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Economical Grain Mixtures For Dairy Cows

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YOUR GRAIN MIXTURE NEEDS TO BE:

Palatable - The main ingredients in the grain mixture are usually feeds such as corn, grain sorghum, barley, or wheat. These grains are well liked by dairy animals. Freshly ground feed is more palatable than stored feed that has been contaminated by rodents or insects or that has molded or mildewed. Frequent preparation is more essential in summer than in winter. Adding dry or liquid molasses may improve palatability.

Economical - The grain mixture should supply nutrients needed to supplement those provided in the forages. Nutrients should be provided at the lowest cost possible. Protein and energy constitute over 90 percent of the cost of the grain mixture. Therefore, a major objective in formulating least cost grain mixtures is selecting the least cost sources of energy and protein acceptable for the ration.

Furnish Necessary Nutrients - The total protein in the grain mixture and the forages must meet the dairy animal's requirements plus a safety margin of about 10 percent. The grain mixture must contain minerals and vitamins to meet the animal's needs not supplied by the forages. The grain mixture should be a good source of energy. Therms of net energy in 100 pounds indicate the energy value of feeds.

EXTENSION SERVICE
UNIVERSITY OF NEBRASKA
COLLEGE OF AGRICULTURE AND HOME ECONOMICS
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Table 1. Total Protein and Estimated Net Energy Value of Common Feeds

Concentrates	Protein Percent	ENE (Therms)
Barley	11.7	80
Beet Pulp, dried	8.8	70
Corn, dent, #2	8.9	80
Corn and Cob Meal	7.4	72
Cottonseed Oil Meal	41.4	76
Grain Sorghums	11.0	78
Linseed Oil Meal	35.1	77
Molasses (less than 10%)	3.0	71
Oats (less than 25%)	11.8	72
Rye	11.9	71
Soybeans, ground	36.8	88
Soybean, hay	14.5	35
Soybean Oil Meal (mech)	43.8	80
Soybean Oil Meal (solv)	45.8	80
Urea	262 or 281.0	00
Wheat Bran	16.0	67
Wheat	13.0	80

Table 2. Recommended Percent Crude Protein in Grain Rations when the Following Forages are Full Fed

	Percent
Legume hay, legume silage or legume-grass pasture or green chop-Excellent Quality	6 - 8
Average Quality	9 - 11
Poor Quality	13 - 15
Legume hay or legume silage	
+ 20 lb. corn or sorghum silage	9 - 11 a
+ 35 lb. corn or sorghum silage	11 - 13 a
+ 50 lb. corn or sorghum silage	13 - 15 a
+ 65 lb. corn or sorghum silage	15 - 17 b
Corn or sorghum silage only	18 - 21 b

If Urea has been added to silage (10# per ton) lower protein by a - 3% b - 4%.

Vitamin Supplementation is generally not needed. Vitamin A supplementation at a level of 2000 I. U. per pound of grain is suggested for cows being fed low quality hay or limited amounts of forage. When the forages are not field cured, such as direct cut silages, a level of 4000 I. U. of Vitamin D per pound should be included in the grain ration.

Table 3 shows a method to determine percent protein and estimated net energy (Therms) in the grain ration. Also shown is a method to determine cost of protein and estimated net energy (ENE) expressed in Therms. One Therm equals 1000 Calories. In compiling the least cost grain ration select feeds that supply nutrients at the lowest possible cost. Protein and Estimated Net Energy (Therms) in different feeds are listed in Table 1.

Determine from Table 2 the amount of protein needed in your grain ration to fit with the forage you are feeding.

Mineral and vitamin supplements are considered to have no protein or energy in calculating percent protein and energy value of the ration.

The following examples show how the cost of the estimated net energy of feeds are determined. The Therm is used as the unit of measurement. One-hundred pounds of shelled corn contains 80 Therms and is $2.40 per cwt. To determine the price per Therm, $2.40 is divided by 80 and this equals 3¢ per Therm. Following the same procedure, other examples are: Ground ear corn with 72 Therms @ $2.10 per cwt. equals 2.9 per Therm; grain sorghum with 78 Therms @ $2.20 per cwt. equals 2.8¢ per Therm and oats with 72 Therms @ 90¢ per bushel or $2.80 per cwt. equals 3.1¢ per Therm. In these examples, grain sorghum is the cheapest source of energy.

The same principal is used in determining the cost of the crude protein in feeds. Crude protein is the most practical measure of the protein value of a feed for dairy cattle. The cost of the protein concentrate is divided by the pounds of protein in 100 pounds. For example, a protein concentrate costs $4.70 and contains 38 percent protein. The $4.70 divided by 38 equals .12 or 12¢ per pound of protein. Following the same procedure, other examples are shown below:

Protein Concentrate, 32 percent @ $4.00 per cwt. equals 12.5¢ per pound protein
Protein Concentrate, 80 percent @ $7.20 per cwt. equals 9.0¢ per pound protein

Table 3. An Example of Compiling a Grain Mixture and Determining Costs

Grain	Amount	Protein Percent	Therms Per Cwt.	Price Per Cwt.	Protein Pounds	Therms Total	Total Cost
Ground Shelled Corn	900	8.9	80	$2.40	80.1	720	$21.60
Ground Grain Sorghum	900	11.0	78	2.20	99.0	702	19.80
*Protein 50%	200	50.0	70	5.75	100.0	140	11.50
	2000				279.1	1,562	$52.90

* Use 70 Therms per hundred for supplements of this type unless a better estimate is available.

$$\text{Percent Protein} = \frac{\text{Total Protein (279.1)}}{\text{Total Amount Grain (2000)}} = .140 \times 100 = 14.0 \text{ percent}$$

$$\text{Therms in 100 Pounds} = \frac{\text{Total Therms (1562)}}{\text{Total Amount Grain (2000)}} = .781 \times 100 = 78.1 \text{ Therms}$$

$$\text{Cost of a pound of protein in total ration} = \frac{\text{Total Cost (\$52.90)}}{\text{Pounds Protein (279.1)}} = .19 \text{ or 19 cents per pound}$$

$$\text{Cost of a pound of protein in the protein concentrate} = \frac{\text{Total Cost Protein Conc. (\$11.50)}}{\text{Pounds Protein in 50\% Protein (100)}} = .115 \text{ or 12 cents per pound protein}$$

$$\text{Cost of 100 Therms} = \frac{\text{Total Cost Ration (\$52.90)}}{\text{Total ENE (Therms) of Ration (1562)}} = .0339 \text{ or 3.39 cents per Therm or \$3.39 per 100 Therms}$$

The above ration contains 14 percent protein and 78 Therms.

Table 4 shows a simple way of putting together the proper ingredients for a balanced grain mixture. For example: Based on the forage you are feeding, assume a 12 to 14 percent protein ration is needed and that you can secure a 50 percent protein concentrate at the lowest cost per pound protein. Grain sorghum based on current price is lowest in cost per Therm of all ingredients in section 4 of Table 4. Mix 200 pounds of the 50 percent protein with 20 pounds trace mineralized salt, 20 pounds dicalcium phosphate and enough ground grain sorghum to make a total of 2000 pounds or 1760 pounds.

If oats or wheat bran or other feeds listed in section 3 are available at a cost per therm not greater than feeds in section 4, then use 300 pounds (100 to 500 pounds) of oats or wheat bran and 1460 pounds of ground grain sorghum. By using the information below and the feeds to which you have access, different kinds of grain rations can be compiled.

Table 4. Economical Grain Rations of Different Protein Levels

	Protein Level Required in Grain Ration				
	6-8%	9-11%	12-14%	15-17%	18-21%
1. Protein Supplement (Use cheapest protein source)		(Select only one protein source)			
Percent	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
32%	00	87	350	610	960
36%	00	75	300	520	815
40%	00	65	260	450	720
44%	00	57	230	400	610
50%	00	50	200	340	525
60%	00	40	155	375	425
2. Minerals					
Trace-Mineralized Salt	20	20	20	20	30
Dicalcium Phosphate or Bone Meal	20	20	20	20	20
3. Restricted Ingredients (Use these ingredients only when cheaper per therm ENE than ingredients below, in group 4.)					
Any one or mixture of: Oats, bran, beet pulp, rye, brewers grains, wheat mids, shorts, rye or gluten feed	500	500	500	500	500
4. High energy sources					
Grain sorghum, ear corn, shelled corn, wheat, barley	(Select the one which provides ENE at least cost. Add amount needed to complete 2,000 lb. mixture.)				

The rations suggested above include one percent dicalcium phosphate or steamed bone meal and one percent trace-mineralized salt. In addition, salt should be offered separately. If mineral is not included in the grain ration, offer cows a mixture of one-half dicalcium-phosphate or steamed bone meal and one-half trace-mineralized salt.