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Some information is extracted from The FEEDS Directory 2nd Edition www.feedsdirectory.co.uk
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Any enquiries regarding this document should be sent to: EBLEX Division, AHDB, Stoneleigh Park, Kenilworth, Warwickshire CV8 2TL.
This guide covers a range of feeds (excluding forages) that are suitable for inclusion in beef and sheep rations. It is not a comprehensive list of all feeds available, but provides a summary of the more common ones.

Feed is a vitally important input to livestock production systems. Not only does it make up the majority of variable costs but it contributes to determining how well animals perform and the profitability of the system. Choosing the right feed will depend on the nutritional requirements of the animals, the facilities available on farm and feed price. Getting better returns from feed relies on providing a well-balanced ration that meets the nutritional needs of the stock. It is dependent on making the right choices about feed purchasing, storage and targeted rationing.

This guide will help farmers to make decisions about the most appropriate feed for different systems, highlighting some of the issues that need to be considered. It includes useful, practical information about storage requirements, palatability, inclusion rates and nutrient composition of feeds suitable for inclusion in rations.
Getting the most out of alternative feeds

As well as the traditional feeds included in beef and sheep rations there is an increasing range of ‘alternative feeds’ available and worth considering. The term ‘alternative feeds’ encompasses a huge range of different dry, moist and liquid feeds and blends that tend to be derived from human food and drink manufacturing processes and now biofuel production. These feeds can offer farmers the opportunity to purchase cost-effective feed products for their livestock that will enable high levels of performance to be achieved when included as part of a properly balanced ration. However it is important that a number of factors are taken into consideration:

Part of a balanced ration

Alternative feeds rarely provide a complete feeding solution for beef cattle or sheep and therefore often rely on good quality home grown feeds to provide a well-balanced ration. Alternative feeds can vary in terms of physical form and nutritional analysis depending upon their source. It is advisable to seek the advice of a professional nutritionist when feeding these products.

Dry, moist or liquid feeds

Alternative feeds are generally categorised by their physical form – dry, moist or liquid. Dry feeds tend to be in either a pellet or meal form, with specific handling and storage characteristics depending on their origin. Moist and liquid feeds, as their name suggests, have a lower dry matter content, which means that good storage facilities are required to minimise waste. Blended feeds are also available which incorporate a range of different alternative feeds into a pellet or meal blend. Always ask for the list of ingredients and composition to be sure you know what you are getting.

Storage and minimising waste

Dry feeds have the most flexible storage options with bins, hoppers, floor or trailer, all being suitable.

For longer-term storage of moist feeds, ensiling is required. Clean side and top sheets are recommended, held down by material such as bales that ensure all the sheet is in contact with the feed. Moist feed can be capped with potato slurry or citrus wet press, which will also ward off some vermin. Alternatively, moist feeds may be clamped with forages or mixed with dry feeds for storage as a complete feed, eg grain-beet is a mixture of brewers grains and molassed sugar beet feed. All liquid feeds require storage in either tanks or drums. Poor storage can cause disease problems.

Cost effectiveness

Regardless of feed type, price will be reduced by being able to order and handle large loads. There may also be opportunities to make savings through forward buying, based on a judgement made about price fluctuations throughout the year.

Farm assurance

Most farm assurance schemes stipulate that animals sold as farm assured must have been fed purchased feeds supplied by certified feed companies. Check the details of your own assurance scheme for specific details of feed source assurance specifications.
Formulating diets

Diets should be formulated with the right balance of protein, energy and fibre to ensure sufficient feed utilisation. The majority of the fibre in ruminant diets is provided as forage which is important for optimising rumen function and stability. In all diets, ensure the animals are fed a balanced ration tailored to the breed, type, sex and stage of production.

Using the information in this guide

Information is presented about nutritional and utilisation characteristics of common feed, but these are by no means the only feeds that can or should be fed.

Category
Breaks the feeds down into groups. Ideally the ration would contain feeds from a couple of different categories, although this is not essential, and would depend on the basal forage.

Nutritional notes
Provides key nutritional information about the feed, highlighting any potential problems.

Palatability
Indicates how readily animals will eat the feed.

Upper inclusion rate
A suggested upper limit for inclusion of the feed in a concentrate ration on a dry matter basis. Exceeding this limit may cause rumen instability and potential acidosis problems.

Storage/processing
An indication of whether a feed needs further processing before feeding. This will affect the overall feed cost, and also storage requirements if processing is carried out on-farm.

Bulk density
A guide to how much space will be required for storage per tonne of freshweight.

Typical analysis
A summary of the average key nutrient composition of feeds. This should be used as a guide only to inform decision-making. A declaration of feed analysis should be sought at purchase to ensure correct diet formulation.
**Cereals**

**Barley**
Cereal grain

**Appearance**

Nutritional notes
High in energy, high in starch, low in fibre, low in protein. Should be fed little and often to avoid acidosis, particularly when processed into small particles. When moist, supplementation with vitamin E and selenium is essential.

**Palatability**
Upper inclusion rate (DM)
Good Beef 80% Sheep 80%

**Processing**
Range of options: dry, moist, whole, rolled and crimped. Dry matters may vary depending on the processing system used. Whole grains are safer for sheep.

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th></th>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>86.0</td>
<td>13.2</td>
<td>12.1</td>
<td>21.1</td>
<td>3.0</td>
<td>59.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

**Bulk density**
Whole 650kg/m³
Rolled 370kg/m³
Crimped 900kg/m³

**Wheat**
Cereal grain

**Appearance**

Nutritional notes
Very high in energy, very high in starch, very low in fibre, low in protein. Must be supplemented with digestible fibre and fed little and often to avoid acidosis, particularly when processed into small particles. When moist, supplementation with vitamin E and selenium is essential.

**Palatability**
Upper inclusion rate (DM)
Good Beef 50% Sheep 50%

**Processing**
Range of options: dry, moist, whole, rolled and crimped. Dry matters may vary depending on the processing system used. For sheep it should be fed whole.

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th></th>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>86.0</td>
<td>13.8</td>
<td>12.8</td>
<td>14.0</td>
<td>2.0</td>
<td>69.0</td>
<td>3.5</td>
</tr>
</tbody>
</table>

**Bulk density**
Whole 730kg/m³
Rolled 420kg/m³
Crimped 950kg/m³
**Triticale**

Cereal grain

**Appearance**

High in energy, high in starch, low in fibre, low in protein. As with all cereals it should be fed little and often to avoid acidosis (particularly when ground into a meal). When moist, supplementation with Vitamin E is essential.

**Nutritional notes**

<table>
<thead>
<tr>
<th>Palatability</th>
<th>Upper inclusion rate (DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>Beef 50%</td>
</tr>
<tr>
<td></td>
<td>Sheep 50%</td>
</tr>
</tbody>
</table>

**Processing**

Range of options: dry, moist, whole, rolled and crimped. Dry matters may vary depending on the processing system used.

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th></th>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>86.0</td>
<td>13.4</td>
<td>12.0</td>
<td>13.2</td>
<td>1.9</td>
<td>66.5</td>
<td>4.0</td>
</tr>
</tbody>
</table>

**Bulk density**

Whole 720kg/m³
Rolled 410kg/m³
Crimped 950kg/m³

---

**Maize**

Cereal grain

**Appearance**

Very high in energy, very high in starch, very low in fibre, very low in protein. A percentage of starch in maize passes through the rumen into the hind gut and is digested down the digestive tract, which complements very well in a mixed cereal diet. Very low in minerals.

**Nutritional notes**

<table>
<thead>
<tr>
<th>Palatability</th>
<th>Upper inclusion rate (DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>Beef 40%</td>
</tr>
<tr>
<td></td>
<td>Sheep 20%</td>
</tr>
</tbody>
</table>

**Processing**

Range of options: dry, moist, whole, rolled and crimped. Dry matters may vary depending on the processing system used.

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th></th>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>86.0</td>
<td>14.3</td>
<td>8.5</td>
<td>12.1</td>
<td>4.3</td>
<td>71.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

**Bulk density**

Whole 750kg/m³
Crimped 1000kg/m³
If you are using your own or are purchasing grain, be aware low bushel weights can reduce feed level. Disease issues can occur. Grain affected by fusarium or ergot must not be fed, as the mycotoxins produced can seriously affect animals, eg poor production, abortion, kidney failure and even death.

Storage and feeding of roots

Where farm grown roots are a permanent feature, a suitable insulated, air cooled, humidity controlled store could be constructed to avoid losses. Otherwise roots need to be purchased fresh as required, particularly if they are pre-washed as that will reduce their keeping quality. Washed carrots can deteriorate quickly in freezing conditions, and will wilt and shrink rapidly in warm hot conditions. Fodder beet, sugar beet, swedes and parsnips can be stored for several months outdoors in straw bale clamps with moderate losses, but are better in cool, dry, aerobic conditions, for example under a roof in an airy building, not sheeted.

If potatoes are to be kept long term, they are best kept unwashed in cool, dark conditions such as outdoor clamps covered with straw and soil.

In anaerobic conditions, washed roots can be mixed with clamped silage or brewers grains, (minimum two parts brewers grains to one part roots). They can also be chopped and clamped with a range of other absorbent feeds, eg sugar beet pulp, malt pellets, wheat feed, soya hulls, dried citrus pulp etc, and/or forages, all on a four parts washed roots to one part absorbent material. Make sure there is no soil contamination.

### Cereals/Roots

#### Oats

Cereal grain

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Nutritional notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Moderate in energy, moderate in starch, high in fibre, low in protein. A very safe feed, lower in energy than other cereals making it less suitable for rapid growth rates in finishing rations, but with good levels of unsaturated fat they can produce good carcase composition.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Palatability</th>
<th>Upper inclusion rate (DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>Beef 80%</td>
</tr>
<tr>
<td></td>
<td>Sheep 80%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range of options: dry, moist, whole, rolled and crimped. Can be fed whole to calves up to eight months old, where as all other cereals need processing for calves.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Typical analysis (% DM or MJ/kg DM for ME)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
</tr>
<tr>
<td>86.0</td>
</tr>
</tbody>
</table>

If you are using your own or are purchasing grain, be aware low bushel weights can reduce feed level. Disease issues can occur. Grain affected by fusarium or ergot must not be fed, as the mycotoxins produced can seriously affect animals, eg poor production, abortion, kidney failure and even death.

### Storage and feeding of roots

Where farm grown roots are a permanent feature, a suitable insulated, air cooled, humidity controlled store could be constructed to avoid losses. Otherwise roots need to be purchased fresh as required, particularly if they are pre-washed as that will reduce their keeping quality. Washed carrots can deteriorate quickly in freezing conditions, and will wilt and shrink rapidly in warm hot conditions. Fodder beet, sugar beet, swedes and parsnips can be stored for several months outdoors in straw bale clamps with moderate losses, but are better in cool, dry, aerobic conditions, for example under a roof in an airy building, not sheeted.

If potatoes are to be kept long term, they are best kept unwashed in cool, dark conditions such as outdoor clamps covered with straw and soil.

In anaerobic conditions, washed roots can be mixed with clamped silage or brewers grains, (minimum two parts brewers grains to one part roots). They can also be chopped and clamped with a range of other absorbent feeds, eg sugar beet pulp, malt pellets, wheat feed, soya hulls, dried citrus pulp etc, and/or forages, all on a four parts washed roots to one part absorbent material. Make sure there is no soil contamination.
**Roots**

**Potatoes**

**Vegetable**

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Nutritional notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High in energy, high in starch, low in fibre, low in protein. Soil contamination can be a problem and sprouted, green or rotten potatoes should not be fed. It takes 4.5–5kg of potatoes to replace 1kg of barley.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Palatability</th>
<th>Upper inclusion rate (DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very good</td>
<td>Beef 40%</td>
</tr>
<tr>
<td></td>
<td>Sheep 40%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chopping essential for cattle to avoid choking. Sheep need good teeth.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Typical analysis (% DM or MJ/kg DM for ME)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
</tr>
<tr>
<td>----</td>
</tr>
<tr>
<td>20.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bulk density</th>
</tr>
</thead>
<tbody>
<tr>
<td>645kg/m³</td>
</tr>
</tbody>
</table>

**Fodder Beet**

**Vegetable**

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Nutritional notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High in energy with moderate sugar and good fibre levels, but fairly low in protein. Can replace rolled barley on a 5:1 dry matter ratio (5kg of fodder beet to 1kg barley). The tops can be fed but should be wilted first, and as with all roots avoid soil contamination as much as possible. Can be grazed in situ by sheep.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Palatability</th>
<th>Upper inclusion rate (DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very good</td>
<td>Beef 70%</td>
</tr>
<tr>
<td></td>
<td>Sheep 70%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole or chopped.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Typical analysis (% DM or MJ/kg DM for ME)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
</tr>
<tr>
<td>----</td>
</tr>
<tr>
<td>18.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bulk density</th>
</tr>
</thead>
<tbody>
<tr>
<td>540kg/m³</td>
</tr>
</tbody>
</table>
### Sugar Beet

**Appearance**

High in energy and sugar and good fibre levels, but fairly low in protein. Can replace rolled barley on a 4.5:1 on a dry matter ratio (4.5kg of fodder beet to 1kg barley). Can be very hard so can be difficult for some stock to eat. The tops can be fed but should be wilted first, and as with all roots, avoid soil contamination as much as possible.

<table>
<thead>
<tr>
<th>Palatability</th>
<th>Upper inclusion rate (DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very good</td>
<td>Beef 70%</td>
</tr>
<tr>
<td></td>
<td>Sheep 70%</td>
</tr>
</tbody>
</table>

**Processing**

Whole or chopped.

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th></th>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>23.0</td>
<td>12.3</td>
<td>6.0</td>
<td>13.6</td>
<td>0.4</td>
<td>3.0</td>
<td>69.0</td>
</tr>
</tbody>
</table>

### Swedes

**Appearance**

High in energy, high in sugar, moderate in fibre, very low in protein. Very high in energy but low in dry matter. It takes roughly 7kg of swedes to replace 1kg of barley due to their low dry matter, (10–12% DM) but they can also be used as a forage replacer. Can be grazed in situ by sheep.

<table>
<thead>
<tr>
<th>Palatability</th>
<th>Upper inclusion rate (DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Good</td>
<td>Beef 60%</td>
</tr>
<tr>
<td></td>
<td>Sheep 90%</td>
</tr>
</tbody>
</table>

**Processing**

Whole or chopped (chopping can reduce risk of choking).

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th></th>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10.5</td>
<td>13.8</td>
<td>9.4</td>
<td>14.5</td>
<td>0.5</td>
<td>1.0</td>
<td>59.1</td>
</tr>
</tbody>
</table>
**Parsnips**

**Vegetable**

**Appearance**

High in energy, low in sugar, high in fibre, very low in protein. Soil contamination is not generally a problem with parsnips. It takes roughly 5kg of parsnips to replace 1kg of barley on a dry matter basis.

**Nutritional notes**

<table>
<thead>
<tr>
<th>Palatability</th>
<th>Upper inclusion rate (DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very good</td>
<td>Beef 50%</td>
</tr>
<tr>
<td></td>
<td>Sheep 50%</td>
</tr>
</tbody>
</table>

**Processing**

Chopped (chopping can reduce risk of choking).

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th></th>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15.0</td>
<td>13.0</td>
<td>8.6</td>
<td>14.5</td>
<td>1.9</td>
<td>3.0</td>
<td>8.5</td>
</tr>
</tbody>
</table>

**Bulk density**

630kg/m³

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**Carrots**

**Vegetable**

**Appearance**

High in energy, moderate in sugar, high in fibre, very low in protein. Lower in energy than other roots, with a low dry matter content similar to swedes. Once washed they do not keep for more than a few days. Not to be fed to finishing cattle within the last 100 days before slaughter as it may change the colour of fat due to the high level of carotene.

**Nutritional notes**

<table>
<thead>
<tr>
<th>Palatability</th>
<th>Upper inclusion rate (DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very good</td>
<td>Beef 45%</td>
</tr>
<tr>
<td></td>
<td>Sheep 25%</td>
</tr>
</tbody>
</table>

**Storage/processing**

Whole or chopped, (chopping can reduce risk of choking, especially in youngstock), but they do not store well for long periods, particularly in freezing or very hot conditions.

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th></th>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>13.0</td>
<td>12.6</td>
<td>9.5</td>
<td>10.5</td>
<td>1.5</td>
<td>10.2</td>
<td>30.0</td>
</tr>
</tbody>
</table>

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**ROOTS**

**Better Returns Programme**
Home-grown protein options

High protein feeds generally make up a small proportion of livestock rations but can still represent a major cost. Home-grown options include bi-crop forages with peas, beans, lupins, or combinable peas, beans and lupins (dried stored or crimped), along with high clover content grass swards, hybrid grasses and lucerne.

Blue lupins are slightly lower in protein than other types; for combining they are better suited to the north and west where harvest is late. White lupins are better suited for combining in the south and can be used for foraging and/or mixed with other crops such as triticale. Yellow lupins suit slightly later areas for combining.

Field beans come in autumn and early spring sown varieties. The spring sown varieties are generally higher quality but can have a very late harvest particularly in the north and frequently require desiccating off before combining. Peas have an earlier harvest but can be difficult to combine.

Peas

Pulse

Appearance

Nutritional notes
High in protein, moderate in starch, low in fibre. Modern varieties contain less anti-nutritional factors than older ones.

<table>
<thead>
<tr>
<th>Palatability</th>
<th>Upper inclusion rate (DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>Beef 50%</td>
</tr>
<tr>
<td></td>
<td>Sheep 50%</td>
</tr>
</tbody>
</table>

Processing

Flaked, rolled or crimped. Can be fed whole to sheep as long as they are not too dry.

Typical analysis (% DM or MJ/kg DM for ME)

<table>
<thead>
<tr>
<th></th>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>86.0</td>
<td>12.8</td>
<td>24.0</td>
<td>19.0</td>
<td>2.0</td>
<td>47.0</td>
<td>6.0</td>
</tr>
</tbody>
</table>
Beans

Appearance
High in protein, moderate in starch, low in fibre. Higher in energy than peas.

Nutritional notes
- Upper inclusion rate (DM)
  - Variable

Palatability
- Beef 30%
- Sheep 30%

Processing
Whole, flaked, rolled, ground or crimped. Can be fed whole to sheep as long as they are not too dry.

Typical analysis (% DM or MJ/kg DM for ME)

<table>
<thead>
<tr>
<th></th>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>86.0</td>
<td>13.8</td>
<td>29.0</td>
<td>17.0</td>
<td>2.0</td>
<td>43.0</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Lupins

Appearance
High in undegradable protein, moderate in starch, low in fibre. Can be used to replace soya bean meal. Blue lupins are lowest in protein and more suited to the north/west of the country where harvest is late. White lupins can be used for silage making mixed with crops such as triticale.

Nutritional notes
- Upper inclusion rate (DM)
  - Good in modern varieties

Palatability
- Beef 30%
- Sheep 30%

Processing
Flaked, rolled, ground or crimped. Can be fed whole to sheep as long as they are not too dry.

Typical analysis (% DM or MJ/kg DM for ME)

<table>
<thead>
<tr>
<th></th>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
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<tbody>
<tr>
<td></td>
<td>86.0</td>
<td>14.3</td>
<td>38.0</td>
<td>23.0</td>
<td>6.2</td>
<td>9.0</td>
<td>4.0</td>
</tr>
</tbody>
</table>
Barley Distillers Grains

Meal, crumb or pellet

Appearance
High in fibre, moderate in protein. Lower in energy than other distillers grains. Can contain high levels of copper which make them unsuitable for sheep. Check with suppliers.

Nutritional notes
Palatability
Good

Upper inclusion rate (DM)
Beef 30%
Sheep 30%

Processing
Ready to feed.

Typical analysis (% DM or MJ/kg DM for ME)

<table>
<thead>
<tr>
<th></th>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>89.0</td>
<td>12.7</td>
<td>26.0</td>
<td>42.0</td>
<td>9.2</td>
<td>3.2</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Wheat Distillers Grains

Meal, crumb or pellet

Appearance
Moderate in fibre, high in protein. Contain good levels of energy, being lower in oil than other distillers grains means they can be included at higher rates in diets. Can contain high levels of copper which make them unsuitable for sheep. Check with suppliers.

Nutritional notes
Palatability
Good

Upper inclusion rate (DM)
Beef 30%
Sheep 30%

Processing
Ready to feed.

Typical analysis (% DM or MJ/kg DM for ME)

<table>
<thead>
<tr>
<th></th>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>89.0</td>
<td>13.5</td>
<td>32.0</td>
<td>32.0</td>
<td>7.5</td>
<td>4.6</td>
<td>4.0</td>
</tr>
</tbody>
</table>
# Dry cereal co-products

## Maize Distillers Grains

**Meal, crumb or pellet**

### Appearance
![Maize Distillers Grains](image)

### Nutritional notes
Moderate in fibre, moderate in protein. Home produced product is very high in energy, whereas imported product is lower in energy and more variable. Can contain high levels of copper which makes them unsuitable for sheep. Check with suppliers.

### Palatability
Upper inclusion rate (DM)
- Good: Beef 30%, Sheep 30%

### Processing
Ready to feed.

### Typical analysis (% DM or MJ/kg DM for ME)
<table>
<thead>
<tr>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td>89.0</td>
<td>14.8</td>
<td>28.0</td>
<td>36.0</td>
<td>11.0</td>
<td>4.5</td>
<td>1.0</td>
</tr>
</tbody>
</table>

### Bulk density
Variable 350–600kg/m³

## Maize Gluten Feed

**Meal, crumb or pellet**

### Appearance
![Maize Gluten Feed](image)

### Nutritional notes
Moderate in fibre, moderate in protein. Can have very variable composition depending on source. Avoid if they have been overheated in drying process and have a black burnt appearance.

### Palatability
Upper inclusion rate (DM)
- Moderate: Beef 45%, Sheep 45%

### Processing
Ready to feed.

### Typical analysis (% DM or MJ/kg DM for ME)
<table>
<thead>
<tr>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td>89.0</td>
<td>12.5</td>
<td>21.7</td>
<td>40.0</td>
<td>4.0</td>
<td>21.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

### Bulk density
625kg/m³
**Wheatfeed**

Meal, crumb or pellet

**Appearance**

High in fibre, moderate in protein. Being relatively low in energy makes it unsuitable for high inclusion in finishing diets, but ideal for youngstock.

**Nutritional notes**

<table>
<thead>
<tr>
<th>Palatability</th>
<th>Upper inclusion rate (DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>Beef 50%</td>
</tr>
<tr>
<td></td>
<td>Sheep 50%</td>
</tr>
</tbody>
</table>

**Processing**

Ready to feed.

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td>89.0</td>
<td>11.5</td>
<td>17.3</td>
<td>38.0</td>
<td>4.0</td>
<td>27.5</td>
<td>7.0</td>
</tr>
</tbody>
</table>

**Bulk density**

Meal 350kg/m³

Pellets 560kg/m³

**Malt Pellets**

Meal, crumb or pellet

**Appearance**

High in fibre, moderate in protein. Being relatively low in energy makes it unsuitable for high inclusion in finishing diets, but ideal for youngstock.

**Nutritional notes**

<table>
<thead>
<tr>
<th>Palatability</th>
<th>Upper inclusion rate (DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>Beef 25%</td>
</tr>
<tr>
<td></td>
<td>Sheep 25%</td>
</tr>
</tbody>
</table>

**Processing**

Ready to feed.

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td>89.0</td>
<td>11.5</td>
<td>23.5</td>
<td>50.0</td>
<td>2.5</td>
<td>15.1</td>
<td>0.4</td>
</tr>
</tbody>
</table>

**Bulk density**

Pellets 600kg/m³
Moist Wheat Co-Product

Moist meal or crumb

**Appearance**

High in fibre, moderate in protein. High in energy and can be used as sole concentrate feed in rations containing forage. There are a number of products available, but always check the nutritional analysis and dry matter before buying.

**Nutritional notes**

- **Palatability**
  - Upper inclusion rate (DM)
  - Good: Beef 50% Sheep 50%

**Processing**

Ready to feed.

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th></th>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>47.0</td>
<td>13.4</td>
<td>22.0</td>
<td>35.0</td>
<td>7.5</td>
<td>16.5</td>
<td>2.5</td>
</tr>
</tbody>
</table>

**Brewers’ Grains**

Moist meal or crumb

**Appearance**

High in fibre, moderate in protein. Can be used as a concentrate or a forage extender. Composition and dry matter can be variable depending on source, (can vary between 23–28% dry matter). Suitable for all stock.

**Nutritional notes**

- **Palatability**
  - Upper inclusion rate (DM)
  - Good: Beef 45% Sheep 45%

**Processing**

Ready to feed.

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th></th>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>23.0</td>
<td>11.7</td>
<td>24.0</td>
<td>56.5</td>
<td>7.1</td>
<td>5.0</td>
<td>1.5</td>
</tr>
</tbody>
</table>
Pot Ale Syrup

Free flowing liquid

**Appearance**

High in protein, high in energy, low in fibre. Suitable for all stock and aids the digestion of straw and fibrous forages. Very acidic feed (low pH) therefore could further limit intake on acidic silages. It is also high in copper and potassium, so avoid feeding alongside feeds including copper in sheep diets. The high level of potassium may cause scouring if fed at abnormally high levels to cattle.

**Nutritional notes**

**Palatability**

Upper inclusion rate (DM)

Good

Beef 20%

Sheep 20%

**Storage/processing**

Can ferment so ensure containers are vented. Ready to feed.

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td>45.0</td>
<td>14.0</td>
<td>37.0</td>
<td>0.7</td>
<td>0.2</td>
<td>1.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Wheat Starch Syrup

Syrup liquid

**Appearance**

High in energy, low in fibre. Suitable for all stock and aids the digestion of straw and fibrous forages, but in general has low dry matter.

**Nutritional notes**

**Palatability**

Upper inclusion rate (DM)

Good

Beef 25%

Sheep 25%

**Storage/processing**

Refer to manufacturers for storage and feed guidelines.

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>14.2</td>
<td>30</td>
<td>1.5</td>
<td>3.5</td>
<td>11.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>
### Biscuit Blends

**Crumb or meal**

#### Appearance

High in energy, low in fibre, high in oil. Variable composition depending on source, excellent cereal replacer.

#### Nutritional notes

<table>
<thead>
<tr>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td>88.0</td>
<td>15.0</td>
<td>9.5</td>
<td>20.0</td>
<td>11.0</td>
<td>49.0</td>
<td>9.0</td>
</tr>
</tbody>
</table>

#### Palatability

Very Good

#### Upper inclusion rate (DM)

Beef 30%  Sheep 30%

#### Storage/processing

Ready to feed. Avoid storing for long periods due to high oil level.

#### Typical analysis (% DM or MJ/kg DM for ME)

<table>
<thead>
<tr>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td>88.0</td>
<td>15.0</td>
<td>9.5</td>
<td>20.0</td>
<td>11.0</td>
<td>49.0</td>
<td>9.0</td>
</tr>
</tbody>
</table>

#### Bulk density

250kg/m$^3$

---

### Bread

**Crumb or meal**

#### Appearance

High in energy, low in fibre. Avoid very high inclusion rates and supplement with digestible and structural fibre.

#### Nutritional notes

<table>
<thead>
<tr>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td>65.0</td>
<td>14.0</td>
<td>14.0</td>
<td>10.0</td>
<td>3.3</td>
<td>69.0</td>
<td>4.7</td>
</tr>
</tbody>
</table>

#### Palatability

Good

#### Upper inclusion rate (DM)

Beef 30%  Sheep 30%

#### Storage/processing

Ready to feed. Short shelf life. Ask supplier for storage advice, as can mould easily.

#### Typical analysis (% DM or MJ/kg DM for ME)

<table>
<thead>
<tr>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
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<tr>
<td>65.0</td>
<td>14.0</td>
<td>14.0</td>
<td>10.0</td>
<td>3.3</td>
<td>69.0</td>
<td>4.7</td>
</tr>
</tbody>
</table>
Breakfast Cereal Blends

Crumb or meal

**Appearance**

![Image of Breakfast Cereal Blends]

Nutritional notes

High in energy, low in fibre. Variable composition depending on source but an excellent cereal replacer.

**Palatability**

Upper inclusion rate (DM)

<table>
<thead>
<tr>
<th></th>
<th>Beef 30%</th>
<th>Sheep 30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very good</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Processing**

Ready to feed.

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th></th>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>90.0</td>
<td>14.0</td>
<td>12.0</td>
<td>11.0</td>
<td>2.0</td>
<td>52.0</td>
<td>6.0</td>
</tr>
</tbody>
</table>

Bakery/confectionery co-products

Different types of soya bean meal

Soya is predominately grown in North and South America, but is slowly becoming more popular in other parts of the world due to new varieties, plant breeding research and technology, and climatic changes. The oil is partially removed by crushing, which is known as the expeller process, with the remaining oil removed by solvent extraction.

There are three types of soya bean meal available for purchase, Hi-pro soya, Brazilian soya and Argentinean soya. Hi-pro soya is generally the most commonly available and better quality soya bean meal, with a crude protein content between 52–55%. All the types of soya are similar in appearance and available as a meal or in some instances containing some nuts/pellets depending on original source.
Hi-pro Soya Bean Meal

**Meal**

**Appearance**

High in undegradable protein. Variable composition depending on source and extraction process. It only requires a low inclusion, depending on the age and stage of production of the animals eating it. This is the best protein source for ewes in late pregnancy.

**Nutritional notes**

<table>
<thead>
<tr>
<th>Palatability</th>
<th>Upper inclusion rate (DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>Beef 20%</td>
</tr>
<tr>
<td></td>
<td>Sheep 30%</td>
</tr>
</tbody>
</table>

**Processing**

Ready to feed.

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th></th>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
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<th>Starch</th>
<th>Sugars</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>88.0</td>
<td>13.8</td>
<td>52.0</td>
<td>13.0</td>
<td>2.4</td>
<td>4.0</td>
<td>10.0</td>
</tr>
</tbody>
</table>

**Bulk density**

625kg/m³

---

Rapeseed Meal

**Meal**

**Appearance**

High in protein. Lower in energy than soya bean meal so ideal in growing rations including low protein forage.

**Nutritional notes**

<table>
<thead>
<tr>
<th>Palatability</th>
<th>Upper inclusion rate (DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>Beef 30%</td>
</tr>
<tr>
<td></td>
<td>Sheep 25%</td>
</tr>
</tbody>
</table>

**Processing**

Ready to feed.

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th></th>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>88.0</td>
<td>12.1</td>
<td>38.5</td>
<td>36.0</td>
<td>3.5</td>
<td>5</td>
<td>9.5</td>
</tr>
</tbody>
</table>

**Bulk density**

660kg/m³
**Linseed**

Meal, cake or lozenge

**Appearance**

High in undegradable protein. Similar to rapeseed meal but contains some residual oils that can increase coat shine. Picture is of linseed lozenge.

**Nutritional notes**

**Palatability**

Good

**Upper inclusion rate (DM)**

Beef 20%  Sheep 20%

**Processing**

Ready to feed.

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th>DM</th>
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<td>88.0</td>
<td>13.0</td>
<td>37.0</td>
<td>20.0</td>
<td>8.0</td>
<td>5.5</td>
<td>5.5</td>
</tr>
</tbody>
</table>

**Soya Hulls**

Pellet or meal

**Appearance**

High in fibre. Can be used to supplement cereals and cereal co-products that are low in digestible fibre.

**Nutritional notes**

**Palatability**

Moderate

**Upper inclusion rate (DM)**

Beef 30%  Sheep 15%

**Processing**

Ready to feed.

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td>89.0</td>
<td>11.9</td>
<td>12.2</td>
<td>67.5</td>
<td>2.4</td>
<td>5.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

**Bulk density**

- Linseed Meal: 600kg/m³
- Linseed Cake: 750kg/m³
- Soya Hulls: 500kg/m³
**Palm Kernel Meal**

**Meal**

**Appearance**

High in fibre. Can be used to supplement cereals and cereal co-products that are low in fibre.

**Nutritional notes**

<table>
<thead>
<tr>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
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<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td>89.0</td>
<td>12.3</td>
<td>18.0</td>
<td>68.0</td>
<td>9.0</td>
<td>4.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

**Palatability**

Upper inclusion rate (DM)

Poor

Beef 30%

Sheep 10%

**Processing**

Ready to feed.

**Typical analysis (% DM or MJ/kg DM for ME)**

**Bulk density**

415kg/m³

**Sunflower Meal**

**Pellets with meal**

**Appearance**

Low in energy, high in protein, high in fibre. It has a role in growing rations as a low quality protein or at very low inclusion rates for finishers. Sometimes available in a Hi-pro version with hulls removed, containing 11.5 MJ ME and 45% crude protein, but the protein is still very degradable.

**Nutritional notes**

<table>
<thead>
<tr>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td>88.0</td>
<td>9.5</td>
<td>36.0</td>
<td>47.0</td>
<td>2.5</td>
<td>1.5</td>
<td>6.0</td>
</tr>
</tbody>
</table>

**Palatability**

Upper inclusion rate (DM)

Good

Beef 30%

Sheep 10%

**Processing**

Ready to feed.

**Typical analysis (% DM or MJ/kg DM for ME)**

**Bulk density**

600kg/m³
Cane Molasses

Appearance

Viscous liquid

Nutritional notes

High in sugar, low in fibre. Can be used at a variety of inclusion rates as an energy source, protein carrier, aid to palatability, aid to avoiding separation of mixes or as a dust reducer.

Palatability

Upper inclusion rate (DM)

Very good Beef 30% Sheep 30%

Processing

Ready to feed, but always check for its dry matter level as it can vary considerably depending on the blend of ‘liquids’, (anything from 45% up to 75% dry matter for straight cane molasses).

Typical analysis (% DM or MJ/kg DM for ME)

<table>
<thead>
<tr>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td>75.0</td>
<td>12.6</td>
<td>6.0</td>
<td>0</td>
<td>0.2</td>
<td>0.0</td>
<td>65.0</td>
</tr>
</tbody>
</table>

Molasses-based and other liquid feeds

There is a huge range of blended liquid feeds available that are more free-flowing than cane molasses. Most are branded products containing cane or beet molasses and other syrup products from the food and drink industry; full nutritional specifications are available from distributors. Products are available to suit a variety of requirements; crude protein level can range from 6% to 60%. Some products are enhanced with minerals and trace elements, some with oil, some are specifically designed to suppress dust and all will help improve palatability.

There are numerous options for on-farm storage from 1000 litre former citrus juice containers, 10–20 tonne specifically made ‘liquid’ tanks, to large industrial and disused lorry transport tanks.

Can be fed as part of a home-mixed ration or on its own through lick feeders. These feeds are ideal for dampening down dusty meals or encouraging intakes of less palatable forages.
Molassed Sugar Beet Pulp
Pellet, nut or shred

Appearance

Nutritional notes
High in metabolised and rumen fermentable energy, with a good fibre level. Well-known rumen conditioner which aids the digestion of other feeds.

Palatability
Upper inclusion rate (DM)
Very good
Beef 50%
Sheep 70%

Processing
Ready to feed.

Typical analysis (% DM or MJ/kg DM for ME)

<table>
<thead>
<tr>
<th></th>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>89.0</td>
<td>12.5</td>
<td>10.0</td>
<td>32.0</td>
<td>1.0</td>
<td>1.0</td>
<td>20.0</td>
</tr>
</tbody>
</table>

Pressed Sugar Beet Pulp
Moist shred

Appearance

Nutritional notes
High in fibre. Used as a forage extender or concentrate replacer and, like dried sugar beet pulp, is a rumen conditioner.

Palatability
Upper inclusion rate (DM)
Very good
Beef 50%
Sheep 50%

Processing
Ready to feed.

Typical analysis (% DM or MJ/kg DM for ME)

<table>
<thead>
<tr>
<th></th>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>28.0</td>
<td>12.7</td>
<td>9.0</td>
<td>42.0</td>
<td>0.3</td>
<td>0.4</td>
<td>5.5</td>
</tr>
</tbody>
</table>

Bulk density
Pellets 550kg/m³
Shreds 250kg/m³

Bulk density
1000kg/m³
Citrus Pulp

Pellets

**Appearance**

High in fibre, very low in protein. Can be used to supplement cereals and cereal co-products that are low in fibre.

**Nutritional notes**

<table>
<thead>
<tr>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td>24.0</td>
<td>12.5</td>
<td>6.5</td>
<td>37.0</td>
<td>3.0</td>
<td>6.5</td>
<td>25.5</td>
</tr>
</tbody>
</table>

**Palatability**

Variable

**Upper inclusion rate (DM)**

Beef 40%  Sheep 20%

**Processing**

Ready to feed.

**Storage/processing**

Ready to feed, can be clamped on its own or with an absorbent. If well clamped and sealed can be kept for six months.

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td>24.0</td>
<td>12.2</td>
<td>6.5</td>
<td>37.0</td>
<td>3.0</td>
<td>0</td>
<td>25.5</td>
</tr>
</tbody>
</table>

---

Wet Citrus Pulp

Moist brown/orange coarse porridge

**Appearance**

High in energy, very low in protein, high in fibre. Can be used to extend forage and supplement cereals and cereal co-products that are low in fibre. Introduce gradually.

**Nutritional notes**

<table>
<thead>
<tr>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td>24.0</td>
<td>12.2</td>
<td>6.5</td>
<td>37.0</td>
<td>3.0</td>
<td>0</td>
<td>25.5</td>
</tr>
</tbody>
</table>

**Palatability**

Orange and lemon good, lime and grapefruit moderate.

**Upper inclusion rate (DM)**

Beef 30%  Sheep 20%

**Storage/processing**

Ready to feed, can be clamped on its own or with an absorbent. If well clamped and sealed can be kept for six months.

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
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<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td>24.0</td>
<td>12.2</td>
<td>6.5</td>
<td>37.0</td>
<td>3.0</td>
<td>0</td>
<td>25.5</td>
</tr>
</tbody>
</table>
Feed Grade Urea

Small prill

**Appearance**

A very concentrated source of non-protein nitrogen that can be used by ruminants to make microbial protein. It contains 46% nitrogen, which is equivalent to 287% crude protein. **Must be mixed thoroughly into the rest of the ration**, as it is fatally toxic if ingested in more than very small quantities. Must be fed alongside readily available energy and introduced gradually into the diet and not fed where there is a possibility of feed or ration separation. It is not suitable for animals under three months of age. Rarely used in sheep diets other than in blocks and liquid feeds.

**Nutritional notes**

<table>
<thead>
<tr>
<th>Palatability</th>
<th>Upper inclusion rate (DM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>Beef 1%</td>
</tr>
<tr>
<td></td>
<td>Sheep 1%</td>
</tr>
</tbody>
</table>

**Bulk density**

600kg/m³

**Storage/processing**

Store bags in dry conditions. Must be mixed with other feeds. Water soluble and can be stored as a liquor. Can be used as a preservative for moist grain, straw and wholecrop.

**Typical analysis (% DM or MJ/kg DM for ME)**

<table>
<thead>
<tr>
<th>DM</th>
<th>ME</th>
<th>CP</th>
<th>NDF</th>
<th>Oil (AH)</th>
<th>Starch</th>
<th>Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td>99.5</td>
<td>0</td>
<td>287.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Fats and oils**

Concentrated source of energy, containing three times as much energy as cereals. They are used to help increase the energy density of the diet. Processing into prills, flakes and granules, and using specific forms of protection with calcium salts, creates a low rumen degradation and rumen solubility. This means the fats and oils arrive in the acidic abomasum and hind gut virtually intact, where the calcium dissolves and the energy is released and readily available for digestion.

**Vitamins and minerals** (see specialist guidance for specific recommendations)

Major minerals (%) – Calcium (Ca), Phosphorous (P), Magnesium (Mg) and Sodium (Na).
Minor minerals (mg/kg or ppm) – Copper (Cu), Selenium (Se), Iodine (I), Manganese (Mn), Zinc (Zn) and Cobalt (Co).
Vitamins – A, D₃, and E (IU/kg), Vitamin B₁₂ (mg/kg). Sometimes other B vitamins are included in supplements, particularly for young calves and lambs, and listed by name eg Thiamine (B₁), Riboflavin (B₂), Niacin (B₃), Pantothenic Acid (B₆) Biotin (B₇), Folic Acid (B₉).

**Direct fed microbials**

Also called probiotics, and include yeasts and lactic acid bacteria. They may help rumen microbes break down fibre and raise rumen pH, alleviating acidosis.