



Important nutrients

Technical Note N05

Energy

Measured as megajoules (MJ) of metabolisable energy (ME).

Main feed energy sources are carbohydrates (starch, sugar, digestible fibre). Protein and fat in feeds can also be used as energy sources.

Rumen microbes use feed energy sources to produce glucose and volatile fatty acids (acetic, propionic, butyric), which are used by the cow as energy for maintenance and milk production.

Starch

Starch is a complex carbohydrate that primarily contributes to milk yield and milk protein %.

Feed sources include cereal grains; pulses (chickpeas, mung beans, fava beans); cereal silage (including corn, barley, sorghum and wheat silage); vegetable waste (including potatoes, peas and beans); bread and bakery waste.

Starch tends to be digested gradually by rumen microbes, compared with sugars, but the rate varies. See Table 1.

Processing changes the speed and extent of digestion of starch by rumen microbes. The more highly processed the grain, the faster and more starch is broken down as an energy source for rumen microbes.

Table 1. Starch content and digestion rates of feeds

Source	Starch %	Degradation rates/hr	Hrs in rumen
Wheat grain	67-67	~40%	2.5
Barley grain	52-56	~30%	3.3
Corn grain	64-70	~20%	5
Sorghum grain	62-66	~10%	10
Potatoes	65-75	~50%	2
Bakery waste	40-60	~25%	4

Sugars

Sugars are simple carbohydrates that contribute to rumen fermentation and milk production.

Temperate and lush tropical grasses are a good source of sugars; their sugar reserves increase throughout the day and peak late in the afternoon.

Other sources include fruit and fruit byproducts and molasses. See Table 2.

Sugars are rapidly digested (within ¼ to ½ an hour) by rumen microbes.

Too much sugar in the diet can cause rumen pH to drop rapidly (acidosis), lowering the number of fibre digesting rumen microbes.

Table 2. Sugar content of feeds

Source	Sugar %
Lush ryegrass	4-14
Citrus pulps	20-25
Molasses	75-80
Ripe bananas	20-25
Cane stalk	25-35
Fruit waste	10-25

Fibre (NDF)

Fibre—measured as neutral detergent fibre (NDF)—is a complex carbohydrate used by rumen microbes as an energy source.

Fibre is slowly digested by rumen microbes, so a high-fibre diet can reduce feed intake and nutrient intake, consequently impacting on milk production. (Refer to Technical Note N04. Factors affecting feed intake.)

NDF is likely to be lower and more digestible when pastures are young and lush.

NDF is likely to be higher and less digestible when pastures are mature and setting seed.

Effective fibre (forage that is 2–5 cm in length) is needed to promote cud chewing (rumination) and maintain rumen health. (Refer to Technical Note N02: Managing for healthy rumen function.)

Rumen digestion rates of fibre vary between feedstuffs. See Table 3.

Table 3. NDF content and digestion rates of feeds

Source	Starch %	Degradation rates/hr	Hrs in rumen
Early veg pastures	25-40	~11-14%	7-9
Late veg pastures	35-55	~9-10%	10-11
Mature pastures	55-75	~3-5%	20-33
Cereal straws	70-80	~3%	33
Peanut shell	70-76	~2%	50
Cottonseed hulls	76-80	~6%	16

Protein

Dairy cows obtain protein from two major sources—rumen microbes and crude protein in feed.

Crude protein in feedstuffs includes both true proteins that contain amino acids (such as protein meals) and non-protein nitrogen (such as urea).

Rumen microbes are digested and absorbed in the small intestine as the main protein source for milk production—providing up to 70–90% of a cow's protein requirements.

True protein is either broken down in the rumen (rumen-degradable protein or RDP), or bypasses rumen digestion (rumen undegraded protein or RUP) to be digested in the intestine; some may pass undigested in the manure.

Metabolisable protein is the protein (microbial protein + RUP) that is absorbed through the intestine and available to the cow for maintenance and production.

Table 4. Protein content and digestion rates of feeds

Source	Crude Protein%	RDP%	Hrs in rumen
Cottonseed meal	41-47	50-58	6-12
Canola meal	38-44	68-72	2-6
Soybean meal	47-52	70-74	2-6
Sunflower meal	32-37	70-74	5-10
Wheat/barley grain	8-15	75-80	2-6

Water

(Refer to Technical Note N02: Managing for healthy rumen function)

Milking cows need approximately 100 L of drinking water/cow/day to maintain healthy rumen function, body maintenance and milk production.

Water requirement is highest in hot weather and immediately after milking.

Minerals

A lack of any essential mineral, particularly calcium, phosphorus, potassium, sulphur and magnesium, will limit milk production and reproduction.

The level of minerals that need to be fed is determined by other nutrients in the diet.

Further information

Contact the DAFF Customer Service Centre by Phone 13 25 23, or Email callweb@daff.qld.gov.au

More technical notes can be found at: www.dairyinfo.biz

Protein Plu\$ checkbook (Published 2006 by DPI&F Qld)

Feed Plu\$ CD v4.0 (Published 2008 by DPI&F Qld)

Condition magician booklet (Published 2003 by DPI Vic)

The project is funded and supported by the Department of Agriculture, Fisheries and Forestry and Dairy Australia.

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