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Urea in Dairy Rations – It's Uses and Functions
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UREA in Dairy Rations

- Its Uses and Functions -

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Urea can replace part of the protein required in the rations of dairy cattle. It has been used successfully in corn silage and in grain rations to reduce the cost of supplemental protein.

Urea is a synthetic source of nitrogen. In the rumen stomach it is converted to ammonia which bacteria and other microorganisms convert to true protein. The animal then digests it and uses it for growth, milk production, and other body functions.

Maximum Levels of Urea

The amount of urea that can be used in the ration depends on the capacity of rumen microbes to convert ammonia to protein, and the amount of non-protein nitrogen such as ammonia, urea, and nitrates, naturally present in the feed. Other factors may be important but are not well established. Animal performances may be less than desirable when the urea intake exceeds about 0.027 pounds of urea per 100 pounds body weight of cattle. This amounts to approximately 0.8% of the total dry matter in the daily ration or 0.35 pound (160 grams) urea per day for a 1,200-pound cow, which is approximately one pound of protein-equivalent from urea.

The maximum amount of urea that can be provided in grain rations and remain within the above limitations is shown in Table 1. Note that urea should not be added to grain rations when corn silage containing 10 pounds urea per ton is the only forage fed. When other forages (hay, haylage, or silages) are fed, the intake of corn silage and urea is reduced proportionately; thus urea can be included in the grain ration as indicated in Table 1.

Reduces Protein Cost

Urea contributes most to reducing protein costs when low protein forages such as corn silage or grass hay are the major forages fed. When high protein forages such as alfalfa hay or haylage constitute the major forage and very little protein supplement is required, the use of urea will be of little importance.

Urea is considered economical when the cost of 10 pounds urea (42% Nitrogen or 9 pounds of 45% N urea) plus 70 pounds shelled corn (or other grain) is less than the cost of 70 pounds of soybean meal.

Balance Forages with Protein

To determine the protein content (%) required in the grain ration, see Table 2.

- (1) Find forage quality similar to yours on left margin.
- (2) Find pounds of hay or hay-equivalent you are feeding (as haylage or grass silage) at top-right.
- (3) Read protein percent below pounds of hay and across from forages fed.

Start Slowly With Urea

Cattle and the rumen microbes require about three weeks to get fully adapted to using urea. Start with a low level (about 1/3 of the final amount) and increase the urea content gradually in subsequent batches until the desired level is reached. Cattle may eat grain rations more slowly until they are accustomed to the urea.

Avoid Urea Toxicity

Complete and thorough mixing of urea in the other ingredients is absolutely necessary to avoid accidents that cause death of cattle from urea toxicity.

1. Never feed urea or a urea-containing protein supplement without diluting it by mixing completely in the grain ration or other feed. One-fourth pound of urea is enough to cause toxicity if fed to cattle that are not accustomed to urea or if it is the only feed consumed. Cattle can consume much larger amounts after they have become accustomed to it and are kept on a urea ration continuously. Cattle can lose their adaptation to urea within 3 to 4 days after urea is withdrawn.

2. Never feed a ration that contains more than two percent (2%) urea.

3. Beware of mixing urea with wet-corn or other ingredients that may cause the urea to "bunch-up" and fail to distribute evenly throughout the ration.

4. Don't try home-mixing unless you have satisfactory mixing equipment to insure uniform distribution.

5. Never leave urea or high urea supplements accessible to cattle or other livestock.

6. Premixing of the urea with a small amount (200 to 300 pounds) of ground dry grain before adding to the full batch of feed will help to insure uniform distribution of the urea.

Urea Toxicity develops rapidly when cattle consume excessive amounts. The symptoms include uneasiness, muscle and skin tremors, excess salivation, labored breathing, incoordination or ataxia, bloat, tetany, and death.

Antidote - Acetic acid as a 5% solution or as vinegar given orally (drench) is an effective cure if given before tetany develops. Approximately one gallon of vinegar is a readily available material for treating an adult cow.

Table 1.

**Maximum Urea Allowable in Grain Rations for
Dairy Cattle Fed Urea - Corn Silage and Other Forages**

Forage Feeding Programs				Corn Silage (no urea added) Other Forages
Urea Corn Silage Fed Free Choice (10 lbs. Urea added per ton Silage)				
a Hay-Equivalent of Legumes or Grasses lbs./day	Maximum in Grain Ration		Prot. Equiv. ^b from NPN %	Maximum in Grain Ration
	Urea %	lbs/T		
0	0	0	0	1.5% Urea
5	0.3	6	0.8	30 lbs. urea per ton
10	0.6	12	1.7	or
15	0.9	18	2.5 ^c	4.2% protein-equivalent from non-protein- nitrogen in grain ration.
20	1.1	22	3.0	
25	1.5	30	4.2	

a Hay-Equivalent = pounds dry hay; 0.6 × pounds. 50% moisture haylage; or 0.33 × pounds wilted silage fed. Table assumes urea corn silage consumption reduced as hay-equivalent from other forages is increased; and one pound grain fed per 3.0 pounds milk.

b "Protein-Equivalent from Non-Protein-Nitrogen" contained in commercial supplements is given on the feed tag. To determine above figure, multiply percentage given on feed tag times hundred pounds (cwt.) of supplement added and divide by cwt. total feed in batch.

Example: Supplement tag reads 23% protein-equivalent from NPN. Two hundred pounds added per ton. $23 \times 2 = 46 \div 20 \text{ cwt. (1 ton)} = 2.3\%$ protein-equivalent from NPN in grain ration. Conclusions: From the table it is observed that if urea-corn silage is fed free choice, then 15 pounds of hay-equivalent per head daily from other forages should be fed. Otherwise, the amount of urea in the grain ration should be reduced.

c Cornage (30% moisture corn grain ensiled) with 10 pounds urea added per ton contains 0.7% urea or 2.0% protein-equivalent from NPN on a dry matter basis. Urea should not be included in cornage to be fed with urea corn silage unless 12 pounds or more hay-equivalent from other forages is also fed.

Table 2

**PROTEIN CONTENT OF GRAIN RATIANS FOR
FORAGE FEEDING PROGRAM**

Forages	Hay Fed Daily with Corn Silage					Hay or Hay- lage only.
	Pounds					
	0	5	10	15	20	
Percent Protein in Grain Ration						
Excellent Alfalfa. 18% Protein pre-bloom, very leafy						Cereal grains to 70# milk/ day. Add 1# SBM or equiv./10# milk above 70.
Corn Silage	19	14	11	10	10	
Urea corn silage (10 lbs./T)	14	12	9	8	8	
Alfalfa, average. 15% protein 1/10 - 1/2 bloom						
Early cut bromegrass						Cereal grains to 60# milk/ day. Add 1# SBM or equiv./10# milk above 60.
Corn silage	19	15	13	13	12	
Urea corn silage (10 lbs./T)	14	13	11	11	10	
Alfalfa & Grass late bloom 12% protein Alfalfa seed stage Clover and Grass mixture						
Corn Silage	19	15	14	13	13	12
Urea corn silage (10 lbs./T)	14	13	12	12	11	
Bromegrass, average 10% protein Timothy, pre-bloom						
Corn silage	19	16	15	15	14	13
Urea corn silage	14	14	13	13	13	
Mature bromegrass, Timothy 6-8% protein Sudan grass, corn fodder						
Corn silage	19	17	17	17	17	17
Urea corn silage						

¹ Haylage pounds \times .6, or wilted silage pounds \times .33 are equivalent to hay in dry matter content. Rations at normal feed consumption for no grain below 20 pounds milk per day and 0.5 pounds grain per pound of milk above 20 pounds per day. Where grain is scarce and forage quality is good, feed no grain below 30 pounds milk per day and feed 0.60 pounds grain per pound of milk above 30 pounds milk per day.

² Table is based on production of 60 pounds milk per cow daily plus maintenance of mature cows. Cows producing above 60 pounds may respond to additional protein.