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Dairy Guidelines

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Protein Supplements for Lactating Cows

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Corn silage has emerged as the principal forage for dairy cattle in Virginia. The corn plant is quite low in protein and corn protein is poorly digested. Because of this low quantity of digestible protein, it is imperative that special attention be given to supplying considerable quantities of protein from other sources.

Concentrate Protein Requirements

In rations where corn silage furnishes most of the forage for dairy cows, an 18-20% crude protein concentrate is usually necessary to meet the protein needs for lactation. However, if moderate amounts of good quality legume hay (0.5-1.0 lb. per 100 lb. bodyweight) are fed with corn silage, 16% crude protein in the concentrate is normally satisfactory. Any oil meal product is an excellent source of protein. Also a number of other feedstuffs, such as corn gluten meal and corn distillers' dried grains are satisfactory protein supplements and often have economic advantages compared with oil meals. Judgment must be exercised when choosing protein sources because some are less digestible and may contain considerable fiber. Fiber tends to reduce the protein and energy available for productive purposes. Comparisons of some common feed sources are shown in Table 1.

Table 2 shows examples of some 14, 16 and 20% crude protein concentrates. These rations are suitable for either urea treated corn silage, corn silage plus legume hay or high quality corn silage, depending on the crude protein content.

Urea As A Protein Supplement

Proteins are complex chemical substances containing carbon, hydrogen, oxygen, nitrogen, phosphorus and sulfur. Rumen bacteria break down the protein of feedstuffs into ammonia and energy-containing compounds. These are in turn, reassembled into some 20 different amino acids, which are utilized as the building blocks for proteins in the animal's body, as well as milk protein.

By contrast, urea is a very simple compound made up chiefly of nitrogen, but it also contains carbon, hydrogen, and oxygen. It is a normal component in the cow's bloodstream and is excreted in the urine as a byproduct of protein metabolism. Urea is rapidly converted to ammonia and carbon dioxide when it enters the rumen. The ammonia is used to form amino acids just as ammonia from protein is utilized. However, urea contains no energy, and is useful in dairy feeds only when fed with high energy type feeds. One pound of urea contains enough nitrogen to form 2.81 lbs. of protein in the rumen if sufficient energy compounds are available.

Nutritionally, a mixture of 7 lbs. corn and 1 lb. urea is nearly equal to 7 lbs. soy-bean meal in crude protein and energy.

Urea In The Concentrate Mixture

In V.P.I. studies, when 0.35-0.40 lb. per day of true urea was consumed per cow, milk production was moderately reduced when compared with cows consuming no urea. Based on these studies, some reduction in milk production can be expected in high producing cows consuming 27-30 lbs. of concentrate containing 1.3 lbs. of urea per 100 pounds. Because of this, concentrate mixtures should not contain more than 26 lbs. of urea per ton. Expressed in the same manner as required by state law on the feed tag, 26 lbs. of urea per ton is equal to 3.6% protein equivalents of non protein nitrogen.

When silage contains 10 lbs. urea per ton, it is unwise to feed concentrates that contain urea. Cows usually consume in excess of 80 lbs. of silage per day. Four tenths of a pound of urea would be eaten at this rate, causing excessive intake if the concentrate contains urea. Although research is underway, sufficient data is not available to recommend the use of urea in the concentrate when the silage contains urea.

Urea In The Silage

It has become quite popular to add 10 lbs. of urea per ton to corn silage at the time of ensiling. Corn silage cut in the hard dough stage, normally containing about 2.7% crude protein, would run about 4.0% protein equivalent if treated with urea. Based on research experience and analytical results, finished silage should not exceed 40% dry matter. Higher dry matter allows more urea to be converted to ammonia and may permit ammonia losses. Ensiling urea with corn has a number of advantages as compared to feeding urea in the concentrate. These are:

- (1) Uniform urea distribution in the feed can be expected with reasonable care.
- (2) Silage overcomes urea palatability problems.
- (3) Urea is consumed over a longer period of time.
- (4) Better utilization of urea can be expected.
- (5) No depression in milk production is likely to occur.

In addition to these advantages, a 14-16% crude protein content in the concentrate is adequate to support high levels of milk production. Thus, the feeding of high priced oil meals can be reduced.

Table 1. Relative Value of Some Common Feedstuffs^{1/}

Energy Sources	Protein		TDM	ENE ^{3/} Therms/100 lbs.	Crude Fiber	Value per cwt. when corn is \$1.50/bu. and SBM is \$5/cwt. ^{4/}
	Total	Digestible				
Corn dent, US No. 2	8.9	6.8	81	81	2.3	2.68
Corn and cob meal	7.4	5.3	73	72	8.7	2.37
Hominy feed	11.1	7.4	84	84	5.0	2.85
Barley	9.1 ^{2/}	6.8 ^{2/}	78	80	5.3	2.70
Oats	11.2 ^{2/}	8.4 ^{2/}	68	70	10.7	2.53
Wheat	10.9 ^{2/}	9.0 ^{2/}	79	79	2.2	2.82
Molasses	3.0	1.7	67	80	0.0	2.35
<u>Protein Sources</u>						
Alfalfa meal (dehy)	20.6	13.6	57	48	19.6	2.25
Cottonseed meal	41.6	33.7	64	69	10.7	4.19
Brewers dried grains	25.9	19.2	60	60	14.5	2.96
Corn, distillers grains, dehy.	27.2	19.3	82	84	9.0	3.64
Corn gluten meal	42.9	36.9	78	78	4.0	4.65
Corn gluten feed	25.3	21.8	74	69	7.9	3.36
Peanut meal	47.4	43.1	75	78	13.1	5.10
Soybean meal	45.8	41.2	73	74	5.8	4.82
Soybeans, whole	36.8	33.1	81	81	6.4	4.48
Wheat bran	16.0	12.5	62	62	10.0	2.58

^{1/}With the exceptions noted, values taken from National Academy of Sciences - National Research Council, Publication 1349.

^{2/}Values from analysis of Virginia grown grains.

^{3/}ENE is calculated from the N.R.C. values in Publication 1349.

^{4/}Values based on available ENE and Digestible Protein (Dairy Guideline Series 107) when corn cost \$1.50 per bu. and soybean meal cost \$5 per cwt., then the feedstuffs are worth the indicated value on a nutritional basis.

Table 2. Some Suggested Concentrate Rations

Ingredient (% protein) ^{1/}	Cost cwt.	Per cent crude protein								
		14	14	14	16	16	16	20	20	
Ground shelled corn (8.9)	3.00	825	700	365	771	840	768	590	480	755
Hominy (yellow) (12.0)	2.82	---	---	500	---	---	---	---	---	---
Corn gluten meal (42.9)	5.10	---	---	---	---	---	160	---	---	---
Corn distillers grains w sol dehy (27.2)	4.00	---	243	---	---	---	---	---	350	---
Ground whole soybean ^{2/}	4.30	---	---	---	---	---	---	300	---	---
Oil meal ^{3/} (42-47)	5.10	143	25	103	200	115	50	78	138	200
Urea (281%)	5.30	---	---	---	---	13.0	---	---	---	13.0

TDN		76.85	78.03	78.87	76.63	73.80	77.21	77.52	78.34	75.74
Crude fiber		2.66	3.87	4.62	2.86	3.01	2.97	4.23	4.98	4.29
Cost cwt.		\$3.34	\$3.34	\$3.17	\$3.47	\$3.32	\$3.52	\$3.60	\$3.68	\$3.49

^{1/}All rations should contain 20# deflorinated rock phosphate (5.00 cwt.), 10# trace mineral salt (2.80 cwt.), 3 million IU of vitamin A (\$0.11), and 4 million IU of vitamin D (\$0.08).

^{2/}Urea should not be formulated with ground soybean seeds. The enzyme urease, present in soybeans, will release ammonia from urea.

^{3/}Soybean, cottonseed, and peanut oil meals may be substituted for each other in any of the rations.