

# Facts on alternative fibre sources

Nutritional values of high fibre by-products are particularly variable. Crunch the numbers before you buy using feed analysis results.

After major or catastrophic environmental events (e.g. floods, bushfires, droughts), when pasture may be limited or absent and fodder supplies are reduced, you may be forced to consider using alternative fibre options which you may not have used before. Many alternative fibre sources are suitable for feeding to dairy stock provided they are supplemented with high energy feeds and protein sources as part of a balanced diet. They vary widely in nutritive value, digestibility, effective fibre value, and may present risks such as ruminal acidosis, mycotoxins and chemical residues. So you need to be careful.

Alternative fibre sources which may be available depending on seasonal circumstances and location include almond hulls, palm kernel meal, cereal straw (barley, oats, triticale, wheat and rice straws) sugar cane and grape marc. As the chart below shows, the nutritional specifications of each of these products are unique, and differ greatly from those of conventional fibre sources such as hay, and grains such as wheat.



## Key messages

Fibre is an essential ingredient in the diets of ruminant animals such as dairy cattle. It supplies energy, maintains normal, healthy rumen function, and in cows is utilised to produce milk fat.

The most commonly used chemical measure of the fibre content of a feed or a diet is Neutral Detergent Fibre (NDF).

The 'physically effective fibre value' of a feed or a diet is also critical. It refers to the ability of a feed to stimulate rumen contractions, stimulate chewing activity and production of saliva, which contains buffers which maintain the cow's ruminal pH in the optimal range (6.2–6.6) for growth of rumen microbes.

NDF intake should ideally be about 28 to 35% of the total diet to maximise daily dry matter intake, however they can eat up to levels of 35% of the diet with minimal impact on intake. Above 35% NDF dry matter intake will decline especially if the diet is forage based. 25% of the fibre in the diet should have a fibre length of approximately 2.5cm. Diets containing rapidly digested starch sources such as wheat should have higher levels of NDF (min 34%).

A rule of thumb for NDF intake is 1% of bodyweight as forage NDF or 1.2% of bodyweight for total NDF intake e.g. a 600kg cow can eat 6 kg DM of NDF per day from forage or 7.2kg DM of NDF/day in the total diet.

If there is not enough long or 'effective' fibre, there will not be enough chewing during eating and ruminating, and therefore not enough saliva produced, leading to a drop in ruminal pH and increased risk of ruminal acidosis.

Cattle can suffer from two forms of ruminal acidosis:

- 'Sub-acute ruminal acidosis' (SARA), where the ruminal pH is in the range 5.5–6. (Cows may not appear sick, but some will be off feed, have mild milk fat depression and be scouring).
- 'Lactic acidosis' where the ruminal pH is below 5.5 – cows will be noticeably sick. (Many cows will be off their feed, down in their milk, lame and scouring. This may then progress to 'downer cow' syndrome and death).

## Almond hulls

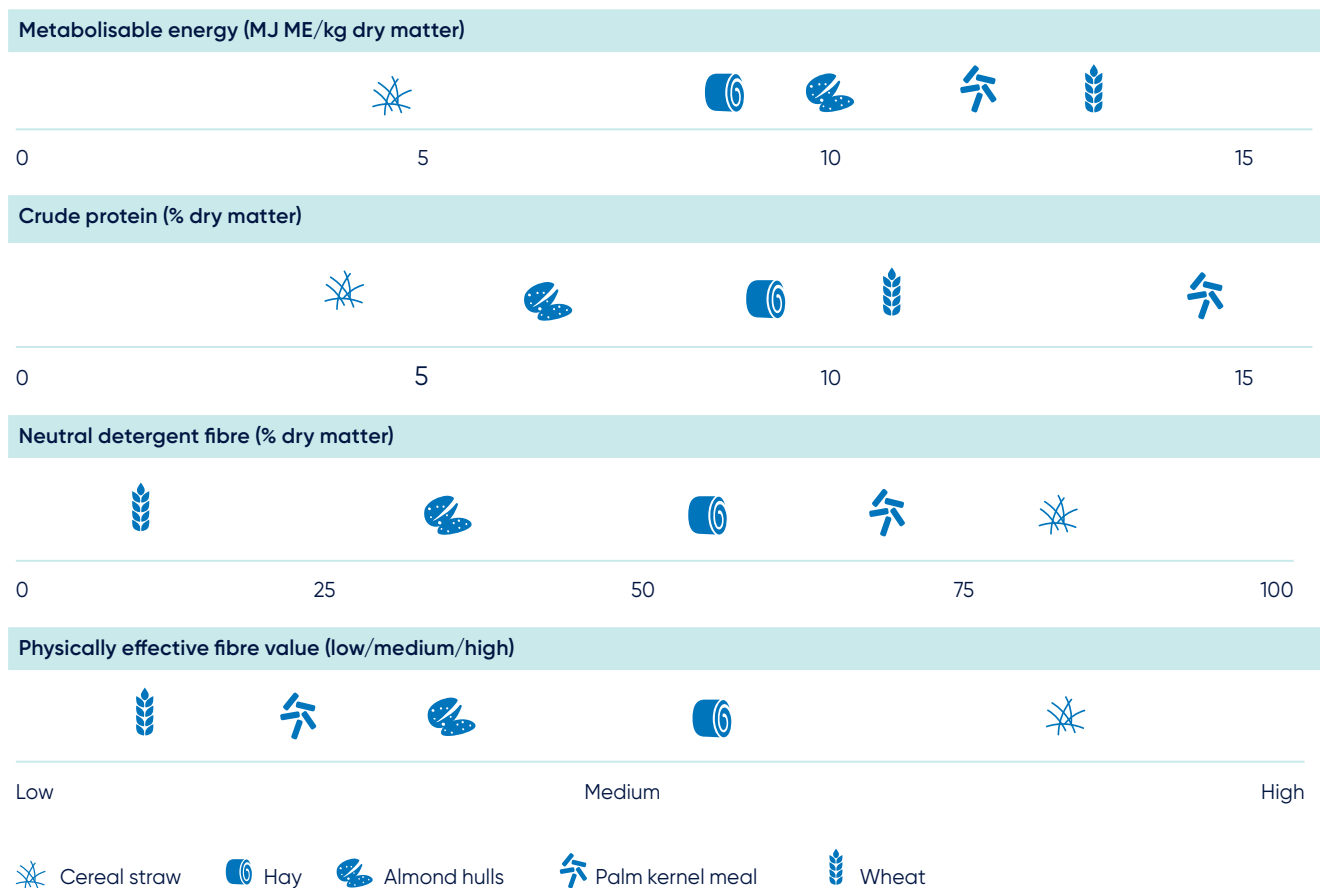
- A good forage extender, with medium effective fibre value when fed whole.
- Reasonable energy source with very good palatability.
- Low in protein.
- Available whole and milled. Whole almond hulls have a higher effective fibre value but a lower bulk density. Milled almond hulls provide no effective fibre.

### Key messages

Nutritional values of high fibre by-products are particularly variable

Crunch the numbers before you buy using feed lab analysis result

Figure 1 Nutritive value of feeds



Keep in mind	Management tip
Highly palatable. If offered ad-lib, cows may consume 6+ kg/cow/day.	Limit daily consumption of almond hulls to 3–4 kg/cow/day. Always feed almond hulls with a palatable, good quality straw/hay.
Sugar level is > 20 per cent	Introduce gradually to cows' diets. Limit daily consumption to 70% of dry matter intake.
If feeding out using a front end loader (FEL), you need to know how many kilograms per bucket, to ensure you don't under or over feed.	Weigh the FEL with and without the bucket full of almond hulls, or estimate using almond hulls' bulk density (kg/litre) and your bucket's volume. Check bulk density regularly.
Can be challenging to regulate daily feed intakes and avoid excess competition and wastage.	Mix almond hulls with other higher quality feeds in a mixer wagon if possible. If offered to cattle separately, place in troughs a fair walk away from water troughs and other forage sources.
Ad-lib almond hulls will not provide the daily nutrient requirements of dry cows or young stock.	Supplement with grain/concentrates, including protein supplements.
Prone to mould growth if allowed to get wet, increasing the risk of mycotoxins (fungal toxins).	Store under cover, ideally on a dry concrete floor. Consider including a reputable mycotoxin binder product in feed.
Potential chemical residue risk.	Purchase almond hulls with a vendor commodity declaration.

## Palm kernel meal

- A forage extender, not a grain replacer.
- Medium digestibility, but low effective fibre level due to small particle size.
- Low in starch and sugars.
- Oil content: 8–10%.
- Medium protein 15–18%.
- High feeding levels of PKE (>3–4 kg/day) will alter the ratio of fatty acids in milk fat, which can be an issue when processing certain products.
- PKE might also be a potential mycotoxin risk.

Keep in mind	Management tip
If offered ad-lib, cows will consume about 6 kg/day. High feeding rates for extended periods without effective fibre sources may lead to animals suffering impacted stomachs.	Limit daily consumption of palm kernel meal to 3–4 kg/cow/day. Always feed palm kernel meal with a palatable, good quality straw/hay.
If feeding out using a front end loader (FEL), you need to know how many kilograms per bucket, to ensure you don't under or over feed.	Weigh the FEL with and without the bucket full of palm kernel meal, or estimate using palm kernel meal's bulk density (kg/litre) and your bucket's volume.
Stimulates high water intakes by cattle.	Always provide plenty of access to water. If palm kernel meal is offered to cattle separately, place it a fair walk away from water troughs and forage sources to help regulate their intakes and avoid excess competition.
Ad-lib palm kernel meal/straw diet will not provide the daily nutrient requirements of springers or dry cows.	Feed palm kernel meal and grain/concentrate 50:50 with forage sources to help ensure daily nutrient requirements are met for maintenance, growth and pregnancy.
Prone to mould growth if allowed to get wet, increasing the risk of mycotoxins (fungal toxins).	Store under cover, ideally on a dry concrete floor. Can be stored in silo, but needs very steep cone. Bocce balls on top of the auger may help avoid bridging problems. Consider including a reputable mycotoxin binder product in feed.
Potential chemical residue and aflatoxin risks.	Limit daily consumption to 40% of dry matter intake. Purchase palm kernel meal with a vendor commodity declaration.

## Cereal straw (barley, oat, triticale, wheat)

- A poor nutritional quality forage, but high effective fibre value.
- Its sole purpose in the diet is to help stimulate chewing and saliva production, and maintain a fibre mat in the rumen.
- Very low in energy and protein.
- If fed at substantial levels, it will reduce performance due to very low ME content and low fibre digestibility

Keep in mind	Management tip
Not very palatable. Cattle may reject if other forage choices available.	Mix cereal straw with other higher quality feeds in a mixer wagon if possible.
Conservation methods vary (variable DM, time of baling after grain harvest, storage), so products may be prone to mould growth, increasing the risk of mycotoxins (fungal toxins).	Check product before you buy, and as you feed out.
Excess intakes by far-off dry cows and young stock may result in body condition loss/poor growth. Mycotoxins may also put pregnant cows at risk.	Not an ideal feed for far-off dry cows and young stock unless well managed. May be better to feed to milkers in small amounts, e.g. 2 kg/cow/day.
Potential chemical residue risk	Limit daily consumption of cereal straw to 30% of dry matter intake. Purchase cereal straw with a vendor commodity declaration.

**Acidosis – do you really understand fibre? Not sure? Ask your adviser.**

## Rice straw

- A poor nutritional quality forage, but high effective fibre value.
- Its sole purpose in the diet is to help stimulate chewing and saliva production, and maintain a fibre mat in the rumen.
- Low in energy and protein.
- High in silica and low in lignin compared to other straws.
- Beware palatability and intake issues.

Keep in mind	Management tip
Not very palatable. Cattle may reject if other forage choices available.	Mix rice straw with other higher quality feeds in a mixer wagon if possible. If not, provide rice straw as the sole forage source, rather than giving animals a choice between rice straw and another straw or hay.
Conservation methods vary (variable DM, time of baling after rice harvest, storage), so products may be prone to mould growth, increasing the risk of mycotoxins (fungal toxins).	Check product before you buy, and as you feed out.
Excess intakes by far-off dry cows and young stock may result in body condition loss/poor growth. Mycotoxins may also put pregnant cows at risk.	Not an ideal feed for far-off dry cows and young stock unless well managed. May be better to feed to milkers in small amounts, e.g. 2 kg/cow/day.
Prolonged feeding may result in urinary stones	Limit daily consumption of rice straw to 10% of dry matter intake.
Potential chemical residue risk	Purchase rice straw with a vendor commodity declaration.

## Sugar cane product

- A low nutritional quality forage, but high effective fibre value. Varies widely in nutritive value.
- By-products of sugar production.
- Sourced from cane growers in NSW and Queensland.
- Two main products: whole plant sugar cane forage (silage or hay), and sugar cane tops (hay).
- Cane varies considerably in nutritive value depending on its age, variety and amount of frosting.
- Silage may contain some significant residual alcohol (6–17%).
- High in iron, magnesium, potassium, manganese, cobalt, and aluminium (which may interfere with phosphorus absorption).
- High DCAD value.

Keep in mind	Management tip
Wide range of nutritive values	Get a feed test so you know what you are feeding. Avoid product from cane harvested at more than 12 months of age. Avoid product from thick stemmed sugar cane varieties. Avoid severely frosted cane (with significant damage to the crown).
Low energy content	Limit sugar cane products to max. 5–8 kg DM/cow/day in lactating cow diets. If feeding to dry cows and young stock, ensure diet is well balanced for energy, protein, calcium and phosphorus.
Sugar cane has a high DCAD value	Do not formulate in transition diets pre-calving.
Cattle have a low tolerance for alcohol. Risk of alcohol poisoning (sugar cane silage).	Check that product was well ensiled, using additives. Be alert for signs of alcohol poisoning if silage has a strong alcoholic smell.
Potential chemical residue risk	Limit daily consumption of sugar cane silage to 40% of dry matter intake.* Purchase sugar cane products with a vendor commodity declaration. Purchase crops which have a good record of chemical use and a low risk of spray drift from surrounding crops. Do not accept fodder containing soil.
Reports of cases of stomach ulceration (abomasum) in cows when fed sugar cane.	Be alert for any problems.

\*Maximum daily intake depends on nutrient value, age of cow and stage of lactation

## Grape marc (raw) meal

- A forage extender, not a grain replacer. Varies widely in nutritive value.
- By-products of red and white wine production.
- Sourced from winemakers throughout Australia.
- Whole seeds are largely indigestible.
- High in tannins, which tend to bind much of the protein.
- May contain some residual alcohol.
- Oil content: approx. 8%.
- Likely to be low in pH. May contain some residual alcohol.

Keep in mind	Management tip
Wide range of nutritive values.	Get a feed test so you know what you are feeding.
High feeding rates for extended periods without effective fibre sources may lead to animals suffering impacted stomachs.	Always feed grape marc with a palatable, good quality straw/hay.
If feeding out using a front end loader (FEL), you need to know how many kilograms per bucket, to ensure you don't under or over feed.	Weigh the FEL with and without the bucket full of grape marc, or estimate using the grape marc's bulk density (kg/litre) and your bucket's volume.
Cattle have a low tolerance for alcohol. Risk of alcohol poisoning.	Limit daily consumption of grape marc to 10% of dry matter intake.*
Prone to mould growth if exposed to the weather for extended periods, increasing the risk of mycotoxins (fungal toxins).	Store grape marc under cover, if possible. Feed within 7 days of delivery to the farm.
Potential chemical residue risk, also heavy metals.	Limit daily consumption of grape marc to 10% of dry matter intake.* Purchase grape marc with a vendor commodity declaration.

\*Maximum daily intake depends on nutrient value, age of cow and stage of lactation.

## Pelleted grape marc

Buying grape marc in pelleted form may be an option. Potential advantages over raw grape marc are:

- Higher digestibility, because grape seeds and skins are dried and hammer-milled before pelleting.
- Less prone to mould growth, given dry matter content is much higher (approx. 90%).
- Can be stored in a silo, rather than on the ground.

The table below lists typical values for some alternative fibre sources. Ranges have been included in brackets.

**Table 1** Nutrient values of some alternative fibre sources

Feed	Dry matter* (%)	Metab. energy* (MJ/kg DM)	Crude protein* (% DM)	NDF* (% DM)	Digestibility	Effective fibre value
Almond hulls (whole)	90 (88–92)	10 (8.5–10.5)	5 (4–6)	35 (30–45)	Medium	Medium
Almond hulls (milled)	90 (88–92)	10 (8.5–10.5)	5 (4–6)	35 (30–45)	Medium	Low
Barley straw	89 (74–93)	6.5 (2.2–8.5)	2.8 (0.2–28.8)	77 (55–87)	Low	High
Oat straw	89 (73–93)	6.2 (4.3–10)	2.8 (0.1–11.9)	73 (55–79)	Low	High
Palm kernel meal	94 (91–96)	11.1 (9.3–12.4)	15.7 (14.8–16.3)	65 (55–74)	Medium	Low
Rice straw	85 (52–94)	6.7 (5.3–8.9)	4.0 (1.9–5)	63 (54–69)	Low	High
Wheat straw	92 (65–96)	5.1 (3.8–9.3)	2.8 (0.2–8.8)	73 (54–86)	Low	High
Sugarcane (silage)	68 (37.7–97.9)	7.5 (3.0–9.5)	4.3	61	Medium	High
Sugarcane (hay)	93 (90.8–95.7)	7.5 (3.0–9.5)	6.5 (3.2–9.8)	67 (56.9–77.3)	Medium	High
Grape marc meal (raw)	55 (19.6–93.9)	6.5 (2.3–12.1)	12.2 (5.4–18.5)	48 (20.3–60.6)	Low	Low

\*Nutrient values of feeds can be highly variable and there is no substitute for actual sampling and testing of the feed in question.

## Glossary

### Dry matter

The proportion of the feed that is not water.

### Metabolisable energy

- Decide where each feed fits in with other feeds you are offering.
- Determine how many megajoules (MJ) of ME per kilogram you need to achieve your target milk production and cow body condition.

### Crude protein

Cow requirements for CP vary according to stage of lactation and range from 16–18% in early lactation, dropping to 11–12% during the dry period.

### Neutral Detergent Fibre (NDF)

- The suggested dietary NDF level for a high-production milker diet is 28–35% of total DM. Greater than 35% will reduce dry matter intake.
- A dietary NDF level less than 28% is high risk for ruminal acidosis.

### Physically effective fibre value

This refers to the ability of a feed to stimulate chewing activity and the production of saliva. Each feed is rated high, medium or low.

#### For further information

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