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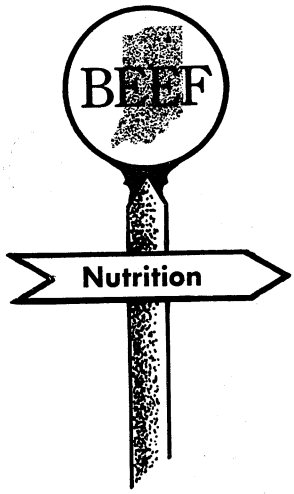

Forage Utilization Guidelines for Beef Cattle

K. G. MacDonald, Animal Sciences Department

The following material is to be used as a guide in balancing rations. To properly use this procedure for balancing rations, you must take into consideration your own particular feeding conditions and available feed materials. You will also have to know just how many pounds of each individual feed is fed per head per day. The rations used as examples are not intended as recommendations.

Beef cattle rations that contain silage or high moisture grain will have to be converted to a 90% air-dry basis before the ration can be properly balanced. This is necessary since the daily nutrient requirements of beef cattle, Table 1, are based upon air-dry feeds containing 90% dry matter. Therefore, we must convert the high moisture feeds to a 90% air-dry basis.

Example for converting silage to 90% air-dry equivalent basis:

Corn silage contains 27.6% dry matter (Table 2) and 72.4% moisture (100% - 27.6% = 72.4%). Twenty pounds of this corn silage would contain 5.52 pounds of dry matter (27.6% x 20 = 5.52). How many pounds of dry matter do we have in a 90% air-dry equivalent basis? Divide the pounds of dry matter in the 20 pounds of 72.4% moisture corn silage by 90% (5.52 ÷ 90% = 6.13) and get 613 pounds of 90% air-dry equivalent dry matter corn silage in 20 pounds of 72.4% moisture corn silage.

Example for converting high moisture corn to 90% air-dry equivalent basis:

Corn that contains 30% moisture contains 70% dry matter (100% - 30% = 70%). Twenty pounds of this corn would contain 14 pounds of dry matter (70% x 20 = 14). On a 90% air-dry equivalent basis, how many pounds of dry matter is there in the 30% moisture corn? Divide the pounds of dry matter in 20 pounds of 30% moisture corn (14) by 90%. This is 15.55 pounds (14 ÷ 90% = 15.55) of 90% air-dry equivalent dry matter in 20 pounds of 30% moisture corn.

Examples of Balancing Rations

1. Finishing 600-pound steer calves as short yearlings.

A. Ration Fed

Corn & cob meal	15 pounds
Soybean oil meal	1 pound

B. Requirements from Table 1.

Body Wt.	Daily Feed Per Animal lb.	Total Protein lb.	TDN lb.
600 lb.	16.40	1.80	10.90

C. Nutrient content of common feeds from Table 2.

Corn and Cob Meal	15.00	1.11	10.98
Soybean Oil Meal	1.00	0.46	0.77
Total	16.00	1.57	11.75
Deficiency	.40	0.23	

D. Addition required to balance ration

Soybean Oil Meal	0.50	0.23	0.38
Total Bal. Ration	16.50	1.80	12.13

This example shows that the ration is short 0.40 pounds of total feed and 0.23 pounds of total protein. This deficiency may be made up by the addition of 0.50 pounds of soybean oil meal which would bring the total feed fed to 16.50 pounds, total protein to 1.80 pounds (the minimum amount), and 12.13 pounds of total TDN.

2. Finishing yearling cattle weighing 800 pounds.

A. Ration Fed

Corn silage	20 pounds
Gr. Shelled corn	15 pounds
Soybean oil meal	2 pounds

B. Requirements from Table 1.

Body Wt.	Daily Feed Per Animal lb.	Total Protein lb.	TDN lb.
800 lb.	22.30	2.20	14.50

C. Nutrient content of common feeds from Table 2.

Corn Silage	6.13	0.46	3.66
Gr. Shelled Corn	15.00	1.31	12.02
Soybean Oil Meal	2.00	0.92	1.54
Total	23.13	2.69	17.22

In this ration, there are no deficiencies as far as the factors calculated are concerned. We have a ration that is just a bit high in total feed, total protein and TDN. The economical way to balance this ration would be to only feed 1.00 pound of soybean oil meal per head per day. This would reduce the total feed fed for a 90% air-dry basis to 22.13 pounds (this is close enough for practical operations). Total protein fed would be reduced to an adequate level of 2.23 pounds, and the TDN value would be reduced to 16.45 pounds, which is not in excess. As the protein supplement is the most expensive single part of the ration, it would be best to keep the total protein figure as close to the requirement as possible.

When protein and moisture values are available through feedstuffs testing, they should be used rather than values from tables of average consumption.

Conversion Tables

In order to reduce the calculations that are necessary to determine whether the ration is properly balanced when the ingredients consist of commonly used feed, the following five tables have been prepared for your use.

For example, if you are feeding 15 pounds of corn and cob meal, add the 5 pound column and the 10 pound column to determine the total nutrient content of 15 pounds of corn and cob meal. Be sure that you keep the decimal point in its proper place.

Remember, in using the conversion tables for corn silage and haylage, you must convert these two feeds to a 90% air-dry equivalent basis as outlined previously.

Table 1. Daily nutrient requirements of beef cattle [a/] [b/]

Line	Body weight (lb.)	Av. daily gain (lb.)	Daily feed per animal (lb.)	Daily requirements per animal: Total Protein (lb.)	Total digestible nutrients TDN (lb.)	Calcium (lb.)	Phosphorus (lb.)
Finishing calves as short yearlings							
!.	400	2.3	11.8	1.3	7.8	0.044	0.033
2.	600	2.4	16.4	1.8	10.9	0.044	0.037
3.	800	2.2	19.4	1.9	12.9	0.044	0.039
4.	1,000	2.2	23.0	2.3	15.3	0.046	0.046
Finishing yearling cattle							
5.	600	2.6	17.5	1.8	11.4	0.044	0.037
6.	800	2.7	22.3	2.2	14.5	0.044	0.044
7.	1,000	2.6	25.8	2.6	16.8	0.050	0.050
8.	1,100	2.3	25.8	2.6	16.8	0.050	0.050
Finishing two-year-old cattle							
9.	800	2.8	23.3	2.3	14.9	0.048	0.048
10.	1,000	2.9	28.2	2.8	18.0	0.057	0.057
11.	1,200	2.7	31.0	3.1	19.8	0.061	0.061
Wintering weanling calves							
12.	400	1.0	10.5	1.1	5.3	0.028	0.022
13.	500	1.0	12.6	1.3	6.3	0.028	0.022
14.	600	1.0	14.3	1.3	7.2	0.028	0.022
Wintering yearling cattle							
15.	600	1.0	14.3	1.2	7.2	0.028	0.024
16.	800	0.7	15.8	1.2	7.9	0.028	0.026
17.	900	0.5	15.8	1.2	7.9	0.028	0.026
Wintering pregnant heifers							
18.	700	1.5	20.0	1.5	10.0	0.033	0.030
19.	900	0.8	18.0	1.4	9.0	0.028	0.026
20.	1,000	0.5	18.0	1.4	9.0	0.028	0.026
Wintering mature pregnant cows							
21.	800	1.5	22.0	1.7	11.0	0.035	0.033
22.	1,000	0.4	18.0	1.4	9.0	0.028	0.026
23.	1,200	0.0	18.0	1.4	9.0	0.028	0.026
24.	1,200	-0.5	17.6	1.3	7.5	0.028	0.026
Cows nursing calves, first 3-4 months							
25.	900-1,100	0.0	28.0	2.3	16.8	0.066	0.050
Normal-growth heifers and steers							
26.	400	1.6	12.2	1.4	6.4	0.035	0.024
27.	600	1.4	16.4	1.5	8.2	0.035	0.026
28.	800	1.2	19.1	1.5	9.6	0.035	0.028
29.	1,000	1.0	21.1	1.6	10.6	0.030	0.030
Bulls, growth and maintenance (moderate activity)							
30.	600	2.3	16.2	2.0	10.1	0.046	0.033
31.	1,000	1.6	20.0	2.4	12.0	0.042	0.033
32.	1,400	1.0	24.7	2.4	14.2	0.037	0.035
33.	1,800	0.0	25.5	2.4	14.0	0.039	0.039

a/ Nutrient requirements of beef cattle, subcommittee on beef cattle nutrition, National Research Council, revised edition, 1963.

b/ Based upon air-dry feed containing 90% dry matter

Table 2. Nutrient content of commonly used feedstuffs[a/]

Line No.	Feed	Total dry matter	Total protein	TDN	Calcium	Phosphorus
		%	%	%	%	%
1.	Alfalfa, hay, all analyses	90.5	15.3	50.7	1.47	.24
2.	Alfalfa meal, dehydrated	92.7	17.7	54.4	1.60	.26
3.	Bromegrass hay	88.8	10.4	49.3	.42	.19
4	Red clover hay, all analyses	88.3	12.0	51.8	1.28	.20
5.	Clover-timothy hay (30-50% clover)	88.1	8.6	51.0	.69	.16
6.	Ladino clover hay	89.5	18.5	59.5	1.53	.29
7.	Corncobs	90.4	2.3	45.7	.11	.04
8.	Lespedeza hay, in bloom	89.1	13.0	46.4	1.00	.19
9.	Mixed hay, less than 30% legumes	89.2	8.8	48.8	.90	.19
10.	Oat straw	89.8	4.1	44.8	.24	.09
11.	Soybean hay	88.1	14.6	48.6	1.10	.22
12.	Wheat straw	92.6	3.9	40.6	.15	.07
	Silages					
13.	Alfalfa, wilted	36.2	6.3	21.5	.51	.12
14.	Alfalfa haylage	60.0	10.4	35.8	.84	.20
15.	Corn, dent, well matured	27.6	2.3	18.3	.10	.07
16.	Grass silage, including legumes	25.6	3.6	15.5	--	--
17.	Pea vine	24.5	3.2	14.0	.32	.06
18.	Sorghum, sweet	25.4	1.6	15.2	.08	.06
19.	Sudan grass	25.7	2.2	14.4	.11	.04
20.	Corn, factory waste	22.4	2.0	16.1	--	--
	Concentrates					
21.	Barley	89.4	12.7	77.7	.06	.40
22.	Corn and cob meal	86.1	7.4	73.2	.04	.22
23	Corn, No. 2	85.0	8.7	80.1	.02	.27
24.	Cottonseed meal, solvent	91.4	41.6	66.1	.15	1.10
25.	Linseed meal, expeller	90.9	35.3	76.3	.44	.89
26.	Linseed meal, solvent	90.9	35.1	71.0	.40	.83
27.	Oats	90.2	12.0	70.1	.09	.33
28.	Rye	89.5	12.6	76.5	.10	.33
29.	Sorghum, milo	89.0	10.9	79.4	.03	.28
30.	Soybeans	90.0	37.9	87.6	.25	.59
31.	Soybean oil meal, solvent	89.3	45.8	77.2	.32	.67
32.	Wheat	89.4	13.5	79.6	.05	.42
33.	Wheat bran	89.1	16.0	65.9	.14	1.17
	Minerals					
34.	Steamed bone meal	95.2	12.1	--	29.0	13.6
35.	Di-cal phosphate	--	--	--	28.0	18.0
36.	Limestone	--	--	--	38.0	--

a/ Beef Cattle, 5th Edition, Snapp and Neumann. Page 652 lists additional feedstuffs.

Table 3. Shelled Corn

Shelled corn in ration	Total protein	TDN	Calcium	Phosphorus
lb.	lb.	lb.	lb.	lb.
1	0.087	0.801	0.0002	0.0027
2	0.174	1.602	0.0004	0.0054
3	0.261	2.403	0.0006	0.0081
4	0.348	3.204	0.0008	0.0108
5	0.435	4.005	0.0010	0.0135
6	0.522	4.806	0.0012	0.0162
7	0.609	5.607	0.0014	0.0189
8	0.696	6.408	0.0016	0.0216
9	0.783	7.209	0.0018	0.0243
10	0.870	8.010	0.0020	0.0270

Table 4. Corn and Cob Meal

Corn and cob meal in ration	Total protein	TDN	Calcium	Phosphorus
lb.	lb.	lb.	lb.	lb.
1	0.074	0.732	0.0004	0.0022
2	0.148	1.464	0.0008	0.0044
3	0.222	2.196	0.0012	0.0066
4	0.296	2.928	0.0016	0.0088
5	0.370	3.660	0.0020	0.0110
6	0.444	4.392	0.0024	0.0132
7	0.518	5.124	0.0028	0.0154
8	0.592	5.856	0.0032	0.0176
9	0.666	6.588	0.0036	0.0198
10	0.740	7.320	0.0040	0.0220

Table 5. Corn Silage[a/]

Corn silage in ration	90% air-dry feed	Total protein	TDN	Calcium	Phos-phorus
lb.	lb.	lb.	lb.	lb.	lb.
1	0.31	0.023	0.183	0.0010	0.0007
2	0.61	0.046	0.366	0.0020	0.0014
3	0.92	0.069	0.549	0.0030	0.0021
4	1.23	0.092	0.732	0.0040	0.0028
5	1.53	0.115	0.915	0.0050	0.0035
6	1.84	0.138	1.098	0.0060	0.0042
7	2.15	0.161	1.281	0.0070	0.0049
8	2.45	0.184	1.464	0.0080	0.0056
9	2.76	0.207	1.647	0.0090	0.0063
10	3.07	0.230	1.830	0.0100	0.0070

a/ Corn silage containing 27.6% dry matter

Table 6. Alfalfa Haylage[a/]

Alfalfa haylage in ration	90% air-dry feed	Total protein	TDN	Calcium	Phos-phorus
lb.	lb.	lb.	lb.	lb.	lb.
1	0.67	0.1044	0.358	0.0084	0.0020
2	1.33	0.2088	0.716	0.0168	0.0040
3	2.00	0.3132	1.074	0.0252	0.0060
4	2.67	0.4176	1.432	0.0336	0.0080
5	3.33	0.5220	1.790	0.0420	0.0100
6	4.00	0.6264	2.148	0.0504	0.0120
7	4.67	0.7308	2.506	0.0588	0.0140
8	5.33	0.8352	2.864	0.0672	0.0160
9	6.00	0.9396	3.222	0.0756	0.0180
10	6.67	1.0440	3.580	0.0840	0.0200

a/ Haylage containing 60% dry matter

Table 7. Alfalfa Hay

Alfalfa hay in ration	Total protein	TDN	Calcium	Phosphorus
lb.	lb.	lb.	lb.	lb.
1	0.153	0.507	0.0147	0.0024
2	0.306	1.014	0.0294	0.0048
3	0.459	1.521	0.0441	0.0072
4	0.612	2.028	0.0588	0.0096
5	0.765	2.535	0.0735	0.0120
6	0.918	3.042	0.0882	0.0144
7	1.071	3.549	0.1029	0.0168
8	1.224	4.056	0.1176	0.0192
9	1.377	4.563	0.1323	0.0216
10	1.530	5.070	0.1470	0.0240

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