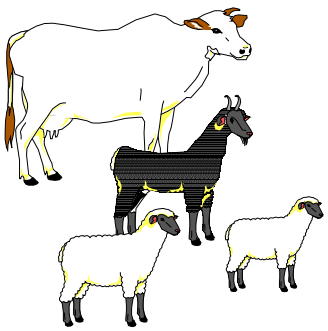
Making Molasses-Urea Feed-Blocks

A short guide to the technique

by M. L. Allen
Prince of Songkla University
Thailand.

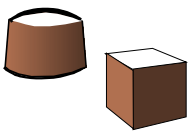
What are molasses-urea feed-blocks?

Cows, sheep and goats can all digest cellulose: They belong to a group of animals called ruminants. These animals are different from other mammals because they have several stomachs. In one of these, stomachs (called the rumen) they maintain several species of bacteria which produce cellulase, the enzyme which breaks down cellulose into starches and sugars. Strictly it is these bacteria which partly digest the cellulose and it is the animal which then digests the starches and sugars produced by the bacteria.



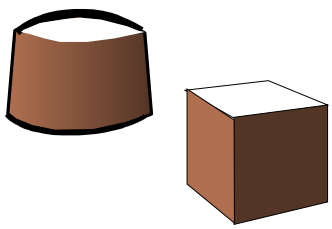
All living creatures make and use proteins in some form or another and because proteins all contain nitrogen, all creatures must have access to a digestible form of nitrogen. Mammals get their nitrogen from eating animal and vegetable protein but many micro-organisms (such as bacteria) can actually make use of inorganic nitrogen sources. (Some can even use the nitrogen in the air). Because of this difference, bacteria in the rumen can be fed on urea even though the animal itself cannot make use of it. Indeed, all animals find urea rather bitter and normally reject it. It is for this reason that molasses is usually mixed with the urea to make the mix more palatable to the animal. (Urea is widely used as a fertiliser and is made from natural gas or some other hydrocarbon source; Molasses is a by-product of the sugar industry and, as well as containing some residual sugar, it has most of the trace minerals taken up by the sugar plant. It is obtained from both sugar cane and sugar beet during the sugar extraction process.)

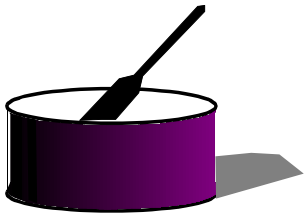
One problem with molasses is that it is a sticky, viscous liquid which is not easily transported to the cows, sheep or goats. By combining the molasses and urea with a filler such as bran or powdered husks, a stable block can be formed which is easily transported, stored and distributed to the animals wherever they may be.



Where is the molasses-urea block used?

The block is most effective in areas





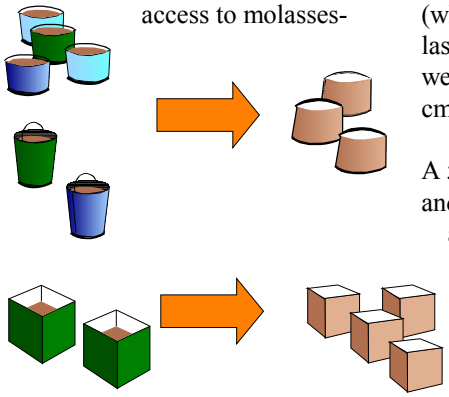
where drought is common. Under drought conditions, there is often insufficient protein in the diet of the ruminant for the bacteria in the rumen to remain healthy. This can be corrected by the use of high-protein concentrates such as alfalfa or cotton-seed cake. Such materials will usually be in short supply and expensive during the dry season: But without them, the animal will not prosper and may even die.
The molasses-urea feed-block is a partial substitute for these expensive concentrates and it therefore provides an effective dietary supplement for animals surviving in drought conditions.

IT CAN NEVER BE A COMPLETE FEED AND MUST ALWAYS BE FED ALONG WITH ROUGHAGE.

It is not a complete substitute for concentrates: Many concentrates actually contain other useful ingredients. However, it can be used in place of **some** of the expensive concentrates available to the farmer.

Not only drought-stressed animals benefit from the use of molasses-urea

blocks: The block increases the efficiency of roughage utilisation in all but the best fed of animals. Thus it will increase milk-yield for nursing and dairy animals and it may even increase fertility in an animal otherwise suffering from malnutrition. Regular access to molasses-



urea feed-blocks helps maintain body weight and condition in ruminants during times of drought and it may assist in increasing body weight at other times.

Are there any problems when molasses-urea blocks are used?

The Food & Agriculture Organisation of the United Nations has developed a formula which has no problems associated with its use. The animal is dissuaded from taking too much of the block at any one time by incorporating salt in the formula. This means that the block feeds urea to the bacteria at a rate at which they can assimilate it. However, it should be stressed that when no other feed is given, the animal will generally eat too much block and may then suffer from urea toxicity. Such an overdose is rarely fatal in itself but it may cause complications and possible abortion for pregnant animals. For this reason,

IT IS ALWAYS RECOMMENDED THAT THE BLOCK IS USED AS A SUPPLEMENT TO OTHER FEEDS.

It is also recommended that the block be available to the animal for the full 24 hours of each day so that it may lick or chew it as it needs it.

How big are these blocks?

Blocks can be made in many sizes depending upon the size of the animal they are to assist. For cows (which lick the block), a 10 kg block lasts a 200 kg animal for about two weeks: Such a block is typically 20 cm x 20 cm x 20 cm.

A 5 kg block is favoured for sheep and goats because they are smaller animals. Also such animals tend to chew the edges of the block rather than lick the surface. Such a 5 kg block would last a small animal for perhaps 3 weeks depending upon the availability and quality of other feeds. Animals also show marked differences in their appetite and preference for the block. Thus cows will try the block immediately whereas sheep may take a week or so before their curiosity leads them to sample the block: Some goats prefer the block to anything else whereas others in the same flock and of the same breed will rarely touch it. This variation means that it is very difficult to know, within a flock, precisely how much block any one animal is consuming.

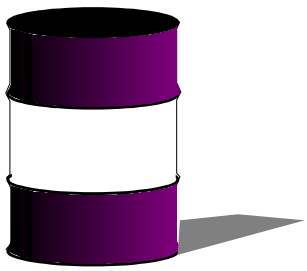
How to make the block.

Component	kgs
Molasses	45
Urea	10
Cement	10
Salt	5
Bran	30
Water	4

A typical Food & Agriculture formula is given in the attached table. As you will see, as well as molasses, urea, salt and bran there is some cement. This cement is needed as an inorganic binder to keep the block stable. Calcium oxide ("Quicklime") can also be used provided that it is free of lumps. It should perhaps be pointed out that both materials are fully reacted when the animal comes to eat the block and it is therefore quite inert in the digestive system of the animal. A small amount of the calcium in the cement may be dissolved by the digestive juices of the animal. (This tiny amount might possibly be beneficial if the animal is suffering from calcium deficiency or "milk-fever".)

Equipment

A cut-down 200 litre drum makes a very good mixing tank for a small unit making a batch of 50 kg of molasses-urea b
locks. A wooden or steel paddle is useful although not essential.



Molasses is easily stored in the same 200 litre drums which were probably used to transport the molasses from the sugar factory. (Placing the drums on a stand helps to reduce wastage). Incidentally, when estimating axle-load on vehicles carrying molasses you should be aware that each 200 litre drum may contain as much as 300 kg of molasses.

A weighing machine (eg a platform balance) is useful when starting to make blocks because it helps ensure

that the quality is consistent. However most people find that they eventually measure the required quantity on a volume basis and then they no longer need regular access to a weighing machine.

Moulds can be very simple: A piece of plastic sheet in the bottom of a pail or bucket is the simplest form of mould. The attached diagram shows a form of mould which has a low cost and makes 16 blocks at a time. (If you intend making blocks for sale such a mould is highly recommended.)

Procedure

* All ingredients are first weighed out into buckets, plastic bags or sacks;

* The cement and water are mixed in the tank by hand or by using a wooden paddle;

* The salt, molasses and urea are then added and similarly mixed;

* Finally the bran is added quite slowly as all the ingredients are mixed together;

* The mix is then shovelled into the moulds where it is tamped to displace the air - if the mould is re-filled during tamping, the larger block used by cows is prepared;

* If the 16 block-mould is being used, it can now be dismantled and removed from the blocks. Other mould-systems are usually left for about 8 hours before being removed;

* After moulding, the blocks are usually left for 24 hours before being placed in storage. (Curing continues for several weeks after this);

* Depending on the climate, blocks can be transported by the farmer to his animals within a few days.

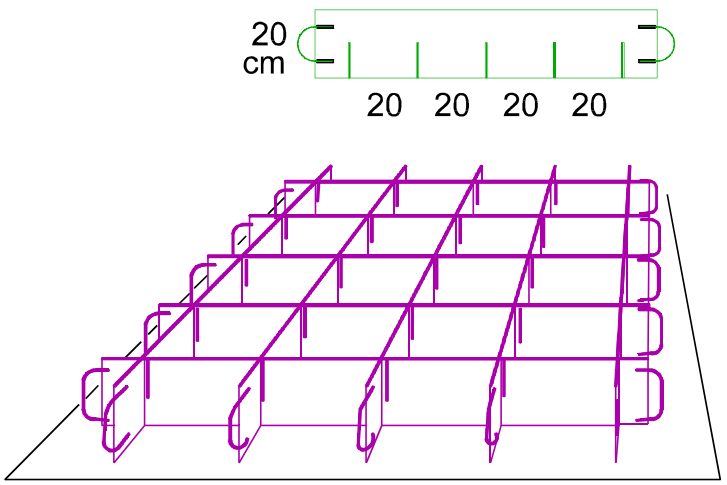
Price of the molasses-urea block

The equipment and process described are suitable for a small-scale experimental unit capable of producing about 100 tonnes a year (10,000 x 10 kg blocks). The process is quite labour intensive so block prices to the farmer reflect the local labour costs as well as the local cost of raw materials. Typically raw materials costs are about US$0.5 for a 10 kg block. This can often be reduced by considering the incorporation of locally available agricultural by-products (eg ground pea-nut husks, olive pulp etc.) in place of some of the bran. High-silica ash made from rice-husks can be used in place of half the bran and half the cement. Such a block is particularly useful when blocks have to be made in a humid atmosphere which would otherwise cause the molasses to slowly leak out. Bentonite and loess soil have also been used to replace part of the bran but total substitution is rarely possible because the block then becomes hard and brittle.

Commercial Production

There has been considerable commercial success in producing molasses-urea blocks using a concrete-mixer in place of the labour-intensive cut-down drum mentioned above. Such a mixer should have at least a 200 litre capacity so that it can make at least 100 kg of mix at a time. Typically a batch takes 20 minutes to make and to pour into the 16-block egg-crate mould illustrated. The mould can then be immediately stripped from the blocks and re-used. (Incidentally, such a mould should cost no more than about US$25 [1991 values]).

Where the sugar factory is operating throughout the year, molasses can be stored in 5 tonne tanks taken from wrecked motor vehicles or railway trucks. However, molasses storage for a 1000 tonne/year plant may have to be substantial if molasses is only available for a short time of the year. Large steel reinforced concrete tanks capable of holding up to 500 tonnes of molasses may then become essential. Even with this extra equipment, 10 kg blocks will have a price of about US$0.8 to $1.20 to the farmer from such a plant. (This is because human productivity is much enhanced by the use of the extra equipment).
Typically, a 200 kg cow would need about US$8.00 spent on molasses-urea blocks to assist it to survive a drought period of about 100 days. Depending upon stock-prices, this is usually an attractive option to the farmer. Another way of assessing economical viability is to compare the block price to the farmer with the price he would pay for a comparable



amount of crude protein in the form of concentrates. Block prices on such a basis are roughly half that of concentrates in many developing countries.

Overall, the commercial process should appeal to an entrepreneur who wants to explore the local market using locally available raw-materials. Such a person will appreciate the low capital cost of the equipment and the possibility of expanding and duplicating the equipment as the demand for the product grows.

The process as described may also be of value to farms having over 50 head of cattle (200 sheep or goats) where concentrate supply, price and quality are variable. Much will depend on the availability and cost of molasses: Some Governments make an allowance of molasses available to assist the farmer in raising livestock. As a consequence, the Ministry of Agriculture may be able to assist the entrepreneur to obtain the essential raw-materials required for molasses-urea block production.

Village co-operatives and schools may be interested in making molasses-urea blocks for sale locally to earn income. In addition, they could be used as part of a science experiment to show how the bacteria of the rumen are indirectly responsible for milk yield and to show the overall value of nitrogen in an animals diet.

Both Faculties of Agriculture and Engineering in Universities could also use this Project Outline as the basis of either under-graduate or post-graduate research topics.

Further information

Further information on the manufacture of molasses-urea blocks and their application to animal nutrition may be obtained from:

The Director, AGA,
Food & Agriculture Organisation
Via delle Terme di Caracalle,
Rome 00100,
Italy.

Further Reading

1) Leng, R.A and Preston, T.R. (ed): "Matching Ruminant Production Systems with Available Resources in the Tropics and Sub-tropics" Penambul Books, Armidale, New South Wales, Australia.

2) Preston, T.R., Elias, A., Willis, M.B. and Sutherland T.M., "Intensive beef production from molasses and urea." Nature 216, 271 (1967).

3) Sansoucy, R.R. "Manufacturing of molasses-urea blocks" World Animal Review 57,40 (1986)

4) Kunju, P.J.G "Urea molasses block lick: A feed supplement for ruminants" Proceedings of the International Workshop, Kandy, Sri Lanka p261 (1986)

5) Sansoucy, R., Aarts, G. and Preston, T.R. "Molasses-urea blocks as a multi-nutrient supplement for ruminants" FAO Animal Production and Health Paper No. 72 pp 263-278 (1988)

6) Allen, M.L. "Design of a Process Plant for Making Molasses-urea Blocks in Sudan" Proc. CHEMECA Conference Auckland 1990.