
	100

Conclusion

- ▶ **Balanced ration should be prepared as per requirement of energy, protein, minerals and vitamins**
- ▶ **Locally available feed ingredients should be included in the ration**
- ▶ **Ration should be economical and the return over feed cost must be increased**



Thank you

