beef+lamb new zealand

# FACT SHEET

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# 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.

The major determinants of the energy requirement of grazing livestock are:

- 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 100kg increase in liveweight requires an additional 11 megajoules of ME a day. Increased grazing and activity on hard hill country incurs significant costs. These maintenance requirements are significantly higher than those used by Geenty and Rattray (1987).

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

| LIVEWEIGHT (KG) | | | | |
|---|---|---|---|---|
| Land classs | 300 | 400 | 500 | 600 |
| Easy hill | - | 55 | 66 | 77 |
| Hard hill | 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.*

A guideline requirement for maintenance can be given as:

- 0.62 MJME/kg liveweight 0.75 for cows on easy hill country
- 0.70 MJME/kg liveweight 0.75 for cows on hard hill country

## 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 x 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 five to 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.

**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 x 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 1kg 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.

## 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 75kg for a 500kg Hereford cow. On the 1 to 10 scale, the weight change per unit is about 40kg.

The approximate quantities of ME per unit change of condition score (CS scale 0-5) range from 4815 MJ ME/CS for a non lactating cow of with a CS of 2, to 5650 for a non-lactating cow with a CS of 4. For lactating cows it is 3450 (CS 2) and 4500 (CS 5) MJME/CS change. These values would be about half for the 1 to 10 scale.

## CALCULATING FEED REQUIREMENTS

In practice most people calculate ME feed requirements in computer models. 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 to 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 | 175 | | 250 | |
| **ME REQUIREMENTS (MJME)** | | | | |
| (1) Maintenance | 365 × 65= | 23,725 | 365 × 72 | 26,280 |
| (2) Weight loss/gain | 30 × 25= | 750 | 30 × 25 | 750 |
| (3) Pregnancy | 0.92 × 1700= | 1,565 | 0.97 × 2300 | 2,230 |
| (4) Lactation and calf growth | 0.86 × 10350= | 8900 | 0.90 × 15,000 | 13,500 |
| **Total annual (MJME/ year)** | | **35,000** | | **42,750** |

*Notes:*

*1 Maintenance requirement from Table 11*

*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*


### ACKNOWLEDGMENTS AND MORE INFORMATION

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