

ENERGY REQUIREMENTS OF CATTLE

SUMMARY

Feed requirements represent the amount of feed which must be consumed to sustain a defined level of production.

For any specified level of performance (eg. pregnancy, liveweight gain or milk production), sufficient nutrients and energy must be supplied to the animal tissues to meet metabolic demands. These requirements can be conveniently expressed as metabolisable energy (ME) because with most pastures, energy is the most limiting factor for a given level of production.

Other nutrients such as protein, minerals and vitamins are almost always present in adequate amounts, except where there is a known deficiency. However protein may be limiting in some instances—for example, young growing animals—especially on low digestible, mature type pastures.

WHAT INFLUENCES METABOLISABLE ENERGY (ME)

- Liveweight and body condition
- Stage of pregnancy
- Level of milk production
- Rate of liveweight gain or loss
- Composition of liveweight gain or loss
- Level of activity in eating and movement
- Possible effects of climate
- Sex of animal
- Walking distance and climbing hills

Obviously it is difficult to include all these variables in tables of ME requirements that are easy to use. In calculating feed requirements for cattle, the requirements for maintenance, liveweight gain, milk production, and pregnancy are estimated separately and then added together.

REQUIREMENTS FOR MAINTENANCE

The ME requirement for maintenance is the amount of ME that must be supplied to provide energy needed for essential body functions. If this energy is not supplied in the diet it must be obtained by mobilising body tissue, predominantly fat.

As liveweight increases, so too does maintenance energy requirement (Table 1.1). Every 100 kg increase in liveweight requires an additional 11 megajoules of ME a day. Increased grazing and activity on hard hill country incurs significant costs.

TABLE 1.1: The metabolisable energy requirement for maintenance of beef cows

Liveweight (Kg)	300	400	500	600
Easy hill (MJME/kg)	-	55	66	77
Hard hill (MJME/kg)	50	65	75	-

Source: Nicol and Brookes (2007)

Notes: Add/subtract seven per cent per MJME for diets below/above 10.5 MJME/kg DM. Add 15% for adult bulls.



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REQUIREMENTS FOR PREGNANCY

The amount of energy used for both maintenance and growth of the foetus and the products of conception depends on:

- Days from conception—the greatest increase in requirements occur in the last trimester of pregnancy
- Number of offspring—twins rarely exceed one per cent of births in beef cattle
- Size of the foetus.

Guideline requirements for pregnancy for calves of varying birth weights are shown in Table 1.2. These values are additional to the maintenance requirements of the cow.

TABLE 1.2: The metabolisable energy requirement of beef cows for pregnancy (in addition to cow maintenance requirements)

	WEEKS BEFORE CALVING				TOTAL FOR PREGNANCY
	-12	-8	-4	0	
Calf birth weight (kg)	MJME/cow/day				MJME
30	6	11	20	34	1700
40	9	15	26	45	2300
50	11	18	32	55	2800

Source: Nicol and Brookes (2007)

Notes:

- Add the pregnancy MJME requirement to the maintenance requirement of the cow
- Adjust proportionately for pregnancy rate of the herd, eg. pregnancy rate = 95%, ME for 40kg birthweight, four weeks pre-calving = $0.95 \times 26 = 25$ MJME/cow/day

REQUIREMENTS FOR LACTATION AND CALF GROWTH

The ME requirement for milk production depends on:

- Total milk yield (litres)
- Milk composition—because milk varies in concentration of fat, protein and lactose, the ME requirement per litre will also vary.

It is extremely difficult to know the milk production of beef cows but it will usually range from 5-10 litres a day for single-suckled cows. In addition and as a guideline, 5.8 MJME/kg milk is assumed.

The costs of lactation and calf growth (Table 1.3) are estimated as 60 MJME/kg calf weaning weight (slightly less for very light calves). Assumptions have been made about the proportion of the calf's requirements supplied by milk and grazing. However, this ratio does not markedly affect the total ME requirements for calf growth to weaning.

→ The costs of lactation and calf growth are estimated as 60 MJME/kg calf weaning weight

TABLE 1.3: The metabolisable energy requirements of beef cows and their calves during lactation (in addition to cow maintenance requirements)

	MONTHS AFTER CALVING				TOTAL FOR LACTATION
	+1	+3	+5	+7	
Calf weaning weight (kg)	MJME/cow+calf/day				MJME
150	35	45	55	55	8700
200	40	55	65	75	12000
250	50	70	85	95	15000
300	60	80	100	115	18000

Source: Nicol and Brookes (2007)

Notes:

- Add these figures to cow maintenance requirement
- Adjust, proportionately for weaning percentage, eg. 85% weaning, 200kg calves, five months = $0.85 \times 65 = 55$ MJME/cow/day
- Add/subtract eight per cent MJME for diets below/above 11 MJME/kg DM

LIVEWEIGHT LOSS OR GAIN

When animals lose weight, mobilisation of body tissue releases energy which therefore does not have to be supplied by the diet. In lactating animals, this energy can be used to maintain milk yield, even though the animal is losing weight. The figure often used for New Zealand beef cows is 55 MJME required per kg of liveweight gain, and 1 kg of liveweight loss in mature cows substitutes for around 30 MJME of herbage intake. Therefore, the net cost of losing and gaining a kilo of liveweight is 25 MJME/kg of liveweight.

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CONDITION SCORE AND LIVEWEIGHT CHANGE

Target condition scores are often given for particular stages of the production cycle. When using the 0 to 5 scale, one unit change in condition score is equivalent to 75 kg for a 500 kg Hereford cow. On the 1 to 10 scale, the weight change per unit is about 40 kg.

The approximate quantities of ME per unit change of condition score (CS scale 0-5) range from 4,815 MJ ME/CS for a non lactating cow of with a CS of 2, to 5,650 for a non-lactating cow with a CS of 4. For lactating cows it is 3,450 (CS 2) and 4500 (CS 5) MJME/CS change. These values would be about half for the 1-10 scale.

CALCULATING FEED REQUIREMENTS

There are two common ways to calculate the feed requirements of cattle.

1. Computer models—In practice most people calculate ME feed requirements in computer models like the Feedsmart App. This app brings together a raft of variables to give farmers instant information on nutritional requirements of different classes of livestock, feed values and feed allocation.

Developed by Beef + Lamb New Zealand (B+L NZ) in conjunction with the Red Meat Profit Partnership (RMPP), the app will help farmers to estimate the feed requirements for sheep and cattle at any time of the year and for different levels of production.

To find out more go to www.feedsmart.co.nz.

2. Feed tables—Less commonly, feed requirements are estimated from feed tables such as in Table 1.1 to 1.4. Requirements in kg DM/head/day can be determined from these tables once a value of the energy (ME) content of feed is known. Pasture typically contains 8–12 MJME/kg of DM depending on the quality of pasture.

Note that some feed tables are quoted in kg DM. These should be used with caution when using them for pastures of varying energy content.

Table 1.4 provides an example of how the previous information can be used to compute the annual metabolisable energy requirements for breeding cows with different levels of productivity on either good or hard hill country. Note the 23% higher feed requirements of the more productive cow in the better environment, compared to that of the cow in the hard hill country.

TABLE 1.4: The annual ME requirements of beef cows in hard and easy hill country

SPECIFICATIONS	HARD HILL		EASY HILL	
Liveweight (kg)	400		550	
Weight loss/gain (kg total)	30		30	
Calves born/ cow joined	92		97	
Calf birth weight (kg)	30		40	
Calves weaned/ cow joined	86		90	
Calf weaning weight	200		250	
ME REQUIREMENTS (MJME)				
(1) Maintenance	$365 \times 65 =$	23,725	$365 \times 72 =$	26,280
(2) Weight loss/gain	$30 \times 25 =$	750	$30 \times 25 =$	750
(3) Pregnancy	$0.92 \times 1,700 =$	1,565	$0.97 \times 2,300 =$	2,230
(4) Lactation and calf growth	$0.86 \times 12,000 =$	10,320	$0.90 \times 15,000 =$	13,500
Total annual (MJME/ year)		35,000		42,750

Notes:

1 Maintenance requirement from Table 1.1

2 Net cost of loss and regain of weight is 25 MJME/kg

3 Total requirement for pregnancy from Table 1.2 and number of calves born

4 Total requirement for lactation and calf growth from Table 1.3 and number of calves weaned

REFERENCE

Pasture and Supplements for Grazing Animals. New Zealand Society of Animal Production Occasional Publication No. 14 (2017) edited by PV Rattray, IM Brooks & AM Nicol.

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