CHAPTER 11
The feed value of unusual feedstuffs

During droughts, it is common to look for feed sources other than hay, silage and grains as feed prices increase. This chapter looks at the energy and protein value of some alternative feeds and issues to consider before purchase and feeding.

Key messages

- **Unusual feedstuffs can pose a higher risk of chemical residues and contaminates.**
- **Ensure a feed analysis is provided for the feed that is being considered for purchase as quality can be quite variable.**

A wide range of unusual feedstuffs can be fed to livestock safely and effectively. However, apart from them being of poor nutritional value, they can also contain chemical residues that can contaminate meat and animal products when used as livestock feed.

All supplementary feeds may contain chemical residues, but feedstuffs not normally fed to livestock pose a much greater risk as the residue transfers are unlikely to have been assessed. The same applies to imported feedstuffs, which may have high feed value to stock but an unknown chemical use history.

Agricultural chemicals used on fruit and vegetable crops are typically designed to be eliminated from the edible parts of the plant at harvesting, however some residues may still be present. In some cases they may be concentrated in the waste plant material after processing. Feeding this waste plant material to stock may cause problems.

Residue problems can also emerge because stock have the capacity to eat a greater quantity of the fruit/vegetable than humans.

Agricultural chemicals are not designed to be ingested by livestock. Unless animal residue studies have been conducted, little is known about the effect of these chemicals on stock and their persistence in animal tissue.

There is a very real possibility that the meat and animal products from stock fed unusual feedstuffs containing chemical contaminants will themselves become contaminated with the chemicals. This can have a severe impact on trade and market access as well as animal and human health.

The best policy is to not feed unusual feedstuffs to stock without first establishing the material is suitable.

Producers should ask the supplier of unusual feedstuffs to certify the material they are supplying is suitable for the purpose for which it will be used. **Ask for a by-product vendor declaration to verify this information**. This will allow you to see the full chemical-use history of the potential feed.

Tests for chemical contamination by an accredited testing laboratory may not provide a satisfactory guarantee of suitability because analytical tests typically only screen for a narrow range of chemicals. The chemical content of unusual feedstuffs may vary from batch to batch.

The composition of many feedstuffs varies widely because of differences in climate, soil conditions, maturity, variety, management and processing. The data in this chapter is a guide rather than a precise statement of nutrient composition.

Before finalising plans to feed any by-product or unusual feedstuff to livestock, it is advisable to have a sample analysed by an accredited feed analysis service. See Chapter 5 for further details.

Most by-products and unusual feedstuffs should be used with caution and introduced into rations gradually, even when low prices favour their use. Factors to consider about unusual feedstuffs are their nutritive value, palatability, possible toxicity or contamination with pesticides or heavy metals, and the effects upon digestion and utilisation of the total ration. The use of by-product stockfeed needs to be declared when completing National Vendor Declaration (NVD) forms.

SAFEMEAT, a partnership between the red meat and livestock industries and Commonwealth and State Governments has conducted risk assessments on the use of unusual feedstuffs. Producers can obtain copies of these risk assessments from the SAFEMEAT website at safemeat.com.au/key-issues/chemical-residues.htm

High moisture content feeds

Stock can eat up to 3.5% of their liveweight per day when the feed is in a dry form, such as hay or grain, but they cannot eat as much dry matter if the feed has a high moisture content.

Fresh, high-moisture feeds are often quite palatable to livestock but most such feeds will ferment and sour quickly unless they are dried or ensiled.

Blending and levels of feeding

It is important that any new feedstuff is gradually introduced to livestock over a period of about two weeks.

As a rule of thumb, most unusual feedstuffs can be effectively incorporated into the rations of livestock to a maximum of about 30% of the total ration without any significant influence on the health of livestock.

Types of feeds

Stock feed is usually categorised as either concentrates (high in energy) or roughage (higher in fibre but lower in energy).

Concentrates can be high in either energy or protein content. Protein concentrates generally contain more than 20% crude protein.

By-product energy concentrates

Almond hulls

Almond hull products vary considerably due to varietal differences and harvesting procedures. Soft almond hulls have about 85% of the energy value of barley grain. Some supplies of almond hulls are contaminated with sticks, dirt, hard shells and other foreign materials at harvest time. This greatly reduces their feeding value and acceptability by livestock.

Almond hulls can be used as a partial roughage replacement when roughage supplies are short and forage prices are high.

When mixed with other ingredients in commercial concentrate mixes, almond hulls usually are restricted to 20% or less in order to maintain high nutrient levels and palatability of the concentrate mix. In complete feedlot rations, almond hulls are limited to about 30% or less.

Apple pomace

Apple pomace is the by-product of apples used for cider or vinegar production. It can be fed fresh, ensiled or dried.

Two problems have hampered feeding of apple pomace in recent years. Pesticide contamination has been a problem in some areas, making the pomace unacceptable in dairy and (occasionally) sheep and beef rations. A second difficulty is that urea or other non-protein nitrogen compounds should not be fed with apple pomace because of the possibility of abortions and/or abnormalities of offspring. The reason for this is unknown.

Apple pomace is a highly palatable feed, medium in energy but very low in protein. When properly supplemented, it can replace up to about one-third of the concentrates in rations and 15-20% in complete feedlot rations.

Bakery waste

Large amounts of unsold bread, doughnuts, cakes and other pastries are available in some areas and are excellent energy sources for ruminant rations. Bakery waste may contain meat or other animal protein and should be used with caution and in accordance with ruminant feed ban legislation. The feeding of any meat product to ruminants (including cattle and sheep) is prohibited in Australia

Bakery waste is usually high in fat and low in crude fibre. Protein levels (on a dry-matter basis) of 10-12% are typical. The low fibre content of the baked material and the baking process itself result in a feed that tends to stimulate ruminal propionate and reduce ruminal acetate production. This is desirable for feedlot livestock being fattened for market.

Up to about 10% can be included in feedlot rations when supplies and economics are favourable.

Supplies should be used quickly while still fresh.

Brewer's grains

Brewer's grains have 20-25% crude protein (on a dry matter basis), making them a good protein source in addition to their energy value.

The brewing process makes this protein less soluble than many protein supplements. This could be valuable in rations, such as silage supplement with non-protein nitrogen that contain large amounts of soluble protein.

Brewer's grains are fed both wet and dried.

In the dry form they have about 80% of the energy value of barley grain (the energy value varies depending on the brewery and additives used in the brewing process). They are not as palatable in the dried form as the original grain and are usually included as 25% or less of a dairy concentrate mix and 1-20% in feedlot rations.

Citrus pulp

Citrus pulp is classified as a concentrate but is also valuable as a partial roughage replacement because of its high level of digestible fibre.

It commonly contains about 15% crude fibre in the dry matter. Its energy value is about 94% of the value of barley grain. It has only about 7% crude protein in the dry matter.

Citrus pulp is usually fed dehydrated. It must be introduced gradually into a ration to let stock get accustomed to its distinctive smell and taste.

Levels of up to 15-20% are acceptable in feedlot rations.

Citrus pulp can also be fed fresh or as silage. Both are very acceptable to stock but pulp and peels from lemons are somewhat more acceptable than those from oranges and grapefruit. Transportation costs preclude the wet pulp being fed very far from processing plants.

Citrus pulp is high in calcium and low in phosphorus, and can aggravate the high calcium-to-phosphorus ratio in a ration when fed with legumes such as lucerne. Unless counter- balanced by other feeds low in calcium and high in phosphorus, citrus pulp can result in higher incidences of milk fever in cattle at, or soon after, parturition.

Fat

Fats and oils have energy values of about 2¼ times that of carbohydrates. Fats are also used to settle the dust and as a lubricant for feed processing. Levels of 2-5% fat are acceptable in commercial feedlot rations. Care must be taken, however, to ensure the fats and oils are not contaminated with extraneous chemicals during collection, storage and use. Tallow and used cooking oil may only be used in accordance with Ruminant Feed Ban Regulations.

Grain screenings

Grain screenings result from the cleaning of small grains before they are milled for human consumption. The best grade of screenings consists primarily of broken and shrunken kernels of grain, wild oats and other palatable weed seeds. When ground, good screenings approach grain in feeding value and have been used as 25% or more of concentrate mixed and 15-20% in feed rations.

Light, chaffy screenings are much higher in fibre and resemble straw more than grain in feeding value. Such screenings should be restricted to 10%.

Grape pomace or marc

Grape pomace or marc is the refuse in the production of grape juice and wine. It consists mainly of some combination of grape seeds, stems and skins. It has little feeding value, being very variable in both energy and protein and highly variable in dry matter.

When included in a concentrate mix, it can be considered only as a filler to reduce the price of the mix. With new harvesting and winery techniques, grape pomace containing few or no stems can be produced. This waste feed has been fed successfully at up to 15-20% of complete feedlot rations.

Grape marc has been found to be extremely palatable to sheep and lambs in pen trials where they consumed 350 g/head/day when fed with straw. This diet was effective in reducing weight loss only.

Studies have found partitioning of oil-soluble chemicals in grape seeds at violative levels, which would readily transfer to animal fat upon ingestion.

There are also concerns about residual levels of copper, which can be toxic to stock, from fungicides used on grapes.

Onions

Onions have been fed successfully to cattle and sheep and they eat them readily. They can, however, cause anaemia in sheep so introducing onions over a period of time is recommended and only up to 50% of the total ration.

Rice bran

Rice bran results from the processing of rice grain for human consumption. Besides the bran itself, it contains the germ from the grain and fragments of the hull not removed in milling.

Levels of up to 15% have been fed successfully to livestock. At these levels, it is roughly equivalent to wheat bran in nutritional value.

Wheat bran and other wheat by-products

Wheat bran consists of the coarse outer coatings of wheat kernels. It is a bulky feed that is relatively high in protein and phosphorus. It is highly palatable to livestock and is utilised efficiently when up to 25% is included in the concentrate mix. From 10% to 20% of wheat bran and other wheat by-products can be used in feedlot diets. The bulky nature of wheat bran and its high phosphorus content make it a popular by-product feed for livestock.

Whey

Whey is the residue from cheese production and consists primarily of lactose, minerals and water. It can be fed dry or liquid. Pollution control regulations and the high cost of drying have resulted in increasing amounts being used as feed liquid in recent years.

Dried whey is a major component of many dry milk replacers fed to calves. It is usually too expensive to be included in rations for older animals but it is sometimes included at low levels in pelleted feeds because of its binding characteristics as well as its nutrients.

Liquid whey contains only 6-7% solids and must be fed quickly or it will spoil. In cool climates it can be stored for 3-4 days before feeding. In warm climates it should be fed the same day it is delivered.

Liquid whey is frequently available for only the hauling costs, making it an inexpensive source of nutrients for animals near cheese plants. Supplies are often variable, however, and storage of whey attracts fly problems.

Tomato pomace

The feeding value of tomato pomace on a dry basis is comparable to good-quality hay.

Variability (especially moisture content) is one of the main problems associated with the use of this by-product feed. In one study, dry matter varied from a high of 27.5% to a low of 11.9%. Pesticide contamination can also be a problem with tomato pomace.

By-product protein concentrates

Many crops grown for oil production also produce by-products high in protein. These by-products are the primary source of supplemental protein in livestock rations.

They include coconut meal, corn gluten meal, cottonseed meal, linseed meal, safflower meal, soybean meal and sunflower meal. Some of these have high fat levels and should therefore not be fed as the whole diet.

Additionally, such by-products as distiller's grains are used extensively as protein supplements in livestock rations. Brewer's grains, previously discussed as an energy feed, are also relatively high in protein content.

Coconut meal/copra

Coconut meal, popularly known as copra, is one of the most palatable feeds available for livestock. It is high in energy and contains about 20% protein. Rancidity can be a problem during storage if the meal is high in fat but high-fat copra contains considerably more energy than copra produced by the solvent process.

Cottonseed meal

Cottonseed meal is a by-product of the production of cotton lint and cottonseed oil. It contains about 40% protein and is well liked by livestock. The amount of oil left in the meal will affect its energy value (amounts vary according to the method of processing). Energy levels are somewhat lower than those found in some other protein supplements, such as coconut meal, soybean meal and linseed meal.

Linseed meal

Linseed meal, the by-product of the extraction of linseed oil from flaxseed, is an excellent protein supplement for livestock. Protein content varies from about 30% to 38%, depending on the source of processing method. When reasonably priced, it can be used as the only protein supplement in livestock rations because it is very palatable.

Poultry litter and manure

Poultry waste (litter and/or manure) has been included in the diets of sheep and cattle in previous droughts but is now prohibited under the Ruminant Feed Ban.

Rendered products

The Ruminant Feed Ban also bans rendered products such as blood meal, meat meal, meat and bone meal, fish meal, poultry meal, feather meal, and compounded feeds made from these products.

Safflower meal

Safflower meal has increased in availability and importance as a protein supplement in recent years because of the popularity of safflower oil in human diets. Safflower meal from unhulled seeds, has about 20% protein, is high in fibre and relatively low in energy. Meal made from well-hulled seeds has about 40% protein and is much higher in energy.

Safflower meal from either source, however, is not as palatable to livestock as the more common protein supplements and is usually restricted to 20% or less of concentrate mix.

Soybean meal

Soybean meal contains 40-50% protein, is high in energy and is highly palatable to livestock.

Sunflower meal

Protein levels vary from 20% to 25%, depending on the processing method and whether the seed is hulled or not. It is roughly equivalent to cottonseed meal as a protein supplement for livestock.

By-product roughage

Canola hay and silage

Canola hay and silage are likely to be available as a fodder source in droughts where frost damage has occurred. In this situation, it is likely that lengthy agricultural chemical withholding periods will apply, up to 15 weeks in some situations (e.g. pre-emergent uses). Vendor declarations must be sought from feed suppliers in these situations to manage the risks.

Both hay and silage can be of good quality but this can vary and there are some livestock considerations.

Table 11.1 is a summary of results in Victoria on canola hay and silage samples analysed during 2006-2007.

Canola hay that has not been aggressively conditioned may have sharp stalk ends and these can pose a problem by piercing an animal's rumen. There have been reported instances of nitrate poisoning from canola products. It is recommended that canola hay or silage is introduced slowly and not fed as a sole ration or to starving animals.

Table 11.1: Mean and range of canola hay and silage samples from the 2006-2007 season (Source – FEEDTEST® 1 Aug 2006 – 10 Jan 2007).

Description	Crude Protein (CP) (%)	Dry Matter Digestibility (DMD) (%)	Metabolisable Energy (ME) (MJ ME/kgDM)	Neutral Detergent Fibre (NDF) (%)
Hay, canola	16.2	67.1	9.9	40.6
(508 samples)	(4.0–27.2)	(33.0–85.3)	(4.1–13.1)	(25.4–66.9)
Silage, canola	17.6	66.3	10.1	41.5
(141 samples)	(9.7–26.3)	(45.6–81.7)	(7.3–12.4)	(25.6–57.4)

More recent season averages can be sourced from: www.feedtest.com.au

Rice hay

Rice hay is generally a good palatable roughage of equivalent feed value to cereal hays. Rice hay, however, is known to contain significant levels of silica and oxalate, both of which may cause problems to livestock. High dietary silica levels can predispose animals, especially steers, to urinary calculi.

If rice hay is fed as the roughage in a hay and grain diet, it is suggested that 1.5% limestone and 0.5% salt is fed to correct the calcium: phosphorus balance in the ration. Rice hay can contain a range of weeds such as umbrella sedge, barnyard grass, starfruit and wild millet.

Rice hulls

Rice hulls have practically no feed value but can be useful as bedding material for livestock. They are very high in crude fibre and silica and the fibre is largely indigestible. Up to 15% of unground rice hulls can be included as a roughage source in drought rations being fed to livestock.

Sawdust

Sawdust has virtually no feed value for sheep or cattle because of its high level of lignification. It has been shown to be useful, however, when feeding high concentrate diets to sheep or cattle during droughts. Sheep survival rates in drought have been shown to be better when 15-20% sawdust (hoop pine and spotted gum) was included in the wheat rations.

Sawdust has also been successfully used as a diluent for adapting cattle to a concentrated diet. The inclusion of 5-15% sawdust in maize-based diets for cattle was found to maintain better rumen function, as evidenced by fewer cases of bloat and liver lesions and less ruminal parakeratosis.

Coarse sawdust was better than fine sawdust in maintaining rumen function.

Sawdust from treated timber should not be used.

Seaweed

Kelp represents the most common type of seaweed that might be available for feeding. The dry matter of kelp contains about 30% minerals (compared to 5-6% in hay, pasture, etc). Kelp contains 0.15-0.2% iodine. Seaweed is sometimes used as a mineral source for livestock.

Kelp can be fed quite satisfactorily at up to about 25% of the diet of livestock. The composition of dried kelp is dry matter 91%, crude protein 6%, minerals (ash content) 30%. ME value of kelp is about 5 MJ/kg DM.

The rich mineral content of seaweed, especially salt, can make the material quite palatable to livestock.

Waste paper

Waste paper has poor feed value and there is the risk of the paper containing contaminants such as lead, cadmium, polychlorinated biphenyls and other toxic substances. The feeding of waste paper to cattle is not recommended.

Table 11.2: Energy and protein compositions of unusual feedstuffs. (If known, ranges in feed values are given in brackets. It is likely that most of these feedstuffs will vary and values are a guide only.)

Feed	Approx. dry matter (DM) %	Metabolisable energy (ME) (MJ ME/kg DM)	Crude protein % dry matter
Acorns	70	7	5
Almond hulls, 15% CF	90	8	2
Almond hulls and shells, 20% CF	90	7	2
Apple pomace, dried	89	10	5
Apple pulp silage	21	11	8
Apples	17	10	3
Apricots, dried	90	12	6
Bakery waste, dried	92	13	11
Banana skins, dried, ground	88	9	8
Bananas	24	13	4
Bread, dried	92	13	13
Brewers dried grains	92	9	22
Brewers dried grains, 25% protein	92	10	25
Brewers grains, wet (range)	28 (14-61)	11 (8-14)	22 (10-29)
Broccoli	11	10	33
Brussel sprouts	15	11	33
Buckwheat	87	11	12
Cabbage	9	13	25
Cabbage leaves	15	10	14
Canola meal (range)	91	12 (10-16)	38 (27-42)
Carrot pulp (range)	10 (8-16)	13 (9-14)	10 (6-15)
Carrots	13	12	10
Cauliflower	9	10	30
Citrus pulp (range)	14 (11-17)	13 (10-15)	9 (6-12)
Copra (coconut) meal	90	11	21
Corn cobs, ground	90	7	3
Cottonseed meal, 41% protein mech-extd	93	3	44
Cottonseed meal, 41% protein, solv-extd	91	11	46
Cottonseed, whole	92	14	23
Grape marc or pomace (range)	55 (20-94)	6 (2-12)	12 (5-17)
Grape/pear/apple pomace, dried	92	6	7
Grapefruit	14	13	8

Table 11.2: Energy and protein compositions of unusual feedstuffs. (continued)

Feed	Approx. dry matter (DM) %	Metabolisable energy (ME) (MJ ME/kg DM)	Crude protein % dry matter
Kelp, dried	91	5	7
Lemon pulp, dried	93	12	7
Lettuce	5	8	22
Linseed meal, 36% protein, solv-extd	90	12	38
Linseed meal, 37% protein, mech-extd	91	12	38
Melons	4	11	11
Milk, cattle, skim, dried	94	13	36
Milk, cattle, whole, dried	94	15	27
Milk, colostrum	25	15	46
Molasses, cane	75	11	6
Oat hulls	93	5	4
Oat straw	92	7	4
Oats, sprouted 5 days	13	10	18
Onions	11	13	10
Orange pulp, dried	88	12	8
Orange pulp, wet	25	12	9
Oranges	13	12	7
Palm kernel meal	88	11	17
Pea hay	88	9	14
Peaches	10	12	9
Peanut meal, mech-extd	93	12	52
Peanut meal, solv-extd	92	12	52
Peanut skins	94	10	17
Pears	17	13	6
Pineapples	15	12	3
Potato meal, dried	91	12	11
Potatoes	23	12	9
Pumpkins	9	13	16
Raisin pulp, dried	89	8	11
Raisins, cull	85	7	4
Rice bran	90	14 (9-15)	16 (13-20)
Soyabean meal	85 (12-94)	15 (13-16)	44 (30-54)
Sunflower meal	91	10 (8-14)	34 (20-39)
Whey	8 (2-27)	14 (12-14)	30 (20-40)

It is important to assess the risk of these feedstuffs and take appropriate precautions to ensure the quality and integrity of the meat or other end product is not jeopardised.