Getting the combination right in rations im pacts on milk production

Particle size pla ys its part

Increased energy costs, silage qualities and quantities, raw material prices and milk buyer pricing criteria all have an effect on margins. James Black from Northern Ireland based feed miller Thompsons looks at the role feeding can play to protect margins.

The high yielding dairy cow is constantly trying to consume enough energy, protein and effective fibre through her daily dry matter intake (DMI) to meet her requirements. These have to be met by forages, supplemented with a blend in the diet feeder, or nuts or cake through the parlour or the TMR.
Whether the ingredients are presented to the cow in the form of coarse blends or ground meals, the intake and benefits are dictated by the varying particle sizes.

Particle size

Ration particle size is known to have effects on feeding behaviour, chewing activity, rumen fermentation and as such impacts on milk production and composition.
Most UK diets will contain a mix of long particles such as straw, hay or possibly round bale silage, and shorter forages such as grass silage, whole crop wheat or maize silage.
Also there will be medium-sized particles such as rolled cereals, moist grain products. Fine particles come from all raw materials that have passed through a grinding process.
For many years producers and nutritionists in US have sieved diets for particle size based on research carried out at Penn State University. The apparatus used is a series of sieves with various screen sizes that correlate to the different stages of rumen digestion. This helps to determine guideline proportions of different particle sizes within the diet.
This system has worked well in the States where forages are quite dry and variability is not as great as the UK. As such, all US diets are sieved to fall into the following particle sizes:
– top sieve: 19mm+
– middle sieve: 8-18mm
– bottom sieve: 1.3-8mm
– bottom layer of sieve: less than 1.3mm

The top sieve will contain material 19mm+ within a TMR. This is the basis of cud formation. Increased cudding activity improves rumen activity within the cow and the critical time when rumen pH is below 5.8. When the rumen is below pH 5.8, clinical and sub clinical acidosis can occur with resultant impact on production, health diseases and milk composition.
It is important to remember that it is the particle size that enters the rumen that is critical to the cow and not that which leaves the feeder wagon. A good example of this is when increasing chop length of grass silage. The occurrence of sorting by the cow with a long chop length is greater than that of a short chop length. As such, cows will select the ingredients with the smaller particle size and increase the risk of acidosis by refusing the long fibre.
Although the guidelines in a US dairy cannot be followed completely, they highlight the practical approach that can be taken to feeding cows and how involved they have become in every level of the cow's diet in order to manipulate it for maximum production.
When the raw materials have been purchased to compliment forage, nutritionists can offer options as to where these two groups of ingredients should occur within the sieves.
Rising energy costs are influencing the composition of diets due to undesirable processing and this can help reduce the cost of a ration. However, this may only be a short term solution as the physical form of the concentrate must compliment the forage fraction of the diet so to achieve the ideal nutrient intake, performance and cow health.

Table 1: Comparing fermentation rates of cereal grains

cereal grain		treatment
wheat		steam flaked
barley		fine ground
oats		coarse ground
sorghum		rolled/bruised
maize		cracked
	increasing fermentation rate	

Ration options

Cereal grains are the area where the options for influencing particle size are more flexible. High yielding dairy cows receive grain as a major source of energy and starch within their diet. Optimising starch utilisation is critical in milk production for the following reasons:
– Starch is fermented in the rumen to volatile fatty acids. These are a major source of energy for milking cows.
– Fermentation of starch in the rumen drives microbial protein synthesis that drives milk production.
– Incorrect speed of fermentation of starch or inadequate balance of starch sources can lead to acidosis or metabolic problems, such as LDAs.
– Faecal losses of starch should be kept to a minimum to improve efficiency.
Any process that makes starch granules from cereal grains more available for microbial digestion increases the risk of clinical acidosis. In most circumstances, increased processing such as grinding or steam addition increases digestibility and potential animal performance. Fine grinding will be more likely to cause acidosis compared to coarsely ground grain. A range of rates of fermentation exist within differing cereal grains, as shown in Table 1, alongside the processing options of each grain.
Combination treatments, along with differing cereal sources and effective forage provision, can allow intensive use of cereals with minimal risk in dairy diets.
Protein sources such as soya bean or rapeseed offer little variation in structure or particle size. Fibre sources such as soya-hulls, beet pulp or citrus pulp can be beneficial in an un-ground pellet form. The fibre structure is only totally destroyedupongrinding.Incircumstances of wet forages or increased acidosis risk, intact fibre sources can be beneficial.

Starting point

Armed with their silage analysis, producers should discuss the feeding options with their nutritionist. They should consider the best combinations and the impact of processing on the availability of starch for digestion in the rumen. It is likely that a coarse blend in the TMR, incorporating, rolled, bruised and possibly some ground cereal, can provide a base ration and help maximise forage contribution and overall milk production. This can then be complimented with ground material in the form of nuts or cake to maximise individual performance.
As with all feeding systems, chemical composition of the forages is the starting point to help maximise both the chemical and physical composition of the concentrates purchased.

James Black

Rumen pH is critical and is affected by particle size