4.COW FEED REQUIREMENTS

Determine what energy is required for different scenarios. Allocate just enough feed, not too much or too little, from using information in the following pages.

4. COW FEED REQUIREMENTS

These feed requirement figures estimate the feed energy that must be eaten for a given level of milksolids production and cow liveweight. They do not allow for any feed offered that was not eaten (wastage). They do allow for energy used in grazing activity and up to 4km/day of walking on flat ground to and from milking. They also include the energy costs of losing and regaining body condition score throughout a lactation year.

Dairy cow annual dry matter requirements

Annual requirements tonnes DM/cow/year at 11.0 MJ ME/kg DM

Breed	kg Lwt	Milksolids production (kg MS/cow/year)							
		250	300	350	400	450	500	550	600
Jersey	375	3.5	3.8	4.2	4.5				
Jersey	400	3.6	3.9	4.3	4.6	4.9	5.3		
Jersey	425	3.7	4.0	4.4	4.7	5.0	5.4		
Kiwicross	450	3.8	4.2	4.5	4.8	5.2	5.5	5.9	
Kiwicross	475	3.9	4.3	4.6	4.9	5.3	5.6	6.0	
Friesian	500	4.1	4.4	4.7	5.1	5.4	5.8	6.1	
Friesian	525		4.5	4.8	5.2	5.5	5.9	6.2	
Friesian	550		4.6	4.9	5.3	5.6	6.0	6.3	6.7

The annual requirements include walking 4 km/day on flat ground for 270 days in milk per cow.

Note:

These requirements should be similar to those calculated by DairyBase,

- DM requirement with increasing feed quality: subtract 5% per MJ ME above 11.0 MJ ME/kg DM
- DM requirement with decreasing feed quality: add 5% per MJ ME below 11.0 MJ ME/kg DM.

Utilisation and wastage

The previous edition of this publication added 6% wastage to the feed requirements. This allowed for feed that was offered to cows under good grazing conditions but was not eaten by the cows. In research trials 6% of the feed offered to cows disappeared, but was not accounted for by milk production or liveweight change, so is assumed to be lost in the grazing process.

Farmers should be aware that cows are unlikely to eat all the feed they are offered. Wastage always occurs, the extent of wastage being dependent on grazing conditions and the type of feed being offered. To meet the expected energy requirements of cows, farmers should allow for some of the feed offered being wasted (not eaten by the cows).

Utilisation and wastage definitions:

Use of utilisation % changes depending on whether you are using it on an annual or daily basis. Utilisation % is an estimate as it is very difficult to measure under grazing conditions.

$$\text{Utilisation percent:} = \frac{\text{The estimated feed eaten (kg DM/ha)} \times 100}{\text{The estimated feed offered (kg DM/ha)} \times 1}$$

Annual pasture utilisation example:

Annual pasture eaten calculated =16 tonnes DM/ha (from table on page 46), 500 kg cows producing 400kg MS/cow=5.1t DM/cow x 3.13 cows/ha= 16 tonnes DM/ha)

Annual pasture growth = 20 tonnes DM/ha

Annual utilisation % = 16/20= 80% utilisation (assuming no feed other than pasture was used)

Exceptional utilisation:	80-85%
Average Pasture Utilisation	75-80%
Poor utilisation would be	<75%

Daily utilisation example:

Good grazing conditions: (free draining soil, no recent rain, fine weather)

1ha of pasture with 3000 kg DM/ha pre-grazing herbage mass is allocated to 100 cows for 24 hours. Grazing residual is 1500 kg DM/ha. 1500 kg DM/ha or 15 kg DM/cow has disappeared (assumed eaten). Under good grazing conditions its likely that the intake is about 6% less than 15 kg DM (14.1 kg DM/cow, 6% wastage)

Poor grazing conditions (poorly drained soils, is raining or soils are already saturated)

Using the same pre and post grazing levels under wet conditions pasture wastage of 25% could occur meaning that intake is likely to be 11.25 kg DM/cow. The uneaten (wasted pasture) was buried in the soil by trampling, or remained uneaten because of soiling.

Dry matter requirements for lactating cows

Daily energy requirements of lactating cows (MJ ME)

The requirements are calculated for pasture at 11.0 MJ ME/kg DM. For different pasture quality make the following adjustments to calculate ME requirements:

- ME requirements with increasing feed quality: subtract 5% per MJ ME above 11.0 MJ ME/kg DM
- ME requirements with decreasing feed quality: add 5% per MJ ME below 11.0 MJ ME/kg DM.

Maintenance MJ ME/day

Lwt (kg)					
375	**400**	**450**	**500**	**550**	**600**
46	50	54	59	63	68

Milksolids MJ ME/kg MS

MJ ME/kg DM	Breed		
	Jersey	**J x F**	**Friesian**
10	81	84	86
11	77	80	82
12	74	77	79

Walking MJ ME/km

Flat	Rolling	Hilly/steep
2.0	3.0	6.0

Pregnancy MJ ME/day

	Weeks before calving					Annual total
	Calf birth weight	12	8	4	2	
Jersey	25	11	18	32	42	1848
Kiwicross	30	12	21	37	48	2114
Kiwicross	35	13	23	41	54	2338
Friesian	40	14	24	44	57	2478

Liveweight MJME/kg Lwt change (diet ME required or saved)

Dry cows		Milking cows	
Lwt gain	Lwt loss	Lwt gain	Lwt loss
72	-30	50	-37

Example 1

CALCULATION EXAMPLE:

Daily requirements of a 450kg J x F cow, producing 2.0 kg MS/day and losing 0.5kg/day Lwt at 12.0 MJ ME/kg DM

Maintenance	54
Walking on flat (3km x 2 MJ ME/km)	6
Milksolids (2.0kg MS x 80 MJ)	160
Lwt loss (0.50kg LWT x -37 MJ)	-19
Total MJ ME at 11.0 ME	201
ME requirements reduced by 5% as 12.0 ME fed = 201 x 95%	191
Total kg DM Eaten (191 ÷ 12.0 ME)	15.9 kg DM

(Diet ME required reduced by 19 MJ ME from loss of Lwt).

Example 2:

CALCULATION EXAMPLE:

Daily requirements of a 450kg J x F dry cow (30kg calf birth weight), 12 weeks before calving and gaining 0.5kg/day Lwt (½ CS in 30 days) at 11.0 MJ ME/kg DM

Maintenance	54
Pregnancy	12
Lwt gain (0.50 kg Lwt x 72 MJ)	36
Total MJ ME	**102**
Total kg DM eaten (102÷ 11.0 ME)	**9.3kg DM**

(Diet ME required increased by 36 MJ ME from gain of Lwt).

Total daily dry matter requirements for lactating cows (kg DM/cow/day)

Daily pasture intakes by grazing cows (kg DM/cow/day) greater than 4% of cow liveweight are very unlikely to be achieved, e.g. 17 kg DM for a 400 kg cow = 4.25% of liveweight is very unlikely.

Daily milking cow requirements: kg DM/cow/day at 10.5 MJ ME/kg DM

Breed	kg Lwt	kg MS/cow/day						
		0.8	**1.0**	**1.2**	**1.4**	**1.6**	**1.8**	**2.0**
J	375	10.4	11.9	13.4	14.9			
J	400	10.9	12.4	13.9	15.4			
J x F	450	11.6	13.1	14.7	16.3	17.8		
Fr	500	12.1	13.7	15.3	17.0	18.6	20.0	
Fr	550	12.6	14.2	15.8	17.4	19.0	20.4	22.0

(No walking or Lwt loss or Lwt gain included).

Daily milking cow requirements: kg DM/cow/day at 11.0 MJ ME/kg DM

Breed	kg Lwt	kg MS/cow/day						
		1.0	1.2	1.4	1.6	1.8	2.0	2.2
J	375	11.2	12.6	14.0	15.4			
J	400	11.5	12.9	14.3	15.7			
J x F	450	12.2	13.7	15.2	16.6	18.1		
Fr	500	12.8	14.3	15.8	17.3	18.8	20	
Fr	550	13.3	14.8	16.3	17.8	19.3	20.6	22.0

(No walking or Lwt loss or Lwt gain included).

Daily milking cow requirements: kg DM/cow/day at 12.0 MJ ME/kg DM

Breed	kg Lwt	kg MS/cow/day						
		1.4	1.6	1.8	2.0	2.2	2.4	2.5
J	375	12.5	13.7	14.9				
J	400	12.6	13.9	15.1	16.3			
J x F	450	13.3	14.6	15.9	17.2	18.5		
Fr	500	13.9	15.2	16.5	17.8	19.1	20.7	
Fr	550	14.3	15.6	16.9	18.2	19.5	21.1	21.7

(No walking or Lwt loss or Lwt gain included).

Dry matter requirements for dry cows

Kg liveweight per body condition score (BCS)

kg Lwt/CS = 6.58% of cow Lwt					
Cow Lwt	**350**	**400**	**450**	**500**	**550**
kg/BCS	23	26	30	33	36

Approximate amounts (kg DM) of 'commonly used feeds' required to be eaten for a 1.0 unit increase in BCS.

Breed	kg Lwt[1]	kg Lwt/ BCS	Autumn Pasture	Pasture Silage	Maize Silage	PKE	Kale[2]	Swedes[3]	Fodder Beet[2]
					MJ ME/kg DM				
			11.5	**10.5**	**10.5**	**11**	**11**	**12**	**12.5**
J	350	23	145	110	115	85	150	125	110
J	400	26	165	130	130	100	175	145	125
J x F	450	30	185	145	145	110	195	160	140
Fr	500	33	205	160	160	125	215	180	155
Fr	550	36	225	180	180	135	235	195	170

[1] Live weights are for the cow only and exclude the weight of the foetus. [2] Requirements for kale and fodder beet were estimated relative to requirements for grass silage from Keogh et al. (2008). [3]Requirements for swedes were estimated as the average of kale and fodder beet.

Note:

- The reason different feeds have different effects on BCS gain is currently unknown, but the results are based on feeding studies in New Zealand
- The differences between maize silage, PKE and pasture silage are not statistically significant – this means that we cannot say with certainty that the numerical difference is real. However, this is the best information available for New Zealand farmers
- The figures presented are average feed requirements (feed eaten) for a 1.0 unit gain in BCS
- The amount of feed required to gain BCS increases later in pregnancy. Realistically, cows do not gain BCS during the last month before calving because of the energy demands of foetal growth

Maintenance and pregnancy requirements for no body condition score gain (kg/DM/cow/day) 11.0 MJ ME/kg DM autumn pasture

Breed	kg Lwt	Weeks pre-calving			
		12	8	4	2
J	350	5.0	5.7	6.8	7.7
J	400	5.5	6.3	7.6	8.5
J x F	450	6.0	6.8	8.3	9.3
Fr	500	6.5	7.4	9.0	10.1
Fr	550	7.0	8.0	9.6	10.8

Daily DM requirements for gaining 1 body condition score in 60 days (kg DM/cow/day), including maintenance and pregnancy requirements. 11.0 MJ ME/kg DM autumn pasture

Breed	kg Lwt	8 - 4 weeks pre-calving
Jersey	**350**	**7.5**
Jersey	**400**	**8.4**
Jersey friesian cross	**450**	**9.2**
Friesian	**500**	**10.1**
Friesian	**550**	**10.9**

No CS gain in last month of pregnancy

Estimating herd/cow liveweight

Average liveweight of mature cows can be determined by weighing a cross section of the mature cows in the herd. Weighing guidelines to establish an estimate are:

- 20–50 cows (the more you weigh the more accurate the result)
- 6-8 years of age
- 100-200 days in milk, making early December a good time to weigh a sample of cows.
- after the morning milking
- BCS 4.5 (add or subtract 14kg for Jerseys, 15 kg for Kiwicross, and 16kg for Holstein Friesian per 0.5 BCS if above or below score 4.5)

This information can be used to validate Lwt BVs and will be most accurate for herds with consistent breeding strategies and limited breed variation within the herd.

Where an estimate of the liveweight for all cows in the milking herd (including the immature 2 and 3 year olds) is required for estimating feed requirements and calculating liveweight/ha, then discount the mature weight by 5%, i.e. multiply the mature weight by 0.95, e.g 520 kg mature weight x 0.95 =500 kg average herd weight allowing for 40% of the herd to be 2 and 3 year olds.

Estimating expected mature liveweight for a group of heifers

Estimating mature liveweight for a group of replacement heifers enables a check on the adequacy of their growth rates for acheiving their mature liveweight. All methods require an estimate of the mature LW of that group first, then estimating their target weight depending on their age.

1. Using average liveweight breeding value (Lwt BV) of the group of heifers.

Breeding values for liveweight are genetic predictions of an animals' mature weight as a 4 year old or older based on parent genetics.

Lwt BV can be used to estimate the target mature liveweight for a group of heifers using the equation:

Mature liveweight (kg) = 500 kg + Average Lwt BV for the group of heifers

Examples:

If the average BV is +20, then the predicted mature target liveweight for that group of animals will be 500 + 20 = 520kg

If the average BV is -15, then the predicted mature liveweight for that group of animals will be 500 + -15 = 485 kg.

Applying this method to individual animals is not recommended.

2. Using the average weight of the mature herd (as above)

This information can be used to validate Lwt BVs and will be most accurate for herds with consistent breeding strategies and limited breed variation within the herd.

3. Typing animals and assigning a breed average

The most effective use of this method is for each animal to be sighted and scored based on coat colour and frame structure to breed. Once breed is selected assign the animal a mature liveweight target based on the breed.

	Average mature cow liveweight kg (New Zealand National Dairy Statistics 2020/21)*	Estimated range in mature cow herd average liveweight
Jersey	435	415 – 465
J x F	485	430 – 550
Friesian	535	510 – 600

** Weighted average liveweight of 6-8 year olds from the NZ Dairy Statistics 2020/21 page 32 Table 4.7.*

Heifer feed requirements

Heifer liveweights

Heifer recommended liveweights – kg LWT

	Age in months					
	3	6	9	15	19	22
	Target % of mature liveweight					
Mature Lwt kg	20%	30%	40%	60%	80%	90%
425	85	128	170	255	340	383
450	90	135	180	270	360	405
475	95	143	190	285	380	428
500	100	150	200	300	400	450
525	105	158	210	315	420	473
550	110	165	220	330	440	495

Annual feed requirements

Heifer total kg DM requirements – kg DM/head at 11.0 MJ ME/kg DM

	Total kg DM		
	Age in months		
Mature Lwt kg	3-10	11-22	3-22
425	891	2455	3346
450	953	2535	3488
475	996	2707	3703
500	1011	2727	3738
525	1048	2839	3887
550	1117	2995	4112

Daily heifer requirements – kg DM/head/day at 11.0 MJ ME/kg DM (including pregnancy)

		Age in months (% of mature liveweight)					
Mature Lwt kg target	Lwt gain kg/day	3 (20%)	6 (30%)	9 (40%)	15 (60%)	19 (80%)	22 (90%)
425	0.54	2.3	3.5	4.6	5.9	7.6	9.2
450	0.56	2.6	3.8	4.9	6.1	7.9	9.4
475	0.60	2.6	3.9	5.1	6.5	8.4	10.1
500	0.62	2.7	4.1	5.4	6.7	8.6	10.3
525	0.63	2.8	4.1	5.4	6.8	9.3	10.6
550	0.67	2.9	4.3	5.7	7.2	9.8	11.1

Heifer intake requirements

- Heifers require energy for maintenance and energy to put on weight.
- Animals become less efficient at using energy for growth as they get heavier.
- Protein requirements are highest from weaning to nine months of age.
- If heifers are on rolling to steep country increase energy requirements by 10%.
- Add or subtract 5% per MJ ME for diets below/above 11 MJ ME/kgDM.
- Heifers should be fed diets of 10.5 MJ ME or higher to achieve target liveweights.

Energy and protein required for maintenance and growth (0.6kg/day) in heifer diets for animals of different weights. Energy for pregnancy is not included.

BW	Maintenance	Growth	Protein
Kg	MJ ME/day	MJ ME/day	%
100	19	17	17
150	26	24	17
200	32	28	17
250	37	29	15
300	42	31	15
350	47	39	14
400	51	40	14
450	55	40	14
500	62	40	14
550	69	40	14

Water requirements

Access to clean fresh water is important for heifer growth and health. Make sure heifers have sufficient access to water.

Water intake of heifers during low day temperatures and high day temperatures

	Litres per day	
Bodyweight (kg)	**4° C (air temp)**	**27° C (air temp)**
45	2.6	4.2
90	8	13
180	14	23
270	19	32
360	24	40
455	28	47

Animal health requirements

Trace elements

Copper and selenium deficiency will decrease growth rates in young stock but only if they are deficient in their diet, or in the case of copper, there are other minerals in the diet that are affecting absorption of copper (molybdenum, iron, sulphur, zinc). Cobalt (VitB12) deficiency can affect growth rates, but this is rare in cattle.

Testing: Every farm's mineral status is different due to differences in soil, topography, fertilisers and the history of the animals arriving on farm. Testing the animals first is crucial to ensure that they are not deficient in minerals and that your supplementation programme is working. Preferably use liver samples to test for copper and cobalt and blood samples to test for selenium.

Supplementation: There are a large range of products to supplement trace elements and some are better than others. Always test your stock to ensure that your supplementation is needed and/or working.

Parasites

Obvious weight-loss, diarrhoea and deaths are the visible signs of worms but are just the tip of the iceberg. Reduced weight gain will occur long before any signs of worms are evident. Parasites need to be managed effectively by:

a. reducing larval intake (prevent infection)

b. helping the animal cope with worms (healthy cattle)

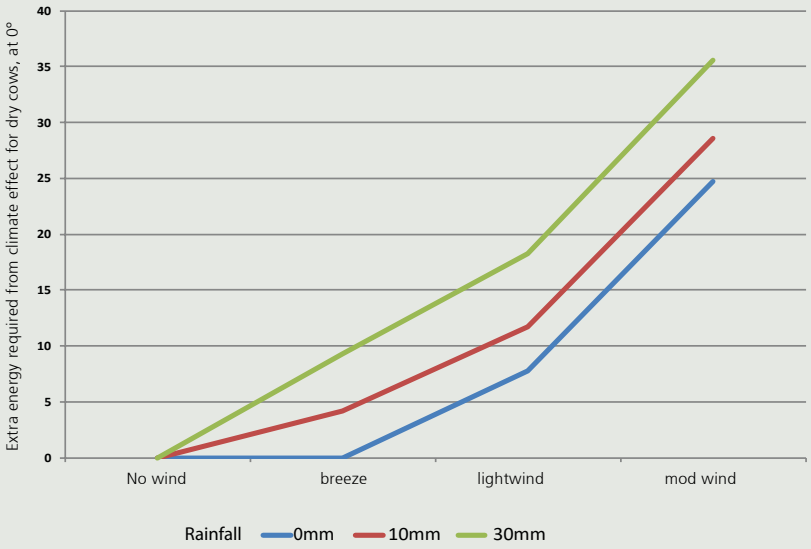
c. killing the adult worms inside the animal (effective drench)

For calves and heifers an effective drench should be a combination drench containing levamisole to target Cooperia worms.

For more information see **www.wormwise.co.nz**

How feed requirements are altered by weather

Cold stress: non-lactating cows.



Temperature thresholds for cold stress (dry cows) °C	
Strong wind and rain	+7.5
Strong wind and no rain	+4
Rain and no wind	0
No wind or rain	-13

Heat stress:

When air temperature is greater than about 21°C and relative humidity is greater than 70% cows begin to experience heat-induced depression of feed intake and lower productivity. Visit **dairynz.co.nz/heatstress** for more on the impact of heat stress on cow productivity in your region, and ways to reduce impact.