Winter brassica crops – feeding to dairy cows (1-75)

Key points

- Determine cows nutritional and feed requirements
- Measure crop yields and dry matter content
- Allocate sufficient crop and supplement to meet cow’s requirements
- Allow for no more than 85% crop utilization, may need to be less to get BCS gain
- Feed allowance is the major factor affecting cow intake - measure the area allocated accurately e.g. use a land wheel or GPS
- Mitigate animal health problems
- Consider animal welfare issues
- Reduce negative environmental impacts.

Nutritional requirements

Nutritional requirements are influenced by a number of factors; namely cow live weight, stage of pregnancy, gain in body condition score (BCS), weather (chill factor) and depth of mud. Most brassica crops used to winter cows contain sufficient protein and energy (MJ ME/kg DM). For information on feeding fodder beet, see farm fact 1-73.

Actual energy intake of the cow is determined mainly by crop allocation and this is usually the major limiting factor.

Table 1, is an example of the dry matter intake (down the throat) required to meet a cow’s energy demand and is based on a typical winter feed combination of swedes and cereal silage with low environmental stress.

To see how to allocate a crop and supplement based on cow size, BCS gain required and environmental conditions [stress], try the Winter Crop Allocation Calculator. This is a useful tool to help allocate crop and supplement, taking into consideration crop yield, paddock size and cow requirements. To use it, visit the Southern Wintering Systems page on the DairyNZ website. See the link below.

http://www.dairynz.co.nz/page/pageid/2145869505/Southern_Wintering_Systems
Table 1. An EXAMPLE from the winter crop allocation calculator of feed eaten and feed offered in kg DM/cow/day to achieve BCS gain for a typical winter diet (70% swedes and 30% cereal silage), given low weather related stress and good [85%] supplement utilisation.

<table>
<thead>
<tr>
<th>BCS Gain</th>
<th>Actual intakes (down the throat; feed eaten) kg DM/cow/day</th>
<th>Feed required to be offered allowing for appropriate utilisation for the BCS gain target kg DM/cow/day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Breed</td>
<td>Jun</td>
</tr>
<tr>
<td>Gaining 1 BCS</td>
<td>F</td>
<td>11.0</td>
</tr>
<tr>
<td></td>
<td>JxF</td>
<td>10.2</td>
</tr>
<tr>
<td></td>
<td>J</td>
<td>9.5</td>
</tr>
<tr>
<td>Gaining ½ BCS</td>
<td>F</td>
<td>10.1</td>
</tr>
<tr>
<td></td>
<td>JxF</td>
<td>9.3</td>
</tr>
<tr>
<td></td>
<td>J</td>
<td>8.7</td>
</tr>
<tr>
<td>No gain</td>
<td>F</td>
<td>9.0</td>
</tr>
<tr>
<td></td>
<td>JxF</td>
<td>8.5</td>
</tr>
<tr>
<td></td>
<td>J</td>
<td>7.9</td>
</tr>
</tbody>
</table>

Studies have shown that with efficient strip grazing, cows can utilise 85% of the crop and meet their energy intake requirements for BCS gain. Forcing cows to achieve a higher utilization with kale reduces their energy intake by pushing them to eat the lower quality lower stem material. Even for root crops where the quality is more even through the plant, 100% utilization will not be achieved due to leaf and root material being trampled into the soil. The allocated feed (offered) per cow must therefore be proportionately more than the cow is required to eat (down the throat), as shown in Table 1.

Research has shown that Friesian cows offered 14 kg DM of kale will actually eat around 12 kg DM of kale plus 3 kg DM straw. Cows offered 11 kg DM of kale consumed closer to 10 kg DM of kale plus the 3 kg DM of straw. These results show that cows are able to consume enough energy for maintenance, pregnancy and liveweight gain, if offered enough crop. If cows are forced to eat the lower 20cm of the stems of kale plants, the quality of the diet will be reduced, as will the intake.

Clearly, if a cow needs to gain BCS over winter, then significantly more feed is required above maintenance and pregnancy levels. In reality, very few cows start winter at the target calving BCS of 5.0 for cows and 5.5 for first and second calvers. Therefore most cows need to gain some weight over winter.

Crops should never constitute 100% of the diet of dry cows. It is good practice to limit the crop intake to 60-75% of the required intake and supply the remaining 25-40% with silage/baleage/hay/straw.
Kale can contribute 75% of diet, with swedes around 70% of diet. This will help balance the diet in a number of ways that will be beneficial to the cow. From Table 1, a Friesian cow on swedes required to gain 1 BCS over 2 month needs to be allocated 13.6 kg DM per day (e.g. 9.8 kg crop + 3.8 kg DM roughage) in June, increasing to 16.3 kg DM (e.g. 11.6 kg DM crop and 4.75kg DM roughage) during July.

**Crop yields and dry matter content**

In order to allocate the correct amount of crop to the cows it is essential to know how much crop is available in the paddock. This can be determined by weighing representative samples taken across the paddock as follows:

- Collect at least 6-8 quadrat samples that are representative of the paddock. The more samples the better with a minimum of 1 quadrat per hectare recommended.

- Sample size minimum of 1 m2 (use a 1 m x 1 m square quadrant or a circle made with a 3.55 m length of alkathene). Harvest all the material within each sample and measure its fresh weight after removing any excess soil, especially from the bulbs of swedes, and turnips, and determine the average wet weight of the samples. For increased accuracy weigh the leaf and bulb material separately and send a sample of each for DM determination.

- Determine the DM content – take a sub-sample of plants and send to the lab for DM analysis. As DM% varies greatly estimating will result in under or overestimating the yield

- Average the DM yield for the quadrat samples (fresh weight x DM %) and multiply by 10,000 for a 1 m2 sample (e.g. 1.44 kg DM from a 1 m2 sample equates to 14,400 kg DM/ha or 14.4 tonnes DM/ha).

It is good practice to take a sub sample and have the dry matter determined by a laboratory as DM contents can vary significantly. The average wet weight multiplied by the dry matter percentage will give the dry matter yield.

**Crop allocation**

Research has shown that incorrect allocation of break size is the major contributing factor to incorrect feeding levels. In long narrow breaks, getting the break size incorrect by only half a metre can result in cows being underfed by 2kg DM/day. It is absolutely crucial to know the face length and crop yield. The use of a land wheel is highly recommended to determine face lengths and break widths accurately. By knowing the number of cows to be fed and the required amount to be offered (not intakes) it is easy to determine the area to be allocated. The DairyNZ Winter Crop Allocation Calculator takes a lot of the hard work out of making these calculations especially if you already have the paddock area and dimensions, number of cows and crop yield.

The crop is utilised more efficiently when long narrow breaks are offered rather than wide breaks. Wastage due to trampling can be reduced by moving the fence once or twice a day rather than offering a few days feed at a time.
Calculations:

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter yield of crop/10,000</td>
<td>= dry matter yield/m²</td>
</tr>
<tr>
<td>kg DM required to be allocated (offered)/ DM yield per m²</td>
<td>= m² required per cow</td>
</tr>
<tr>
<td>Number of cows in paddock x m²/cow</td>
<td>= m² of area to be allocated</td>
</tr>
<tr>
<td>m² to be allocated for the break / face length</td>
<td>= width of the break</td>
</tr>
</tbody>
</table>

Example:
A 3 ha paddock has a crop of kale with a 12 ton yield. A herd of 100 Crossbred cows have a BCS of 4 and therefore need to gain 1 BCS over winter. The face length of the crop is a measured 200m.

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter yield – 12,000kg/10,000m²</td>
<td>= 1.2kg DM per m²</td>
</tr>
<tr>
<td>kg DM required to be allocated</td>
<td>= 8.3 m² per cow/day</td>
</tr>
<tr>
<td>– 14 kg DM per cow/per day offered</td>
<td></td>
</tr>
<tr>
<td>(10kg crop + 4 kg baleage)</td>
<td></td>
</tr>
<tr>
<td>10kg DM crop/1.2kg DM per m²</td>
<td></td>
</tr>
<tr>
<td>100 cows x 8.3m²</td>
<td>= 830 m²/break</td>
</tr>
<tr>
<td>830m²/200m face length</td>
<td>= 4.15m break width</td>
</tr>
</tbody>
</table>

If the break width was incorrectly measured by 0.5m, it would result in the cows being underfed by 1.2kg DM.

Animal health issues
There are a number of potential problems that can arise from feeding crops. Fortunately most can be prevented by correct management procedures.

Transition
Ruminants depend on microbes in their rumen to digest the feed. When changing from one feed source to another e.g. grass to crops, the microbes need time to adjust to the new feed source. Cows should be offered 1-2 kg DM of crop on the first day (1-2 hours grazing) after being well fed on a forage such as silage, baleage, hay and/or pasture. The amount of crop offered can be increased by 1 kg DM per cow per day until cows receive their full allocation after 10-14 days.

Acidosis
Crops are relatively high in rapidly fermented energy (NSC or sugars) but low in fibre (NDF). The microbes convert these energy sources into volatile fatty acids, which lowers the pH (increases acidity) of the rumen. The lack of fibre (NDF) lowers the amount of rumination that occurs. This results in less saliva which helps buffer the rumen and lowers the pH even further. This can result in clinical acidosis. Adding 25-40% roughage to the crop diet and the gradual adaptation of cows to a crop can help prevent these problems. Often the poor doers in the first 2-3 weeks of crops suffer from sub clinical acidosis. These animals need to be identified and removed from crops and fed more roughage.
Bloat

Bloat on crops is not the typical frothy bloat that occurs when cows graze clover. Frothy bloat results from the formation of foam that prevents the cow from belching out gases that form in the rumen. Bloat on crops is typically caused from acidosis that reduces the contractions of the rumen and prevents belching. Grazing frosted crops can increase the risk of bloat. It is good practice to wait until the frost lifts before offering the cows their break. Feeding more fibre before cows are put onto a new break will help reduce the risk of acidosis and bloat.

Nitrate poisoning

Nitrate poisoning is a major health risk when feeding winter crops. The nitrates in the plants are converted to nitrites and ammonia by the microbes in the rumen. These nitrites are absorbed into the bloodstream which lowers the blood's ability to carry oxygen to the tissues. Clinical signs of nitrate poisoning are sudden deaths, cows appearing uncoordinated and anoxia (lack of oxygen to tissues). Periods of rapid growth after dry spells or frosting, as well as the recent or high application of nitrogenous fertilisers, can lead to a concentration of nitrates in the plant.

Test kits are available for testing the crops. Risk is reduced by gradual adaptation of the cows to crops and ensuring enough roughage is available to cows before feeding the breaks. Hungry cows that gorge themselves on crop are at greater risk of nitrate poisoning.

Red water

Red water is caused by SMCO’s (S-methyl cysteine sulphoxide) found in brassicas and especially kale. Excessive use of nitrogen and sulphur fertilisers can increase the concentration of SMCO’s in the plants. Cow’s urine is discoloured from the typical yellow to a dark pink/red colour. Other clinical signs include weakness, diarrhoea, decreased appetite and poor performance. Avoid feeding cows flowering brassica crops as flower heads have the greatest concentration of SMCO’s in the plant and increases the risk of poisoning. Ensure animals have adequate levels of selenium before going onto crops.

Milk fever

Crops can contain high levels of calcium and only marginal levels of phosphorus. Brassica’s also contain low levels of magnesium but high levels of potassium. This imbalance is conducive to milk fever. Avoid feeding brassicas to springing cows. Springers should be transitioned to a grass based diet preferably two weeks before calving. Magnesium can be supplemented by supplying 60 grams/cow/day of magnesium chloride or sulphate in the water at least one month before calving. Silage or grass for springers can be dusted with an additional 60 grams/cow/day of magnesium oxide. Refer to Farmfact 3-1 for more information on magnesium supplementation.

Trace minerals

Brassicas contain low levels of copper and are likely to induce copper deficiency in cows fed brassicas for prolonged periods. High levels of iron and sulphur could further reduce copper uptake. Cows copper status should be checked before drying off and topped up with copper injections before grazing crops. Selenium is an essential element in the enzyme (glutathione peroxidase) that helps prevent red water. Se levels in cows should also be checked prior to drying off and topped up with injections if required. Brassicas contain low levels of iodine and may also contain high levels of goitrogens which can block the uptake of iodine resulting in an iodine deficiency in cows. Iodine deficiency may increase the risk of stillbirths or reduce the viability of new born calves. Iodine supplementation in drinking water is the only viable solution.
**Animal Welfare**

**Water**

Dry cows on crops must always have access to clean drinking water. Despite bulbous plants having relatively high moisture content, there is not enough moisture to meet the cow’s needs and cows will require up to 20 litres of water per head per day. Portable water troughs should follow cows daily as the back fence is moved forward. Water is also the ideal way to supplement cows with copper, selenium, magnesium and iodine while on crops.

**Shelter**

The animal welfare code of practice states that cows need access to shelter. This is especially important during spells of inclement weather. Cows should be stood off crops and offered shelter during severe wet or cold spells. Ensure that there is enough baleage, silage or hay in reserve.

**Environmental impact**

Environmental challenges revolve around reducing leaching of nitrogen and phosphate run-off into waterways and the negative impact on the health of the soils.

**Distance from waterways and run-off water**

Regional council requirements regarding distance from waterways must be considered when establishing crops and should be a minimum of 3m from the nearest waterway and adequately fenced. Ensure that this barrier has a good grass cover that can trap and filter any surface run-off water. Steeper cropping areas may require wider areas of grass to trap potential run-off water. The potential for run-off water from steeper areas during heavy rain should be considered and stock moved if necessary. Graze animals towards the waterway rather than starting closest to the waterway and grazing away.

**Leaching**

Crops are grazed at a high stocking density relative to pasture and consequently nitrogen losses during winter make a disproportionate contribution to the total dairy system losses. N-losses from winter grazing of crops have been estimated to make up 44% of the total system losses while only constituting 15% of the area. Leaching from shallow stony soils appears to be considerably higher than deeper soils. Consider the possible impact of leaching from soil types as well as tiles when selecting paddocks for cropping.

**Soil structure**

The high density of stock used to graze forage crops during a period that coincides with high soil water content has the potential to cause considerable physical damage to the soil. Soil can be severely compacted reducing the soil’s macro porosity. This damage can be view as short term if the crop is followed by pasture. Paddocks that are subjected to repeated cropping can suffer from reduced macro porosity which can be cumulative and reduce the soils productivity over the longer term. It is still regarded as good practice to back fence and limit the amount of trampling caused by cows in the paddocks. Placing the baleage out in the paddock before winter can help reduce tractor induced damage to paddocks. Direct drilling may also result in less pugging than conventional ploughing.