


MICHIGAN BEEF PRODUCTION

Cooperative Extension Service  Michigan State University

Protein-Mineral Supplements for Growing and Finishing Cattle Fed Corn, Corn Silage Rations

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This fact sheet outlines the amount/head/day of protein-mineral supplement needed for growing and finishing cattle fed shelled corn, corn silage rations. Amounts are given for different weights, sexes, frame sizes, amounts of corn in the ration, and whether or not the corn silage was treated with a non-protein nitrogen (NPN) product. Also, the desired nutrient content of the protein-mineral supplements are given as well as the amounts of ingredients/1000 lb. batch soybean meal and urea based supplements. The supplementation programs are based upon Fact Sheet 1097, "Summary of Nutrient Requirements for Growing and Finishing Cattle." This fact sheet has two parts. The first describes the protein and mineral requirements of growing and finishing cattle, the average nutrient composition of corn, corn silage and supplements used to develop the feeding guidelines, and adjustment for sex and frame size of cattle. The second part contains a series of supplement feeding guidelines for different silage treatments.

Summary of Nutrient Requirements Used

The protein and mineral requirements are based on the concept of *equivalent* weight. All weight groupings are referenced to an average framed steer, one that will reach a fatness of low choice at a weight of 1050 to 1100 lbs. The term equivalent weight is used to indicate weights at which animals of different frame sizes are equivalent in body composition, hence nutrient requirements. Small framed steers are defined as those reaching a fatness of low choice at 800 to 880 lbs., while large framed steers reach that point at

1200 to 1300 lbs. Small framed heifers reach low choice at 660 to 720 lbs., average framed at 800 to 880 lbs., and large framed at 940 to 1030 lbs.

Table 1 summarizes the protein requirements, as a % of ration dry matter, by sex, frame size, weight, and lbs. corn/head/day/cwt. body weight. Allowances were made for protein quality differences between corn grain and corn silage. As gain/day increases, as noted in Fact Sheet 1041, "Protein Requirements for Growing and Finishing Cattle," the *biologically available* protein required/day for tissue growth increases. Thus the biologically available protein required, as a % of ration dry matter, increases. But, the protein quality of corn grain is superior to that of corn silage; as a result, less total (crude) protein is required/lb. of weight gain on high grain than on high silage rations. The net effect is a small increase in total protein required as the corn/head/day fed increases for cattle with equivalent weights of less than 900 lbs. For equivalent weights of 900 lbs. to market weight, total protein required decreases as the corn in the ration increases since the major portion of the protein required at that stage of growth is for maintenance, not tissue gain. The mineral requirements for calcium, phosphorus, potassium, and salt are given in Table 2.

Table 3 summarizes the feeds used in developing the supplements and their nutrient values. Shelled corn is the primary energy feed. Protein feeds are 44% crude protein soybean meal and feed grade urea. Roughages include untreated corn silage and corn silage treated with sufficient NPN to raise its crude protein from 8% to 13% of dry matter. Minerals in-

Table 1. Protein Requirements for Shelled Corn, Corn Silage Rations

Lbs. Corn/ head/day/cwt. body weight*		Animal sex, frame size, and weight (lbs)				
		Heifer:				
	Small frame	To 385	385-450	450-510	510-575	575-Market
	Average frame	To 480	480-560	560-640	640-720	720-Market
	Large frame	To 570	570-665	665-760	760-860	860-Market
	Steer:					
	Small frame	To 480	480-560	560-640	640-720	720-Market
	Average frame	To 600	600-700	700-800	800-900	900-Market
	Large frame	To 720	720-840	840-960	960-1020	1020-Market

Dry Corn	High Moisture Corn	Total protein, % of ration dry matter				
		None	None	13.0	12.0	11.0
.6-.7	.7-.8	13.5	12.5	11.5	11.0	11.0
1.4-1.5	1.7-1.8	14.0	13.0	12.0	11.0	10.5
1.8-1.9	2.2-2.3	—	—	12.0	11.5	10.0

*These rates are for cattle started on feed as calves; increase 10% for cattle started on feed as yearlings.

clude dicalcium phosphate, limestone, calcium sulfate, and salt. Calcium sulfate is used only when urea is used in the protein-mineral supplement or when the corn silage is treated with an NPN product to raise its protein content. Calcium sulfate contains 17% sulfur.

The protein-mineral supplements developed contain calcium sulfate when an NPN product is used in either the supplement or as a corn silage treatment method. This was done to obtain a nitrogen: sulfur ratio in the neighborhood of 13:1. For some all-purpose supplements, the ratio may be less but it should *never be less than 10:1*. Specifically, 20 lbs. and 37 lbs. of calcium sulfate were used/100 lbs. urea and ammonia recovered from the silo, respectively.

Vitamins A and D are included in the supplements. However, most Michigan rations are high in corn silage which typically has a high carotene content. Cattle can convert carotene into Vitamin A. But, if you are feeding a high grain ration or if your corn silage does not have a good green color, such as in late harvested silage, feed 20,000 IU of Vitamin A/head/day. Thus, if an animal is fed at least one lb. of protein-mineral supplement/head/day there should be 20,000 IU per lb. of supplement and 20 million IU/1000 lb. supplement batch. Cattle exposed to sunlight synthesize adequate quantities of Vitamin D. Cattle fed in confinement, however, should receive 2,000 IU of Vitamin D/head/day. If the minimum amount of protein-mineral supplement fed/head/day is one lb., then there should be 2,000 IU/lb. of supplement, or 2 million IU/1000 lb. of supplement. Most vitamin pre-mixes on the market contain Vitamins A and D in the ratio 10:1. Vitamin E, with the exception

of heat processed grains, is adequate under conditions where natural feedstuffs are fed. Where grains are heat processed, research suggests that it may be advisable to provide supplemental Vitamin E. The requirement appears to be in the range 10 to 25 IU/head/day for growing and finishing cattle. Thus, there should be 250 IU/head/day or 250,000 IU/1000 lb. supplement batch. If supplemental vitamins are obtained *exclusively* through a mineral supplement, then the IU/lb. will have to be four to six times larger than in a protein-mineral supplement because mineral supplements are fed in much smaller amounts/head/day.

Supplementation Programs for Corn - Corn Silage Rations

The following sections outline recommended supplementation programs for different amounts of corn/head/day cwt. body weight and for various *equivalent* weights. The sections are differentiated by whether or not the corn silage was treated with an NPN product. Various levels of NPN treatment are considered.

Each cattle feeder will only need to use the section that covers the silage treatment system he uses. Further, while many supplements are given in each section, no more than two, and often only one, protein-mineral supplement will be needed for any individual. At the end of each section, examples of how to use the tables are given.

If you are considering a commercial supplement that has a different composition than those given in this fact sheet, work through Fact Sheet 1098, "Ra-

Table 2: Mineral Allowances

		Animal, sex, frame size and weight (lbs)				
Heifer:						
Small frame	To 385	385-450	450-510	510-575	575-Market	
Average frame	To 480	480-560	560-640	640-720	720-Market	
Large frame	To 570	570-665	665-760	760-860	860-Market	
Steer:						
Small frame	To 480	480-560	560-640	640-720	720-Market	
Average frame	To 600	600-700	700-800	800-900	900-Market	
Large frame	To 720	720-840	840-960	960-1020	1020-Market	

Mineral	Mineral, % of ration dry matter				
Calcium	.46	.40	.34	.28	.28
Phosphorus	.34	.28	.26	.24	.24
Potassium	.60	.60	.60	.60	.60
Salt	.25	.25	.25	.25	.25

Table 3: Feed Nutrient Values (Michigan)

Feed Description	Dry Matter	TDN	NE _m	NE _g	Total Protein	Calcium	Phosphorus	Potassium	Salt
	%	% of DM	Mcal/lb. DM	Mcal/lb. DM	% of DM	% of DM	% of DM	% of DM	% of DM
Concentrates:									
Corn	85	91	1.02	.67	10.0	.03	.40	.46	—
Soy 44	90	81	.88	.59	50.8	.36	.75	2.21	—
Urea	100	—	—	—	281.0	—	—	—	—
Minerals:									
Dicalcium Phosphate	100	—	—	—	—	23.0	18.0	—	—
Limestone	100	—	—	—	—	38.0	—	—	—
Calcium sulfate	100	—	—	—	—	20.3	—	—	—
Salt	100	—	—	—	—	—	—	—	100
Forages:									
Corn silage	32	70	.71	.45	8.0	.20	.21	.95	—
Corn silage with NPN added	32	70	.71	.45	13.0	.20	.21	.95	—

tion Evaluation Worksheet," to see if it will work your rations.

Adjusting for Age, Sex, and Frame Size

Table 4 gives the adjustment factor for amount of supplement fed/head/day for age, sex, and frame size. All amounts/head/day in subsequent sections are given for an average frame steer started on feed as a calf. But, a 780 lb. large framed steer has *equivalent* nutrient requirements, as a % of ration dry matter, to an average framed steer weighing 650 lbs. Thus pro-

tein-mineral supplement, as a % of ration dry matter, is the same for the 650 lb. average framed steer and the 780 lb. large framed steer. At 780 lbs., however, the large framed steer eats 13% more dry matter/day than the average framed steer and thus would need more lbs. of supplement/day.

Example:

A cattleman is starting a set of large framed heifer calves on an all corn silage ration; 2.1 lbs. of protein-mineral is recommended/head/day for an average framed steer started on feed as a calf. How should he

Table 4: Adjustment Factors for the Protein-Mineral Supplement Feeding Rate for Frame Size, Sex, and Age.

Age	Sex	Frame	Adjustment Factor, % of Average frame steer calf feeding rate
Calf	Heifer	Small	72
		Average	84
		Large	96
	Steer	Small	84
		Average	100
		Large	113
Yearling	Heifer	Small	80
		Average	93
		Large	105
	Steer	Small	93
		Average	110
		Large	124

adjust the daily feeding schedule? He should multiply the amount/head/day by .96 since the adjustment factor is 96%. That would yield,

$$2.1 \text{ lbs./hd./day} \times .96 = 2.0 \text{ lbs./hd./day.}$$

If he had a set of large framed yearling steers, the adjustment factor would be 1.23. A set of small framed steer calves would have an adjustment factor of .84.

Adjustment for Feeding Rumensin

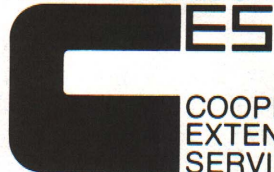
Rumensin is a feed additive for beef cattle that improves feed efficiency by increasing the energy available from a given amount of ration. Daily dry matter intake is reduced approximately 10% when rumensin is fed at the recommended rate, and daily gains are unchanged, resulting in a 10% reduction in feed requirements.

Due to the reduction in dry matter intake and no change in daily gain, some changes must be made in requirement values used to balance the ration. Although the animal is eating 10% less, its daily protein, mineral and salt requirements in actual lbs. are the same because the rate of gain is unchanged. *Thus, the percentages of protein, mineral and salt in ration dry matter given in Tables 1 and 2 in fact sheet 1097 must be 10% higher.* To do this, multiply the percentage requirement by 1.1 and multiply the expected dry matter intake by .9.

The recommended level of feeding rumensin is 30 grams per ton of dry matter or 150 milligrams/head under 600 lb., 200 milligrams from 600 to 800 lb., and 300 milligrams/head/day to those over 800 lb., based on expected daily dry matter intakes.

However, the amounts of supplement to feed/head/day recommended in fact sheets 1204A and 1204B would not be greatly changed. By following those recommendations you are feeding the same amount of supplemental protein and minerals even though rumensin is fed and total ration dry matter intake is reduced.

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