

Effective Rations

Sugar has now moved from a product used primarily for palatability, to a nutrient essential for the maintenance and efficiency of the rumen, which in turn helps the livestock producers profitability in these tough times.

For maximum performance, good herd health and fertility, cows need a well balanced diet geared to optimising rumen function. Ruminants have evolved to utilise forage and in the current market, maximising forage intake and utilisation is vital. Molasses based liquid feeds have been shown to have a positive impact on ruminant performance in several different ways.

It's essential to provide a ration which is balanced in terms of energy supplying the correct mix of sugars, starch and fibre and the right balance of protein sources both rumen degradable and by pass protein to ensure optimal production.

RATIONS NEED SUGAR

The key to fuelling effective rumen fermentation is the supply of energy in the form of quickly degradable carbohydrates, i.e. soluble sugars together with a balance of starch and fibre (see figure 1). The rapid fermentation of these sugars stimulates the overall rumen fermentation ensuring the maximum benefit from the feed consumed.

It has been shown that adding 6-Carbon sugars in the ration, increases the overall rate of feed digestion and so boost dry matter intakes. Nutritionists advise an overall sugar level of 6-7% and a starch:sugar ration of approximately 3:1, in well balanced rations.

It is important to be aware that while the total supply of energy to an animal is important, the actual makeup of the energy supply is equally important.

RATION ADVICE

Even when cereals are cheap, their use should be limited to no more than 4kg/head/day in dairy rations to avoid metabolic disorders and possible adverse milk quality issues.

ALL SUGARS ARE NOT EQUAL

Sucrose has been shown to be the most effective form of sugar for boosting rumen function and microbial population in the rumen. In trials, sucrose has been shown to give the highest production of microbial protein, and also to be the most efficient at mopping up excess ammonia (see table 1).

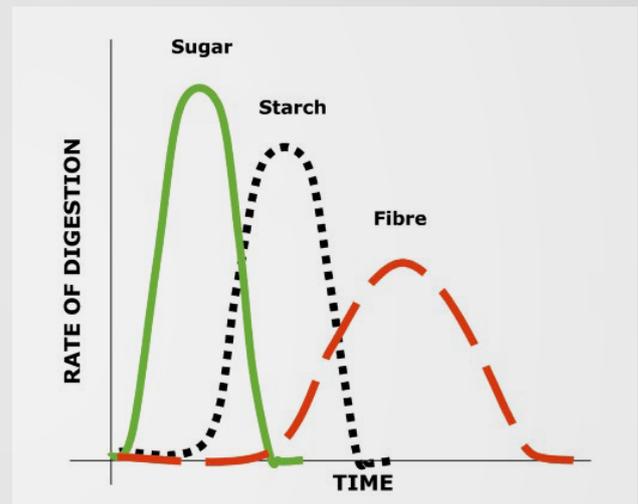


Figure 1: The relative rates of digestion of sugars, starch and fibre.

	Silage Alone	Added Sucrose (from molasses)	Added Starch	Added Xylose	Added Lactose	Added Fructose
Rumen Ammonia Concentrate (average)	255	157	231	180	158	164
Microbial Protein Synthesis g/d	64	93	74	82	89	86

Table 1: The Impact of Sugar Source in the Rumen

IMPROVE PERFORMANCE – ADD SUGAR

Cane molasses has over 60% sucrose in the dry matter and so represents the most cost effective source of sugar available to farmers. Many research trials have demonstrated the benefits of sugars on performance.

So how much to feed?

After extensive research and development work, ED&F Man has developed the **Sugar Gap Calculator**. The Sugar Gap is the difference between the sugar requirement of the animal and the amount of sugars actually supplied by the ration. The difference can be expressed either in grams of sugar or as a % of the cow's sugar requirement.

$$\text{SUGAR GAP} = \text{SUGAR REQUIREMENT} - \text{SUGAR SUPPLIED IN CURRENT DIET}$$

ED&F Man's Sugar Gap Calculator allows you to identify the gap. It is then a case of closing the gap by choosing the most appropriate molasses product and the correct feeding level.

Group	Recommended sugar level %
Close up	5
Early lactation	6
Peak lactation	7
Mid lactation	6
Late lactation	5

Table 2: The recommended sugar level for different milk yields

IMPROVE DRY MATTER INTAKES

Balancing the diet to include a source of sugar improves digestion efficiency, so the animal is able to consume more, sooner. This results in higher dry matter intakes (DMI) and in turn higher productive output (see table 3).

As molasses is a liquid, there is a lower substitution effect compared to dry feed, again boosting DMI. The palatability of molasses improves ration appeal, and so enhances appetite.

	Molasses Inclusion			
	0%	5%	10%	15%
DMI kg/d	14.8	16.6	17.4	18.2
Milk Yield kg/d	22.1	23.2	23.3	23.7
Protein Yield /kg	30.6	30.9	31.0	31.4
Fat Yield g/kg	38.1	37.4	37.3	36.1

Table 3: DMI Increased with Increases in Molasses

IMPROVE MILK QUALITY

Increasing dietary sugar levels has been shown to raise milk protein and butterfat contents. Conversely, high starch levels can suppress butterfat, so replacing some starch with sugar can lead to increases in the levels of butterfat and milk protein (see table 3).

Trial data

Adding sugar in the form of a molasses blend (Stockmol 20 or Regumaize 44) boosted milk protein content significantly by more than 0.1% in a trial at CEDAR (see figure 2).

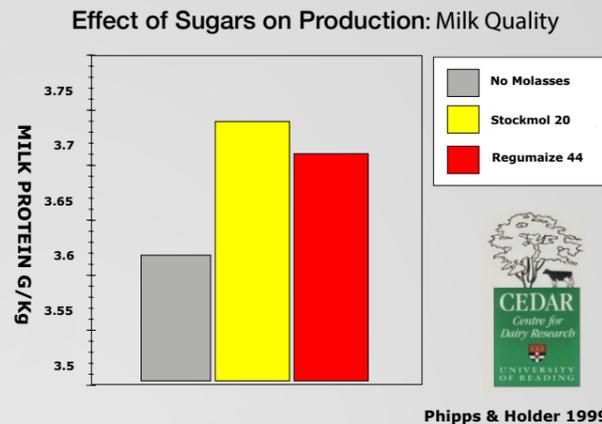
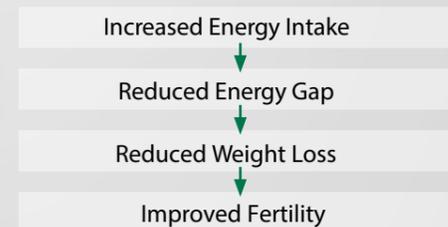


Figure 2: Adding a Molasses Blend Improved Milk Protein Content

With many milk contracts paying a premium for quality, adding sugars can boost financial returns.

IMPROVE FERTILITY

For high yielding dairy herds, the challenge is always to get sufficient energy into the cow to support the demands of milk production and avoid creating an energy gap and consequent weight loss leading to poor fertility. In this, sugars again have a key role to play:



The longer term benefit of ensuring the diet is balanced to include sufficient sugar sources is better herd fertility.

REDUCE 'SORTING' – ADD MOLASSES

The formulation of a balanced TMR can all be in vain if some cows then sort through the ration, selecting out the tastier concentrate portion and leaving the more fibrous components such as silage and straw. With insufficient intakes of effective long fibre, these cows can then suffer sub acute ruminal acidosis.



The consequences include low butterfat levels, inefficient feed utilisation, depressed production, loose dung, and production-related diseases such as lameness and ketosis. Also the less dominant animals such as heifers, will not get their share of concentrate feeds and thus consume more high fibre, poorly digestible feeds.

The result is animals in poor body condition, with all its associated health problems. The addition of molasses has been shown to reduce sorting. It makes the meal/concentrate ingredients stick to the forage so it is more difficult for cows to sort out the ration. Secondly, as the ingredients are all coated with molasses, this masks the taste of any unpalatable components, another reason behind sorting. This ability of molasses to reduce sorting was demonstrated in a trial carried out with the University of Edinburgh's Langhill dairy herd (see figure 3).

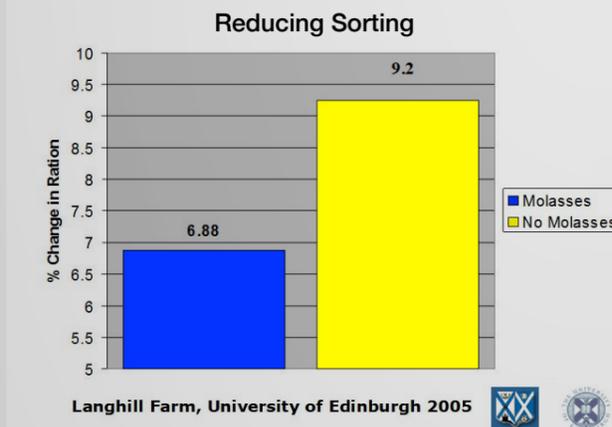


Figure 3: Adding Molasses Reduced Sorting of the TMR

A TMR consisting of concentrate (a 6mm pellet), brewers grains, whole crop wheat and grass silage was mixed with or without molasses. The difference between the ration at 'put down' and then 24 hours later was assessed using a Penn State Forage Particle Separator. This is a series of sieves with different sized holes which can be used to separate the diet constituents out by particle size, and so assess the amount of sorting that has occurred.

First signs of a sorting problem:

- Bullying at the trough
- Loose dung in some, but not all cows
- Fat (bully) cows and thin (timid/heifer) cows
- Sub acute ruminal acidosis in some cows

Reducing sorting has resulted in:

- Increases in herd milk yield
- Increases in butterfat level
- More consistent dung
- Less mastitis
- Less acidosis
- Less bullying
- More consistent body condition across the herd
- Improved fertility

MOLASSES BENEFITS

Recent trial work (Table 4 below) has highlighted the numerous benefits of including a molasses based liquid feed in a well-balanced TMR.

The study highlighted improvements in Dry matter intake, milk yield and milk quality, all of which will add significant value to any dairy enterprise. ED&F Man's own market research has highlighted that 80% of the top performing herds in Scotland include a liquid product in the TMR.

Trial data: Extra return per cow of adding molasses

	No liquid feed	+Molasses based liquid feed	The effect
DMI (kg)	27.7	29.1	+1.4kg (+5%)
Milk Yield (lts)	41.2	43.1	+1.9kg (+4.6%)
Milk Fat %	3.81	3.92	+0.11kg (+3%)
Milk Protein	3.36	3.35	No effect
Milk Fat Yield (g/d)	1,550	1,680	+130g (+8.4%)
Milk Protein Yield (g/d)	1,360	1,450	+90g (+6.6%)
Sorting	-	25% less	25% reduction

Table 4 (DeVries & Gill: Journal of Dairy Science 2012)

Reduced risk of Acidosis

Sub acute rumen acidosis (SARA) can have a major impact on herd performance without being obvious. Different feeds produce different volatile fatty acid profiles when they are fermented in the rumen.

Starch → Lactic acid

Sugar → Propionic/Butyric

Fibre → Acetic

Lactic acid is 10x more acidic than Propionic or Butyric acid. Therefore replacing 1kg of cereal with the equivalent amount of a molasses blend can reduce the acid load in the rumen and reduce the likelihood of SARA.

The Liquid Benefit

The fact that molasses is a liquid, provides a number of unique benefits including de-dusting and low substitution rate, but not all liquids have the same benefits to rumen fermentation. It is sugars that drive fermentation and there are liquids on the market that have already been fermented and therefore have little fermentable value (see figure 4).

Molasses – an excellent sugar source

- Its sugar content is 100% 6-carbon sugars
- It's a liquid, so it binds up dust
- It's a liquid, so a low substitution effect
- It's highly palatable
- It reduces 'sorting' of the TMR
- It's convenient to feed
- Approved storage systems available – no need for shed space
- Wide range of formulations available
- The ED&F Man Liquid Products sugar gap calculator can help identify the best molasses blend to feed

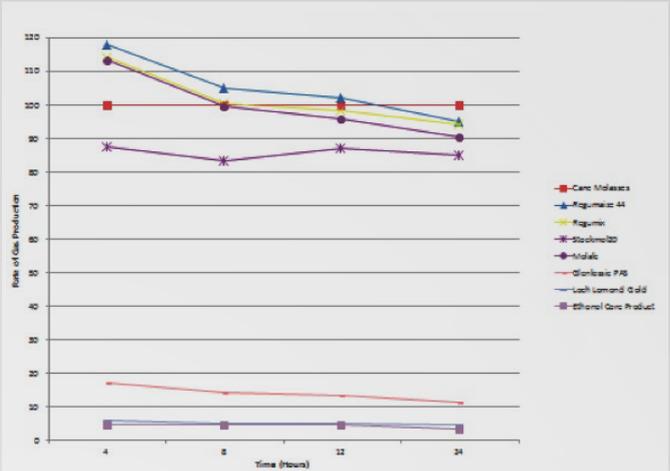


Figure 4: Rumen activity of various liquid feeds and liquid co-products

Including sugar in the ration, in the form of molasses based liquid feed, has a number of benefits to milk production and animal health. A financial value to these benefits can only be a rough estimate, but some approximate values for individual benefits of molasses inclusion in the diet are highlighted below.

Benefit	Trial data/on-farm experience of adding molasses	Extra return per cow
Higher dry matter intakes	Increase of 1kg/day = extra 2 litres of milk	+40p/day +£122/lactation
Improved milk quality: protein	Increase of 0.1%	+7p/day +£21/lactation
Improved milk quality: butterfat	Increase of 0.2%	+10p/day +£28/lactation
Improved fertility	5 day reduction in calving interval	+£12.50/lactation
Reduced sorting	Improved production, health and fertility	?
	Total potential benefit	+£183.50/lactation

Table 5: Potential financial gains from adding sugars in the form of molasses

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