

Chapter 2: (Pasture) Dry Matter — What It Is and How to use it

Dry matter (DM) — the plant material remaining once all moisture is removed.

DM is the basic "currency" of feed budgeting, just as dollars are the currency of financial budgeting: pasture supply and animal demand are both measured in DM.

The units of Dry matter (DM) are kilograms kgDM

Why use kgDM as the default unit?

Other units exist — DSE, ewe equivalents, cow days, MJME, CP%, NDF%, soluble sugars/starch% — but this text recommends working in kgDM first, converting to other units only when needed.

There are three main reasons:

1. **It's intuitive.**

5 kgDM of pasture is easier to picture than 55 MJME of the same feed.

2. **It's measurable in the field.**

ME can't practically be measured on-farm; DM can, with several available tools.

3. **It's a convenient accounting basis.**

Comparing 12 kgDM of pasture + 4 kgDM of baleage is far simpler than comparing 66 kg of wet pasture + 9 kg of Baleage — even though they contain the same amount of dry matter. (pasture ~18% dry matter; baleage ~45% dry matter)

Daily feed requirement for a lactating dairy cow producing 2 kg milk solids per day		
Dry Matter Basis		Wet Matter Basis
	kgDM	
Pasture	13	87 square metres of pasture
Green feed turnips	3	30 kg of fresh turnips or 3.75square metres of turnip crop
Maize meal	3	3.33 kg of maize meal
Total	19 kgDM	??

Table 1 Comparison of feed-stuffs on a dry and wet matter basis

But there is an important qualification: all kilograms of DM are not created equal.

For example, a kilogram DM of high-quality pasture will deliver considerably more nutritional value than a kilogram DM of wheat straw. This is where **MJME/kgDM** becomes important. It tells us how much metabolisable energy (energy usable by the grazing animal) is contained in each kilogram of dry matter.

For budgeting purposes, pasture can generally be assumed to provide around **11 MJME/kgDM**, although exceptional, clover-rich pasture may provide up to around **13 MJME/kgDM**.

Other feeds will have different energy values. For example, hay may provide around 8 MJME/kgDM, silage around 9.4 MJME/kgDM, while maize meal (ground corn) is 13.0 to 13.5 MJME/kgDM.

The important point is that while **the moisture content of feeds varies enormously, their energy value per kilogram of DM varies much less**. This is why comparing feeds on a DM basis is pragmatically useful and makes sense.

Where a supplement's energy value differs significantly from the assumed pasture value, say, by more than 10–15% the kgDM allowance can be adjusted accordingly. For example, if pasture is budgeted at 11 MJME/kgDM but hay provides only 8 MJME/kgDM, approximately 20–25% more hay DM would be required to provide a similar amount of energy. ie simply up the amount of kgDM of hay fed by 25%

Feed budgeting does not need to be exact to be useful. Even working within 80–90% of theoretical values can deliver substantial improvements in feed utilisation and livestock productivity. The objective is not to achieve laboratory precision, but to make **better decisions about how much feed is available, how much livestock require, and when shortages or surpluses are likely to occur**. With experience, you will soon intuitively adjust dry matter (DM) allocations for different feed types to achieve consistently excellent results

In a feed budget, it is usually much more convenient to express this requirement in kgDM of feed rather than in megajoules of energy. But where a supplement's energy value (MJME/kgDM) differs significantly from the assumed pasture value say, by more than 15%, the kgDM allowance can be adjusted accordingly.

For example, if pasture is budgeted at 11 MJME/kgDM but hay provides only 8 MJME/kgDM, approximately 25% more hay DM would be required to provide a similar amount of energy.

DM% of pasture

Actively growing pasture is typically ~18% DM, ranging from ~11% (rapid spring growth) to ~30% and even higher (dry summer). Day-to-day variation of 3–4 percentage points is normal and doesn't materially affect decisions; 18% is a reasonable default outside obvious extremes.

Typical Dry Matter % and Metabolisable Energy content of pastures in New Zealand		
	DM%	ME MJ/kgDM
Pasture ryegrass/white clover dominant		
North Island of New Zealand		

Typical Dry Matter % and Metabolisable Energy content of pastures in New Zealand		
	DM%	ME MJ/kgDM
Spring	12-15	11.5-12.5
Summer leafy	15-20	10.5-11.5
Summer dry stalky	20-30	9.5-10.5
Autumn/winter	13-18	11.0-11.5
Kikuyu		
Leafy	20-30	9.0-11.0
Stemmy	40-60	7.0-9.0
Table 2: Typical Dry Matter % and Metabolisable Energy content of pastures in New Zealand		

Total, available and residual DM

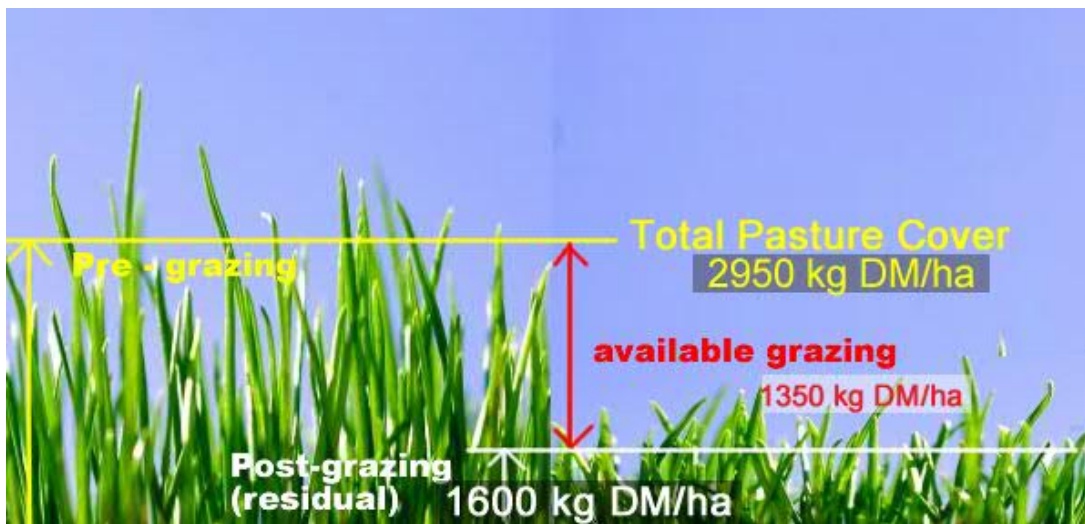
Understanding the difference between total, available and residual DM is fundamental. Make sure you have a very clear understanding of what each term means in the context presented here, because these terms are sometimes used by others in different contexts.

A typical pre-grazing dairy pasture might have a total cover of 3000 kgDM/ha — meaning that if the plant material on 1 ha were cut to ground level and oven-dried, it would weigh 3000 kg.

But stock can only consume the portion of this DM that is above the desired residual. For example, if total cover is 3000 kgDM/ha and the desired residual is 1600 kgDM/ha, then 1400 kgDM/ha is *available* for consumption.

$$\text{total cover minus residual} = \text{available DM}$$

“Pasture cover” and “total cover” can both refer to the total amount of pasture DM present, expressed as kgDM/ha. “DM on offer” is also sometimes used in this sense, although its meaning can vary between people and contexts.



DM of other feed-stuffs

DM applies equally to hay, silage, and other supplements (see the appendices for DM% by feed type and bale/pit dimensions).

Worked examples:

Wet weight from DM required: Feeding 180 heifers 2 kgDM each of pit silage = 360 kgDM needed. Silage at 580 kg wet/m³ and 30% DM = 175 kgDM/m³, so $360 \div 175 \approx 2$ m³ to feed out.

DM from wet weight:

wet weight $\times$ DM% — e.g. 20 kg hay $\times$ 85% = 17 kgDM;

25 kg maize meal $\times$ 88% = 22 kgDM.

Wet weight from DM required (reverse):

DM required $\div$ DM% — e.g. 3 kgDM $\div$ 80% = 3.75 kg hay;

3 kgDM $\div$ 88% = 3.4 kg maize meal;

3 kgDM $\div$ 10% = 30 kg fresh turnips.

Feed-stuff	Dry matter %	Moisture %
Water	0	100
Short, leafy, rapidly growing spring pasture	10	90
Leafy early summer pasture	20	80
Pasture Pit Silage	30	70
	40	60
Baleage /Haylage	50	50
	60	40
	70	30
Meadow Hay	80	20
Grains – Maize, Wheat,	90	10
	100	0

Table 3 DM percentages of some common feed-stuffs

Beyond DM: ME, CP, NDF, SS, SSS

kgDM says nothing about a feed's actual nutritional value — quality clover hay and barley straw can have near-identical DM% but very different feed value. For that, other measures matter.

Metabolisable Energy (ME), in MJ/kgDM, is the energy an animal can actually use for maintenance, activity, pregnancy, production and growth (excluding energy lost to faeces, urine, heat or methane). It's hard to measure directly (requires lab bomb calorimetry) but well-documented for common feeds and stock classes (see appendices).

Pasture is typically assumed at 11 MJME/kgDM, varying with growth stage (short leafy pasture ~11.7, mixed-length ~10.8, dry/stalky ~8.1 MJME/kgDM) — adjust DM allowances for variations of 10%+.

ME values of different stages of pasture growth			
Pasture	% DM	*Relative ME Value on DM Basis	ME Concentration (MJME/kgDM)
Short leafy	15	1.1	11.7
Mixed-length leafy	18	1.0	10.8
Dry stalky	28	0.8	8.1

Table 4: ME values of different stages of pasture growth

Beyond DM — other nutritional measures (CP, NDF, soluble sugar/starch % and fat%)

As your knowledge and experience in feed budgeting develop, you will encounter other measures of feed quality, such as crude protein (CP), neutral detergent fibre (NDF), soluble sugars and starch, and fat. These measures add nutritional detail beyond simply knowing how much DM is available.

Metabolisable energy (ME) provides a useful measure of the overall energy value of a feed, broadly capturing the combined contribution of these nutrients to the animal's energy supply. However, ME does not tell you about the individual balance of those nutrients. For example, molasses and spring pasture can have a very similar ME value — around 11.6 and 12 MJME/kgDM respectively — yet they are very different feeds. Molasses is much lower in CP and NDF and extremely high in soluble sugars, which means that over-feeding it can create a risk of rumen acidosis.

Fortunately, good pasture is a remarkably well-balanced feed. Typical pasture nutrient levels comfortably meet the requirements of a 25-litre dairy cow and, for CP and dietary nitrogen, generally exceed them. The main potential gaps are usually trace minerals, which are best addressed through appropriate fertiliser programs or supplementation.

This is why, provided pasture quality is reasonable, kgDM alone is a safe and sufficient basis for basic pasture feed budgeting. There is little benefit in getting too involved with CP, NDF, sugars, starch, fat and other measures until the fundamentals of DM feed budgeting are second nature. ME, CP, NDF and other nutritional measures can then be used to fine-tune the budget when the situation requires it — particularly in high-input, high-production systems.

Feed Analysis of Spring Pasture and Molasses against the nutritional requirements of a milking cow							
	DM	ME	CP	NDF	SSS	Starch	Fat
	%	MJME/kgDM	%DM	%DM	%DM	%SSS	%
Pasture, spring	12 - 15	11.5-12.5	20-30	35-45	7 - 25	2 - 4	4 - 6
Molasses	75	11.6	4 - 6	0	65	0	0
Requirements of a milking cow 25 l/day	N/A	11	16-18	28-32	max of 38	max of 30	max of 6 to 7

Source: Adapted from the feed-stuff value appendices.

Key points

- DM is feed weight with moisture removed — a consistent basis for comparing feeds regardless of water content.
- Total DM/ha is not what stock get to eat: available DM = total DM – residual DM.
- kgDM alone, used well, delivers most of the productivity gain available from feed budgeting; other units (ME, CP, NDF, SSS, fat%) refine the picture later, mainly by adjusting DM allowances up or down.

End-of-chapter questions

1. Why do we measure pasture in kilograms of dry matter (kgDM) rather than kilograms of "as is" (wet) pasture?
2. A hay bale weighs 20 kg "as fed" and is 85% DM. How many kgDM is that?
3. What is the formula for "available DM"?
4. Why is "total DM/ha" on a paddock not the same as what stock actually get to eat?
5. True or False: a default DM% of roughly 18% is often assumed for fresh pasture.