A place for molasses in the NZ dairy industry

The NZ dairy industry is based on good quality pastures dominated by perennial rye grass and clover.

Good quality pasture is a great feed, usually containing up to 20-30% protein and 12 MJME in spring which coincides with the normal seasonal peak as most farms calve in early spring. As freshly calved dairy cows require 18-20% protein in their diet, pasture often has more protein than required. The surplus N from protein is transported to the liver and kidneys and converted to urea to be excreted in milk or urine. Excreting excess nitrogen not only uses energy but is bad for the environment.

The protein in good quality pasture is rapidly fermentable in the rumen. When rapidly fermentable sugars are fed along with rapidly fermentable proteins, the rumen microbes are provided with a balance of energy and protein needed for optimal microbial growth resulting in better microbial protein yields and less losses of N. Adding dietary sugars, like molasses, at 2.5% to 5% has been shown to be beneficial. Under NZ conditions and intakes this is typically 0.5 to 1 kg molasses/cow/day.

Despite molasses being more rapidly fermentable than the starch in grains, Ohio State University has reported it does not lower the rumen pH as much as starches which can be the cause of milk fat depression and acidosis. The supplemental sugar increases the lactate-consuming bacteria helping maintain the pH and butter fat test. There is therefore a place for additional sugars like molasses as well as additional starch like grains in a pasture based system. Their different rates of rumen fermentation are complimentary enhancing microbial digestion. The added energy can have a direct benefit.

Molasses can help improve microbial digestion of fibre releasing the energy in the higher NDF pastures as long as there is sufficient protein in the diet. Cheap nitrogen sources such as urea can be combined with molasses to raise the protein content and digestion of high roughage low quality dry cow feeds improving digestion and intakes. The improved digestion and dry matter intake as well as the extra potassium can aid in cows dealing with heat stress in summer.

Another major benefit of molasses is high palatability which is often under-valued as a benefit when simply using formulas to determine the cost per unit of energy (MJME). Additional grain or grain/PKE blends fed in the shed are often dusty and unpalatable. On farms that do not feed any molasses with the grain, there is often a build-up of un-eaten grain in the feed trough. Grain left in the trough does not increase the cows energy intakes. Leaving feed behind does not necessarily mean the cow is fully fed and not hungry, as is so often stated, but could be due to sub-clinical ketosis.

High producing, well-conditioned cows with inadequate energy intakes will mobilise body fat to meet energy demands. The liver uses the triglycerides from fat to make glucose rather than using energy sources digested in the rumen. This can result in a build-up of ketones in the bloodstream and what is known as ketosis. Cows with ketosis have poor appetites, do not eat their grain and look empty even when leaving high pasture residuals. There are a number of symptoms but poor appetites, poor rumen fill, drooling, detachment with a stare as if on another planet, rapid weight loss and sudden death are typical signs of ketosis. Feeding molasses with the grain can improve the intake of the supplement and help prevent ketosis, both directly by adding extra energy and indirectly, by promoting higher energy intakes from the other supplements.

Weight loss between calving and mating is perfectly natural in cows with good genetic potential. A reasonable weight loss is inevitable during this period and cannot be prevented but needs to be managed. When this loss becomes excessive and cows lose too much condition between calving and mating, the reproductive performance at subsequent mating has been shown to be compromised. The body condition score at mating is the BCS that has the biggest influence on the breeding success.

Limiting this loss of BCS to less than 1 BCS, in other words ensuring cows do not drop from a 5 BCS at calving to 4 or below by mating, will give the cows a better chance of getting pregnant. Using molasses to provide extra energy and increasing palatability of other additional energy sources like grain can help reduce the energy deficit and improve reproductive performance.

While pasture is a great feed, it is not perfect. Lactating cows have a high demand for macro minerals like calcium and magnesium. Pasture can be lacking in these minerals, especially for the higher producing cows. Grain is also low in calcium further compounding the problem. Dusting pastures with lime flour and magnesium oxide is one way of supplying cows with these minerals but is time consuming and wasteful. Usually 2-3 times the desired amount is dusted onto the pasture and the farmer hopes the minerals are not washed off by rain or brushed off by cows. Using 3 times the required amount and hoping for the best is not only expensive and inefficient, but adds to unnecessary mineral loading of the environment. Molasses is a great carrier for these minerals, not only removing dustiness but ensuring a good intake of unpalatable minerals. The amount of minerals required can be mixed with molasses and accurately dispensed to each cow eliminating any waste and ensuring each cow gets her daily requirement. Using molasses as a carrier of calcium is a great way of boosting colostrum cow's calcium intakes just after calving and can help prevent milk fever after calving. Having a palatable feed source like molasses in shed also helps with cow flow.

Traditionally trace minerals are added to the dosatron and fed via the water. This assumes there are no mineral interactions between the added minerals and that all the minerals remain in suspension. Inorganic minerals are taken up by a passive transport system in the digestive system based on the electrical charge. As most trace minerals have a similar charge, the mineral in highest supply is likely to be taken up the most, to the detriment of other minerals uptake. Besides this, water intakes vary with the weather and moisture content of the pasture. Water leaks add to the unreliability of this method. Adding trace minerals, especially organic minerals or chelated minerals, to molasses and administering each cow her daily requirement can eliminate these problems and ensure cows get their exact mineral requirement every milking.

The old method to help prevent milk fever (a lack of calcium) was to restrict calcium intakes during late pregnancy and dust with magnesium. This would trigger the absorption of calcium from the cow's bones before calving and help prevent milk fever. Feeding lime flour prior to calving reduces the absorption of calcium from the bones increasing the incidence of milk fever. Springer cows needed to be kept off effluent paddocks in order to reduce the amount of potassium eaten which interferes with magnesium and lowers the absorption of calcium for the bones. This works reasonably well in lower producing cows. As production per cow increases, more milk fever problems are likely to arise as calcium reserves are rapidly depleted due to the sudden increased demand shortly after calving.

A more modern approach over the last 30 years has been to use a Dietary Cation Anion Diet (DCAD) or a transition diet. The mineral content of potassium and sodium are kept low while sulphur and chlorides are elevated creating a negatively charged diet which improves the absorption of calcium and helping prevent milk fever. Calcium levels in these diets are normally kept elevated by adding calcium sulphate (not lime flower) increasing the calcium uptake from the feed as well as from the bone reserves. These salts are notoriously unpalatable and molasses makes a great carrier for DCAD minerals. Care is required as too much molasses can however elevate the potassium content which can be counter-productive.

In summary molasses has a number of benefits in the NZ pasture based system as summarised below:

- Molasses can improve the balance between protein and energy supply to the rumen improving rumen fermentation and microbial yields of quality bypass protein and amino acids
- Molasses can increase energy to the cow by directly supplying extra sugars and improving digestion
- Molasses can also indirectly improve energy intakes by improving palatability and intakes of other energy dense supplements like grains
- Molasses can help to improve energy supply which can improve milk production
- Molasses can help reduce ketosis by improving energy intakes and reducing fat mobilisation
- Molasses effect on limiting weight loss through better energy supply can limit the loss in body condition and ensure better subsequent breeding performance
- Molasses is a great carrier of both macro and trace minerals ensuring animals are adequately and efficiently supplied with minerals – using a targeted approach rather than hoping for the best!
- Molasses can be used to improve the palatability of transition diets and help reduce milk fever
- Molasses is great for cow flow and besides all the nutritional benefits it can help reduce milking times.

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