

**NUTRA-MERGE: A SIMPLIFIED COMPUTERIZED RATION
FORMULATION PROGRAM FOR BEEF AND DAIRY CATTLE**

**By Dee L. Cross,
Professor of Animal, Dairy and Veterinary Sciences
Clemson University**

INTRODUCTION

Nutra-Merge is a program designed to assist beef and dairy cattle producers in formulating rations that meet the nutrient needs of the animal. The primary objective of this program is to simplify the formulation process. The basis of the program is simply trial and error formulation. For example, the user estimates the proportions of the ingredients in the ration and then allows the computer to merge these proportions and calculate the nutrient composition of this mix. The resulting nutrient content of the estimated proportions of the ration is then compared to the nutrient requirements of the animal(s) for which the ration is being formulated. Using the knowledge of the nutrient composition of the feeds in the ration, the user can then adjust the proportions. Nutra-Merge is designed to allow users to enter the estimated percentage of each feed ingredient in the ration. The total ration percent must always be 100.

Nutra-Merge calculations for feeds and requirements are made on a dry matter basis. Therefore, the ingredient data are entered on a dry matter basis along with the dry matter content of the feed. Later in the program, this dry matter value is used to convert the feeds back to an as-fed basis for mixing. Some feeds for beef cattle, such as corn silage, have a high moisture content which makes this formulation approach necessary. Also, nutrient content on an as-fed basis is calculated and displayed adjacent to the nutrient content on a dry-matter basis.

This program uses nutrient density ($\%$, MCal/lb, etc.) for requirements rather than the actual amount (e.g., Lbs. protein/hd/day).

THE PROGRAM

This program uses a Lotus 123 or compatible spread sheet for storage, calculations and manipulations of the data. Normally, to use the Louts 123 spread-sheet program, it must be installed in the computer memory before initiating the program that interacts with Lotus. This requires some knowledge of the Lotus commands. To simplify this program, Lotus 123 has been written into the program using a program called Baler.

EIGHT SIMPLE STEPS TO FORMULATION OF A BEEF RATION

Step 1: **INSERT THE DISKETTE** in the appropriate drive and type NM-Beef. Observe the Main Menu and print it out for future reference.

Step 2: **LOOK UP THE NUTRIENT REQUIREMENTS** for the animal(s). This can be a growing animal, mature animal or cow nursing a calf. Use nutrient concentration tables only. The requirements table will guide the user to select the appropriate requirements listing for the animal in question. For example, let's suppose we are interested in formulating a ration for a 700 lb. medium frame growing steer with a projected gain of 2.5 lbs/day. Below are the nutrient requirements for that animal.

Nutrient Requirements (dry matter basis)

<u>% Protein</u>	<u>% TDN*</u>	<u>% Ca</u>	<u>% P</u>
10.5	79.0	.40	.22

*Other measures of feed energy may be used instead of TDN, e.g., ME, NE_m and NE_g. Many times these are more accurate but TDN is used in this example for simplification purposes.

Step 3: **SELECT THE FEEDS** and their feed identification number from the ingredient table (ALT I) to be used in the formulation. The feeds selected will be dictated by what is available and the price. In this example let's select corn grain grade #2 (20), cottonseed hulls (23), soybean meal 49% (51), Di-calcium phosphate (40), limestone (31) and salt (43). Salt will be fixed in the ration at .5%.

Step 4: **ENTER THE INGREDIENT IDENTIFICATION NUMBERS.** After selecting the ingredients, enter the respective identification numbers by using the ALT R keys to get to the Beef Cattle Formulation Worksheet. After entering the appropriate numbers, the feed names will appear. Check for accuracy.

Step 5: Use the Page Down key to **MOVE TO THE RATION TABLE** of the Beef Cattle Formulation Worksheet. Using your knowledge of feeds and nutrition, estimate the percentage of each feed required to meet the specified nutrient requirements. Under the Units As Fed column, input the estimated percentage of each in the final ration (as fed basis). Note that the total appears at the bottom of the table. This must add up to 100% when the ration is completed. After entering the estimated percentages, check the Ration Summary on the right side of the screen to see how close you came to meeting the requirements. Then, using your knowledge of the feeds in the ration, begin to adjust the percentages until your ration summary meets or exceeds the requirements for the animal. Note that the ration summary is presented on a dry matter and as fed basis. Your formulation is on a dry matter basis. The as fed basis column is presented as additional information. Output from this example problem is presented in Appendix Table 1. Remember, those requirements in the N.R.C. tables are minimum requirements,

so exceeding them is better than not meeting them.

Step 6: SPECIFY BATCH WEIGHT. In the Ration Table above the Ingredient Name column is a heading entitled Ration Batch Weight. Input the weight of the total mix you want here. For example, let's suppose your grinder-mixer holds 3,500 pounds. After you input this, depress your right hand arrow key until you see lbs/ton. This column lists the pounds of the ration/ton on a dry matter basis and an as fed basis. Next to that is the Batch Weight column. The batch weights are calculated on an as fed basis that would be required for mixing 3500 pounds of the feed in this example.

Step 7: CHANGE PRICES. The Ration Table has a column entitled Price/Unit and another entitled Unit. Update prices here to reflect your costs for the various feeds. In the Ration Summary are two rows entitled Avg Cost/lb and Cost/Ton.

Step 8: ADDING NEW INGREDIENTS. Use the ALT A key to add new ingredients. This allows you to input the nutrient content of the feeds actually being used (usually as reported from a laboratory analysis). For example, you may send your hay to a lab for analysis and find that its nutrient content varies greatly from the average values for the hay used in the ingredient table. Move the cursor to the first blank line below the last ingredient and enter the appropriate information. The original ingredient data, with the exception of price, has been protected against manipulation to prevent accidental deletions or changes.

ADDITIONAL CAPABILITIES OF THE PROGRAM

LEAST COSTING

Some selection of least-cost feed ingredients can be accomplished by replacing ingredients in the ration with alternative ingredients and observing the effect on ration cost. For example, let's suppose you want to compare barley to the corn used in our example ration. Simply put barley back into the ration in place of corn and manipulate the ingredients until you have the same nutrient content in the ration summary. Remember, barley is higher in protein and lower in energy than corn. Therefore, it will take more barley to meet energy needs but less soybean meal will be required to meet protein requirements. After reformulating, check the ration cost to determine whether there was a cost savings by using barley at current prices. You can change prices and reformulate to reflect "what if" situations. For example, what if barley dropped 10 cents/bu? Input the new price and look at total feed cost. These simple procedures will meet the needs of most beef and dairy cattle producers for least-costing. More complex least-costing computer programs designed especially for simultaneous evaluation of a group of feeds are available for this purpose.

FORMULATING A SUPPLEMENT

Many times a high moisture feed or pasture grass is part of the formulation and needs to be considered as a part of the total ration to meet nutrient needs. For example, if corn silage is part of the ration and represents 75% of the as fed total, and the other 25% is a supplement mix, merely input a 0 for the 75% corn silage. Then, scroll over to the as fed lbs/ton column and the proportions of each ingredient is listed in pounds/ton which allows mixing of the supplement without further calculations.

COMPUTER OUTPUT FROM EXAMPLE RATION

RATION TABLE BEEF CATTLE FORMULATION WORKSHEET

Ration Batch Weight: 3,500 Lbs.

RATION SUMMARY

No.	Ingredient Name	Units (As-Fed)	Price /Unit	Unit	Item	DN Basis		-- Lbs./Ton --		Batch As-Fed	Cost; As Fed		Cost;DN Basis	
						As-Fed	DM	As-Fed	DM		/Lb.	/Ton	/Lb.	/Ton
20	CORN GRAIN GRADE #2	75	3.45	BU.	% Protein:	10.5%	9.3%	1,320	1,500	2,625	0.062	92.41	0.070	105.01
23	COTTONSEED HULLS	19.7	120.00	TON	% TDN:	79.1%	70.3%	359	394	689	0.060	23.64	0.066	25.98
51	SOYBEAN MEAL 49%	3.8	260.00	TON	NE; Mcal/Lb:	1.30	1.16	68	76	133	0.130	9.88	0.144	10.98
40	PHOSPHATE-DICALCIUM	0	320.00	TON	NEm; Mcal/Lb:	0.86	0.77	0	0	0	0.160	0.00	0.165	0.00
31	LIMESTONE	1	100.00	TON	NEg; Mcal/Lb:	0.56	0.50	20	20	35	0.050	1.00	0.050	1.00
43	SALT	0.5	0.30	LB.	% Ca:	0.40	0.35	10	10	18	0.300	3.00	0.306	3.06
0		0	0.00		% P:	0.31	0.27	0	0	0	0.000	0.00	0.000	0.00
0		0	0.00		Avg Cost/Lb:	0.0650		0	0	0	0.000	0.00	0.000	0.00
0		0	0.00		Cost/Ton:	129.93		0	0	0	0.000	0.00	0.000	0.00
0		0	0.00		Avg Ration DN:	88.8%		0	0	0	0.000	0.00	0.000	0.00
TOTAL OR AVG:		100						1,777	2,000	3,500	0.0650	129.931	0.0822	146.03

No.	Ingredient Name	Units (as fed)	Wt. /Unit	%	%	%	NE	NEm	NEg	Ca	P	(Avg)
												DN
20	CORN GRAIN GRADE #2	75	56	88	10.1	90.0	1.48	1.02	0.70	0.02	0.35	75.00%
23	COTTONSEED HULLS	19.7	2000	91	4.1	42.0	0.69	0.31	0.07	0.15	0.09	19.70%
51	SOYBEAN MEAL 49%	3.8	2000	90	55.1	87.0	1.43	0.98	0.67	0.29	0.70	3.80%
40	PHOSPHATE-DICALCIUM	0	2000	97	0.0	0.0	0.00	0.00	0.00	22.00	19.30	0.00%
31	LIMESTONE	1	2000	100	0.0	0.0	0.00	0.00	0.00	34.00	0.02	1.00%
43	SALT	0.5	1	98	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.50%
0		0	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00%
0		0	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00%
0		0	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00%
0		0	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00%
0		0	0	0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0.00%
TOTAL OR AVG:		100			10.5	79.1	1.30	0.86	0.56	0.40	0.31	