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SUPPLEMENTATION OF MOLASSES IN LIVESTOCK FEED

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Abstract: Molasses is a sticky dark by-product of processing sugar cane or sugar beets into sugar. Molasses can be a source of quick energy and an excellent source of minerals for farm animals. Molasses can also be a key ingredient for cost effective management of feeds and pastures. The calcium content of sugar cane molasses is high (up to one percent), whereas the phosphorus content is low. Cane molasses is also high in sodium, potassium, magnesium and sulphur. Beet molasses is higher in potassium and sodium but lower in calcium. Molasses also contains significant quantities of trace minerals such as copper, zinc, iron and manganese. Supplementing poor quality hay with molasses will increase feed intake and improve palatability. Microbes in the rumen break down the sugars in molasses rapidly, which extensively causes a rapid release of energy that makes molasses very useful for balancing other feeds in the dairy diet all year round. Feeding molasses to farm animals will improve digestion of pastures/hay; increase milk production, help maintain body condition and appetite and result in less feed waste. Cane sugar, which has similar benefits to molasses, is an inexpensive alternative to use.
Keywords: Livestock, feeding, molasses, micronutrients, toxicity.

Introduction

Molasses is a dark brown, viscous liquid produced as a co-product of the production of sugar. After dissolving sugars out at high temperature, the crystals of sugar settle out as the liquid cools leaving the molasses, much of which was traditionally mixed back with the pulped fibers to produce molasses sugar beet feed.

Feeding rates

Molasses is suitable for inclusion in the diets of all ruminant livestock and can offer a very cost effective way to increase the palatability of feeds whilst contributing good levels of energy and protein. In dairy cows, ideal for complete diets added up to 3kg of molasses per head per day. Where as, in beef cattle up to 10 per cent of molasses can be included in beef diets depending on the nature of other feeds in the mix and subsequent storage facilities for the finished ration. Similarly, up to 10 per cent of molasses can be safely included in young

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stock diets from four weeks of age. In sheep, molasses can be used at up to 10 per cent of dry sheep diets, but is not generally the preferred molasses product for ball or lick feeders.

Handling and Storage

Molasses is delivered in bulk liquid tankers with discounts available for 15, 20 and 25 tonne lots. Tanks should be built to hold and dispatch bulk liquids and care should be taken to ensure they are cleaned out from time to time to ensure no build up of sediment. 4 inch diameter pipe work, or the metric equivalent, is adequate to handle molasses.

Nutrient composition of molasses (dry matter basis)

Dry Matter	74%
Crude Protein	6.5%
Oil	Trace
NDF	Nil
Starch	Trace
Sugar	65%
ME (MJ/KG DM)	12.5

Key Benefits

- High in digestible energy
- High level of degradable protein
- Highly palatable
- Ideal to complement low protein
- forage diets, such as whole crop
- cereal, maize silage or straw
- Free flowing liquid – easily handled
- High copper content.

Molasses as Stock Feed

The value of molasses as feed is based mostly on its sugar content (around 50 per cent). In comparison with the carbohydrates in concentrated form, molasses contains a small amount of protein, but it provides also a certain amount of non-protein, non-sugars which have some nutrient value especially for ruminants. In general, molasses should be added to feed when it is essential to compensate for an excess of protein. Molasses has a high mineral content, but it usually lacks adequate calcium and phosphorus. These must be taken into account when

preparing mixed feeds and they should be supplied by suitable supplements (*e.g.* lime) or by a proper combination of feeding materials.

NUTRIENT CONTENT OF MOLASSES AND MOLASSES PULP

Feed product	Dry substance (g/kg)	Digestible protein (g/kg)	Starch (units/kg)
Molasses	790	28	475
Molasses pulp (dried)	900	54	520

CONTENT OF TRACE MATERIALS IN MOLASSES

Micronutrient	Amount found in molasses (p.p.m.)
Cobalt	0.6
Boron	3.0
Iron	115.0
Copper	4.9
Manganese	18.0
Molybdenum	0.2
Zinc	34.0

DIRECT FEEDING OF LIQUID MOLASSES

The feeding of molasses takes various forms and proportions. When fed directly, the molasses is usually offered after it has been diluted with water. The diluted molasses should not be used for drinking purposes but only in combination with raw feed. It is best to pour or to sprinkle the molasses solution over the fodder in the manger or trough. The molasses sticks to the feed materials so that it cannot be picked out of the mixture by the animals. If the distribution is uniform, the rationing can be accomplished with sufficient accuracy if the total amount of molasses to be fed each day is diluted in a tub with water. There are different opinions about the amounts of water recommended for diluting the molasses. For example, the ratio of water to molasses may be 4-6 **:** 1 or 2-4 **:** 1, or even 1 **:** 2. The main criterion is that the solution must allow good mixing with hay, chopped materials, raw feeds, etc. Small mechanical devices are available for aiding in the preparation of molasses feeds, *e.g.* for mixing diluted molasses with chopped straw. In the case of silage it is desirable that the molasses, which should be as concentrated as possible, is well distributed. The desired

uniform division is achieved by using a blower chopper, connected with a small geared pump, provided the molasses is warmed to around 70°C or is diluted 1 **:** 1 with water.

Feeding of stock with molasses brings considerable advantages, such as

- Economical high grade feed
- Nutrient compensation for the excess of protein of green fodder with addition of crude fiber
- Making palatable raw feed and lower grades of farm products
- Increased production of milk and its fat content
- Nutritive balancing of a uniform and high grade feed in the preventive action against fertility disturbances in breeding
- Saving of oats in the horse barn and prevention of colic
- Saving of cracked corn and vegetable and grain feeds in swine food
- Prevention and fighting against certain deficiency diseases
- Closure of the gaps in the natural agricultural cycle: field-animal stomach- field and the related resulting better use of manure so that the minerals, trace elements and other materials indispensable to high yields are returned to the soil.

BENEFITS

Molasses can reduce the dusty powdery nature of some finely ground feeds. In this role, it makes a feed mixture more palatable and edible to livestock. Molasses can be added to replace missing sugar and trace minerals and help with fermentation in cases of low quality forages especially with low sugar levels.

Cattle and Dairy

• Provides sugar during early pasture growth
• Promotes animal health
• Increases milk solid production
• Increases diet density when intake is reduced before calving
• Improves milk let-down
• Improves digestion of fiber
• Helps reduce heat-related stress
• Helps growth and development of young stock
• Assists pregnancy rates (condenses calving patterns)

Horses

• Combines to reduce the dust in feed

• Increases palatability

• Reduces the ability of picky horses to sort through feed

Sheep and Goats

• Prevents pregnancy toxemia

OPTIONS AND DIRECTIONS FOR USING MOLASSES

Treating Large Round Bales Dispersing molasses supplements throughout a big bale will considerably enhance the nutritional value and palatability of hay, straw, stalks and other cereal grains. Simply pour on, or probe into, the face of the bale. Application rate is typically seven to ten percent by weight. Molasses is usually used in amounts not exceeding ten to fifteen percent of ration.

Cattle and Dairy Feeding Regiment

• Dry dairy cows: 1-2 lbs. or 500 g-1 kg/day

• Springing dairy cows: 1.5-5 lbs. or 700 g-2 kg/day

• Lactating dairy cows: 1-5 lbs. or 500 g-2 kg/day

• Adult beef cattle: 1 lb. or 500 g/day

• Calves and heifers: 3 oz-1 lb. or 100-500 g/day

After parturition: 8 oz. or 240 ml in warm water.

Feeding Regiment for Horses

2-4 lbs./1,000 lbs. or 1-2 kg/450 kg of body weight two to three times a day

Feeding Regiment for Sheep and Goats

• Lactating or gestating: 3-6 oz. or 100-200 g/day.

The high molasses feeds contain 30-40% molasses and the proportion by weight is limited to 2 or 3 parts of the permissible impregnated carriers. To a great extent, molasses is used in various kinds of mixed feeds, which contain 5-15% and only occasionally more molasses. The Standard table given in the German Feedstuff Law permits the following amounts of added molasses

Calf feeds	5 %
Calf nutrition meals	5 %
Goat mixed foods	10 %
Dog biscuits	10 %

Dairy cattle feeds	15 %
Milk-producing feeds	15 %
Cattle fattening feeds	20 %
Horse mixed feeds	30 %

SAFETY

Molasses can be toxic if fed at ad libitum (free choice), therefore, it is recommended that molasses should be supplemented in a restrictive form.

METABOLIC DISEASES ON MOLASSES-FEEDING SYSTEMS

Three metabolic diseases may occur in cattle and sheep fed diets in which molasses is used as a supplement (as a vehicle for urea) or as the basis of the diet. These are: urea toxicity, molasses toxicity and bloat.

UREA TOXICITY

With ad libitum feeding of molasses/urea mixtures, urea intakes may reach as high as 300 g/d (e.g. in a 500 kg dairy cow consuming 10 kg/d of the molasses/urea mixture). Even in these cases, there is rarely any risk of urea toxicity since the sugars in molasses and ammonia from urea are quickly used in microbial cell growth. Animals which have never previously consumed urea can be safely permitted free access to mixtures of molasses containing up to 3 percent urea without fear of toxicity. The principle underlying the use of molasses with 8–10 percent urea is that the high urea concentration inhibits consumption of the mixture. Toxicity will only occur if the urea is not uniformly mixed or if the mixture has a high water content which may encourage the animal to “drink” rather than “lick” the mixture.

MOLASSES TOXICITY

This used to be the most serious problem associated with ad libitum molasses feeding. For example, in the first year following the introduction of the molasses/urea fattening system in Cuba, mortality and emergency slaughter rates in a 10000 head feedlot increased from 0.1 percent and 0.4 percent (when a forage-based diet was fed) to 1 percent and 3 percent respectively, when the diet was changed to high levels of molasses/urea.

Cattle suffering from molasses toxicity salivate, stand apart in a “dejected” posture, usually with their head lowered; and frequently are found “leaning” against the fence or feed

trough. Invariably, eye-sight is affected and often the animal is blind. When disturbed they have an unsteady and uncoordinated.

The nervous symptoms and blindness, that were a feature of molasses toxicity, indicated damage to the brain and it was subsequently shown that the clinical syndrome was indistinguishable from that of cerebro-cortical necrosis (CCN) also known as polioencephalomalacia (Edwin *et al*., 1979). The necrosis in the brain is readily seen and this allows rapid diagnosis. The cause of the necrosis is likely to be a decrease in the energy supply to the brain either because of an absolute deficiency of alimentary thiamine, binding of thiamine analogues produced in the rumen and/or through the action of thiaminase in the rumen (Edwin et al., 1979); or a deficiency of glucose (Losada and Preston, 1973).

Bloat

Bloat, which is the retention in the rumen of gas, either free or entrapped in foam, occurs in almost all feeding systems. It is more frequent in the diet of other carbohydrate sources which have little or no fibre but which are highly digestible, such as raw sugar (MacLeod *et al*., 1968) and maize grain (Fermin *et al*., 1984).

Treatment and Prevention

In high-molasses feeding systems, it is usual to restrict the supply of forage (either to stimulate molasses intake or because of the greater cost of forage compared with molasses). Inadequacies in the forage supply, either in quantity or "quality", appear to be the main causative factors of molasses toxicity. Thus, the incidence of molasses toxicity was less when wheat or barley straw, rather than sorghum forage or maize silage, were used as the forage sources in molasses-based feedlots. Furthermore, there have been no reports of toxicity when high protein forages (e.g. leucaena, and cassava and sweet potato leaves) have been used. Equally, the feeding of palatable forage with a high protein content appears to be the best cure for affected animals. The recent developments in the molasses feeding system have emphasized the technical and economic advantages of giving high protein forages, especially from leguminous trees like leucaena, gliricidia and erythrina, as a combined source of both "roughage" and "bypass" protein (Preston *et al*., 1967). Such procedures are also likely to offer the most cost-effective solution for molasses toxicity. The above discussion emphasizes the critical role of management in any feeding system where economic constraints dictate a less than optimum degree of supplementation.

CONCLUSION

The added benefits of feeding molasses have been quantified by numerous research studies. There is no doubt that molasses is an excellent source of energy and minerals for ruminants. It can be fed in various ways and is very useful in many situations. Cattle and small ruminant producers can feel confident feeding molasses, knowing that they are feeding a safe and economical supplement.

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