1-1-1962

Urea for sheep and cattle on dry feed

Laurence C. Snook
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By L. C. SNOOK, Animal Nutrition Officer

Urea can be a valuable supplement for ruminants which have to depend on dry feed low in protein. It is not a substitute for good quality conserved fodder. Urea is extremely poisonous if eaten in excess and great care must be taken when feeding it to stock.

There are a variety of ways in which urea can be fed and these are outlined in this article. The Department of Agriculture's Animal Nutrition Laboratory is now carrying out trials to determine the most convenient and safest method.

Urea is most effective as a fertiliser; when used in this way it results in higher yields and appreciably increases the protein content of the herbage.

**UREA** is a simple nitrogenous compound which can be manufactured cheaply. It is being used in increasing quantities as a fertiliser for crops.

The bacteria in the rumen (or paunch) of ruminants can utilise the combined nitrogen in urea to synthesise protein. To do this, the organisms need an assured source of energy. The grazing animal normally supplies this in the food it eats. Essential minerals such as phosphate and cobalt must also be present, along with certain accessories.

Given these essentials, the rumen microorganisms build up valuable protein in their own cells. In due course these cells are digested by the host animal, which thus obtains the equivalent of a protein-rich supplement.

The mature dry herbage on which most of our grazing animals depend over the summer is seriously deficient in protein. Dry feed usually contains plenty of energy but this is poorly utilised in the absence of protein. Digestive processes slow down, and the appetite flags. Protein concentrates are too expensive to feed to grazing animals, but now that urea has become cheap and readily available it can be used as an indirect source of the protein in their diet.

Urea has been used for many years as an ingredient of feed-stuffs manufactured for cattle and sheep. In the U.S.A. urea is a standard component in most commercial dairy feeds. For a variety of reasons, however, it is not so easy to devise ways of supplying urea to animals in the field.

*It is important that stockmen should thoroughly understand the limitations, as well as the advantages, of using urea in feedstuffs.*

Basic principles are:

- Urea is of value only to ruminants, that is to animals which chew their cuds. The compound is of no value when included in the feed for horses, pigs, or poultry.
Urea is extremely poisonous if consumed in excess. Most of the experimental work has been concerned with the development of ways of limiting consumption to safe levels.

Fortunately urea is extremely bitter, and this normally limits intake. Foods containing urea are most dangerous when fed to hungry animals which will eat ravenously despite the disagreeable taste.

Urea can be utilised by micro-organisms only in the presence of energy-rich food. Crude roughage such as mature grass or cereal straw can provide this energy. If ordinary feed is in short supply urea not only becomes valueless but it also becomes highly toxic. Urea is not a substitute for feed.

The rumen micro-organisms need minerals and other accessories in order to grow and work efficiently. Phosphorus and cobalt are the two minerals most likely to be missing, and these should be added to any mixture supplying urea. Investigation is required to determine just what “accessories” are required to permit the rumen flora to make maximum use of urea.

### SUPPLYING UREA TO GRAZING ANIMALS

The following methods of supplying urea to sheep and cattle in the field will be considered:

1. Spraying dry pasture with mixtures of urea and molasses.
2. Supplying urea in mixtures fed in the form of:
   a. Solid blocks.
   b. Liquids.
3. Adding urea to cereal grain.
4. Adding urea to drinking water.
5. Urea as a fertiliser.

### 1.—SPRAYING ON DRY PASTURE

This method was pioneered in South Africa. Solutions containing urea and molasses are sprayed onto the dry material which is to be fed to the cattle or sheep. The main object is to distribute the urea over a considerable bulk of feed so as to eliminate any risk of poisoning. The molasses serves as an adhesive and to encourage the stock to eat the treated material.

There is no doubt that under certain conditions this method of use is effective. It is unlikely, however, that spraying dry pasture or standing stubble will be practised to any degree in Western Australia. Considerable labour is needed to prepare the solutions; molasses tends to clog the spray nozzles; much of the solution runs onto the ground where it is wasted and fresh areas have to be sprayed every few days.

### 2a.—UREA IN COMPOUND BLOCKS

This method of feeding urea to sheep and cattle has many advantages. The object is to provide a supplement which will so stimulate the appetite that the animals will seek out and consume the dry roughage available in the field.

Last autumn, for example, farmers were able to entice stock to eat cereal stubbles normally not eaten at all. This was achieved by providing blocks containing urea, molasses and minerals which helped the digestion of the low quality roughage. Because the roughage is digested the animals become hungry and eat more roughage. It is this effect on appetite which is most beneficial.

The main difficulty is to perfect a block which can be used with safety. The mixture must be palatable enough to entice the animal to eat enough urea without it being so attractive that over-consumption is likely. It has already been stressed that urea is poisonous if eaten too quickly. But obviously, the blocks will be useless if the material is not consumed in moderation.

Satisfactory commercial blocks can now be purchased which have only been put on the market after exhaustive trials.

Under most conditions these blocks will do the job for which they were designed. In tests carried out by the Animal Nutrition Laboratory last season it was found that neither sheep nor cattle took any interest in the commercial blocks while the paddock feed was reasonably good. But as the season progressed and the dry roughage declined in nutritive value the blocks attracted more and more attention until consumption reached the expected optimum intake.
Certain precautions are necessary if losses are to be avoided. The blocks may contain as much as 36 per cent urea, so that if fragments can be broken off and eaten, deaths could result. However, animals are only likely to eat dangerous quantities if they are hungry, or have a craving for minerals. If mineral supplements are given to the stock (as should be done) for some time before the blocks are exposed, and if ample dry feed is available, there is little likelihood of stock losses from well-made blocks placed in solid containers.

The biggest drawback to the use of commercial blocks is the high cost of transport. This seriously limits the areas where purchased blocks may be economically used.

Because urea is potentially dangerous it is debatable whether farmers should be encouraged to make their own blocks. If maximum use is to be made of urea, however, farmers in outlying districts, who have most of the ingredients on hand, should be given the opportunity to make urea-mineral blocks. For this reason tests are now being carried out at the Animal Nutrition Laboratory to determine just what can be done.

Home-made Urea Blocks

It is easy to give a recipe for a home-made block but again it must be emphasised that urea is a deadly poison if it is eaten to excess.

Extreme care is essential in preparation of urea mixtures. The procedures are simple and straightforward but there is no margin for carelessness.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Cost in Perth</th>
<th>Probable cost per pound on farm</th>
<th>Quantity required</th>
<th>Cost to farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urea</td>
<td>£49 per long ton s. d. 0 6</td>
<td>33 lb.</td>
<td>s. d. 16 6</td>
<td></td>
</tr>
<tr>
<td>Molasses</td>
<td>£3 14s. per 44 gal. drum 0 4</td>
<td>5 lb.</td>
<td>1 8</td>
<td></td>
</tr>
<tr>
<td>Salt</td>
<td>£8 10s. long ton 0 1</td>
<td>50 lb. 4 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pollard</td>
<td>£32 per short ton 0 3</td>
<td>10 lb. 2 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superphosphate</td>
<td>£13 per long ton 0 1½</td>
<td>2 lb.</td>
<td>0 3</td>
<td></td>
</tr>
<tr>
<td>Commercial cobalt sulphate</td>
<td>8 0</td>
<td>1 oz.</td>
<td>0 6</td>
<td></td>
</tr>
<tr>
<td>Cost of ingredients for</td>
<td>100 lb. = 25 7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The basic ingredients and the quantities required are roughly as shown in the table below.

The salt is used mainly to limit intake. It may also serve to attract sheep to an otherwise unpalatable block.

The pollard is added as a binder. It also provides readily available energy to stimulate the growth of rumen organisms.

Superphosphate is added as a convenient source of sulphate, which appears to be necessary for the efficient utilisation of urea. This also supplies phosphorus which is equally necessary.

The cobalt sulphate ensures that the essential cobalt element is present.

Mixing

Preliminary tests show that a reasonable block can be obtained by thoroughly mixing the salt, urea, pollard and superphosphate on a clean floor then adding the molasses and cobalt mixed with enough water to make the whole mass moist and sticky.

This moist mass can then be rammed into cut-down 4 gallon drums or tins and left to harden.

Sheep and cattle are not likely to be able to eat excessive amounts of such a mixture, even if there is an urge to do so. However, when the containers are first put out, careful watch should be maintained until it is apparent that the lick is not too attractive. To date our test animals have eaten very little of the blocks available to them.

Quantity to Feed, and the Cost

In trials carried out in Queensland (Morris, 1958) with heifers fed bush hay containing 4½ per cent. crude protein, it was found that on the hay alone the average loss in body weight was 40 lb. During the same period similar heifers on the same hay plus 2 oz. of urea per head per day gained 60 lb.

From this and similar evidence it seems that cattle on dry feed should receive from 2 to 3 oz. of urea per head daily. This amount will be obtained from 6 to 9 oz. of the mixture containing 33 per cent. urea. In other words, the block must be made so that cattle will eat up to half-a-pound...
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Junior.—

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(b) Physics and Chemistry (or Science A and Science B), or General Science.
(c) Book-keeping.
(d) Others such as Geography.

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a head a day. This quantity is safe if obtained slowly by licking but could be fatal if eaten in one lump.

The ingredients to make the above mixture cost about 3d. a pound. This means that quite an adequate supplement of urea can be provided for cattle at a cost of 1½d. a head a day.

Considerable benefit could be obtained if cattle on dry feed regularly consumed as little as a third of a pound of the block daily, equivalent to 1 oz. of urea. This amount of home-made block would cost less than a penny a head for ingredients.

Sheep on dry feed will need about 1½ oz. of urea per week. If a sheep eats about a pound of a mixture containing 33 per cent. urea each month it will obtain close to this amount at a cost for ingredients of about 3d.

The main difficulty is to make a block which will be eaten at about the required rate. Various blends will be fully field tested for this and for their usefulness to stock during the coming summer, using sheep and cattle on poor quality dry feed. Stock owners will be advised as further information becomes available.

Alternative ingredients are also being tested. The salt, for example, is worthless except to limit consumption. Superphosphate may be equally effective for this purpose and could be more convenient and equally as cheap on many farms. Pollard can be replaced by finely ground wheat—and this too could appreciably reduce costs for outback farmers.

Molasses is the most annoying ingredient. It clogs up the works at all stages. Investigations in progress at the University Institute of Agriculture (Moir, 1962) indicate that molasses may supply "accessory factors" which improve the efficiency with which urea is converted to protein by ruminal organisms. It is possible, however, that cereal grain may also supply these factors. If such is the case the molasses could be eliminated and all that the farmer would need to buy from the city would be the urea and the cobalt.

If a mixture along the following lines can be compounded into a satisfactory block, which is consumed at the required rate, the outback farmer will be able to provide his stock with urea quite cheaply.

### MIXTURE UNDER TEST

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urea</td>
<td>33 lb.</td>
</tr>
<tr>
<td>Salt</td>
<td>20 oz.</td>
</tr>
<tr>
<td>Finely ground wheat</td>
<td>15 lb.</td>
</tr>
<tr>
<td>Superphosphate</td>
<td>32 lb.</td>
</tr>
<tr>
<td>Cobalt Sulphate</td>
<td>1 oz.</td>
</tr>
</tbody>
</table>

| Total                   | 100 lb.  |

**Precaution:** Never give hungry animals access to urea-mineral-molasses mixtures. It is the hungry animal which is most likely to eat a supplement ravenously, even if it is unpalatable. It is also the hungry animal which is most vulnerable to an overdose of urea.

Mineral deficient animals are likely to have depraved appetites and may eat excessive amounts of a normally unpalatable mixture. For this reason it is recommended that farmers who plan to make their own urea-mineral mixture should first make up a mixture containing all the ingredients except the urea and supply this first to the stock. Stock sometimes eat excessive amounts of a mineral mixture when it is first made available, but in a matter of weeks the craving becomes satisfied and much smaller intakes suffice. It is for this reason that the urea should be omitted until consumption rates become standardised. During the preliminary feeding period before urea is used, it may be advisable to leave the mixture loose and flakey to encourage consumption.

### 2b.—UREA IN NUTRIENT LIQUIDS

In the U.S.A. large numbers of cattle are given urea supplements in a liquid form. In addition to urea these supplements contain salt, molasses, and minerals which limit the intake of fluid. This method of supplying urea and minerals must have advantages as large companies have been established overseas to provide the liquid concentrate.

This method was used to supply urea to sheep in the successful tests carried out at the University Institute of Agriculture by Mr. Moir. In these tests penned sheep did quite well on no other feed than oat...
hulls and the urea-molasses-mineral solution.

A local company is marketing a liquid concentrate which supplies urea. Freight charges are likely to restrict the use of this form of supplement.

3.—ADDING UREA TO CEREAL GRAIN

This method of using urea is perhaps the most promising of all for stock owners with supplies of cheap grain.

If 8 lb. of urea, costing 4s., is dissolved in enough water to dampen 3 bushels of oat grain, costing 10s., the resultant mixture (costing 14s. on the farm) will contain as much nitrogen and as much energy as 100 lb. of linseed meal which would cost about 50s. in Perth. It is not suggested that oats plus urea are as good nutritionally as linseed meal. The figures are quoted simply to indicate how urea can increase the "protein replacement" value of cereal grain.

Here again the problem is to limit consumption of a feed stuff containing urea. Salt could be used but a better deterrent is available in the form of Christmas Island phosphatic dust ("Christmas Phos"). When 5 lb. of this dust is added to each 100 lb. of oat grain the palatability is so reduced that wethers in pens will take all day to eat 2 lb. of grain, which would normally be eaten in an hour or so.

Farmers can use this deterrent to limit the consumption of grain treated with urea. A suggested mixture is:

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oat grain</td>
<td>100 lb.</td>
</tr>
<tr>
<td>Urea</td>
<td>3 lb.</td>
</tr>
<tr>
<td>&quot;Christmas Phos&quot;</td>
<td>5-10 lb.</td>
</tr>
<tr>
<td>Commercial cobalt sulphate</td>
<td>1 oz.</td>
</tr>
</tbody>
</table>

The urea and cobalt sulphate is dissolved in enough water to moisten all the grain. This can be done with a spray or in a cement mixer.

The phosphate dust is then added so that each grain is coated. By adjusting the amount of "Christmas Phos" which is used, it should be possible to make treated grain available to sheep in self-feeders or open troughs without danger of over-consumption.

Here again tests should be made with dusted grain before any urea is added. If it is found that intake can be controlled satisfactorily then, and only then, should 3 per cent. urea be added. If sheep eat ½ lb. of treated oat grain per head daily they will obtain close to 7 grams (¼ oz.) of urea. This is quite a reasonable intake and, for the farmer who has cheap oat grain on hand, is possibly the cheapest and most convenient way of providing urea to sheep on dry feed.

Cereal grain treated with 3 per cent. urea should be one of the safest vehicles through which to supply urea. Well-fed sheep or cattle could probably eat their fill without coming to any harm. Toxic effects would be expected in hungry animals.

Molasses has not been included in the grain-urea-cobalt-phosphate mixture because it is anticipated that the grain will provide the "accessory factors" which may be needed. If it is considered that molasses is necessary 5 lb. can be added to the water required to treat each 100 lb. of grain.

4.—ADDING UREA TO DRINKING WATER

Preliminary tests carried out with penned sheep at this Laboratory some years ago indicated that urea could be easily supplied through the drinking water.

Unfortunately there are a number of practical difficulties which seriously limit this method of supplementation. In the field accidents can happen which can result in serious losses. Consumption of water can vary considerably from animal to animal, and from time to time. This makes the adjustment of treatment rates difficult.

The growth of organisms in treated water can be controlled with copper solutions but nevertheless chemical changes can at times be a problem. For the present, therefore, farmers should not attempt to supply urea to stock through the drinking water.

On pastoral properties it is probable that the only economic way to provide the supplement is through drinking water. To meet this situation a West Australian company, after many trials, has perfected a
simple yet efficient unit designed to add specific quantities of urea and minerals to drinking water. These units give good service when the special mixture is used as directed. These units may give valuable returns where rank mature grass is the only fodder available to cattle and sheep on extensive range.

5.—UREA AS A FERTILISER

The most effective way to use urea is as a fertiliser.

When used in this way not only will heavier yields of fodder be obtained from treated crops and pasture, but the protein content of the herbage will be increased appreciably. Obviously, it is better to let growing plants turn urea into protein than to carry out the work and run the risks associated with the use of urea in livestock rations.

UREA IS NOT A SUBSTITUTE FOR GOOD HUSBANDRY

The main purpose of supplying urea to sheep and cattle is to enable them to utilise dry grass, straw, and similar products which are normally of little value.

Urea is useful for this purpose but it should always be remembered that the most profitable form of livestock husbandry is to grow and conserve good quality feed. Only in times of emergency should it be necessary to depend on low grade roughage.

Good quality home grown fodder will always give better results than inferior roughage plus urea. On a well developed farm it could be taken as evidence of bad management if urea has to be used to make sheep or cattle eat coarse roughage.

EFFECT OF UREA ON NON-RUMINANTS

When feeding stuffs containing urea are made available to sheep and cattle, it is certain that other animals, especially horses, will gain access to the supplement. It is unlikely, however, that the supplements will be harmful to non-ruminants. In Queensland urea-molasses-mineral blocks have been used extensively for some years and no reports of any losses in horses have been received.

It is a reasonable precaution to keep other stock away from the urea supplements prepared for sheep and cattle but it is not anticipated that careful segregation will be necessary.

SUMMARY

Urea, along with essential minerals, can be of considerable value to ruminants dependent on dry feed lacking protein.

Alternative ways are being investigated for supplying urea to stock. These include spraying on dry pasture, feeding in compound blocks, in nutrient liquids, with cereal grain and in drinking water.

Where cereal grain is freely available this appears to be the safest and most economical vehicle for the supply of urea.

Urea is of NO value to horses, pigs or poultry, nor to sheep and cattle which have access to feed containing adequate protein.

REFERENCES

Moir, R. J. (1962): Personal communication.
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