Dairy Ration Estimation
Michigan State University Extension Service
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How to Figure Your Ration Needs:

Follow the example first — then use the Dairy Ration Estimation Tables (p. 4) to calculate your own ration. (Open bulletin flat for ease in using tables.)

Procedure

1. **TABLE A, Requirements.** *Select the desired pounds (lb) of milk in column 1. The lb of TDN and lb crude protein required for a 1,300 lb cow producing 3.5% milk is opposite this value (columns 2 and 3). Enter these two values in line a of TABLE F.*
2. **TABLES B, C AND D, Feed Sources.** *Select the lb of hay, haylage, corn silage and/or corn fed. "Average" hay (haylage) = 13% crude protein content on a dry basis; "good" = 16.7% and "excellent" = 20%. In lines to the right of lb fed is lb of TDN and crude protein in that amount of feed. Record these TDN and protein amounts in lines b, c, d, and e of TABLE F. Then add these lines for lb TDN and lb protein from these feeds, and enter this sum on line f of TABLE F.*
3. **CALCULATE** *lb TDN and lb protein still needed by subtracting line f from line a, to obtain line g.*
4. *a) Use the value for lb TDN still needed from line g and locate approximate lb TDN needed in column 1 of TABLE E, Grain mix.*
   b) Corresponding value in Column 2 of TABLE E is lb grain to be fed/cow/day to furnish that amount of TDN needed.
   c) To the right of lb TDN needed, locate a value nearest to the lb protein needed on that same line. Now, you can determine the protein percent (%) needed in that amount of grain. (Since 2.7 is between 2.5 and 2.9, 15% protein is needed.) To calculate grain ingredients needed to achieve that % protein, follow instructions on next page.

EXAMPLE RATION — TABLE F

			1b TDN	1lb Protein
(a) Requirements for:	55 lb milk		32.0	6.0
(b) Nutrients in forages and corn fed	6 lb hay	, good	3.3	0.9
(c)	14 lb haylage, 50% moisture, good		4.4	1.2
(d)	20 lb corn silage 0 NPN		4.4	0.5
(e)	10 lb HM corn (shelled)		6.6	0.7
(f) Total nutrients			18.7	3.3
(g) Nutrients still needed (subtract line f from line a)			13.3	2.7

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MY RATION #1 — TABLE F

		lb TDN	*lb Protein*
(a) Requirements for:	___ lb milk	___	___
(b) Nutrients in forages and corn fed	___ lb hay , ___	___	___
(c)	___ lb haylage, ___% moisture, ___	___	___
(d)	___ lb corn silage ___ NPN	___	___
(e)	___ lb HM corn (___)	___	___
(f) Total nutrients		___	___
(g) Nutrients still needed (subtract line f from line a)		___	___

MY RATION #2 — TABLE F

		lb TDN	*lb Protein*
(a) Requirements for:	___ lb milk	___	___
(b) Nutrients in forages and corn fed	___ lb hay , ___	___	___
(c)	___ lb haylage, ___% moisture, ___	___	___
(d)	___ lb corn silage ___ NPN	___	___
(e)	___ lb HM corn (___)	___	___
(f) Total nutrients		___	___
(g) Nutrients still needed (subtract line f from line a)		___	___

Example Calculation of Grain Mix Proportions

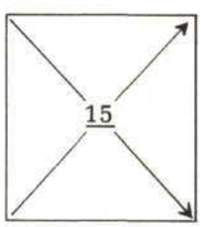
Desired Batch Size: 3,000 lb
Desired Crude Protein: 15%

Available ingredients:

Energy feed (shelled corn: 9% crude protein)
Protein supplement (soybean meal: 44% crude protein)

% Protein in Energy Feed 9

% Protein in Supplement 44



29 Parts Energy Feed in Mix (44-15=29)

6 Parts Protein Supplement in Mix (15-9=6)

35 **Total Parts in Grain Mix**

COMPOSITION OF GRAIN MIX:

(1) *parts energy feed ÷ total parts in grain mix = fraction or percent of energy feed*
(29 ÷ 35 = .829 or 82.9%)

(2) *parts protein feed ÷ total parts in grain mix = fraction or percent of energy feed*
(6 ÷ 35 = .171 or 17.1%)

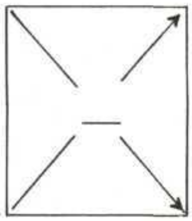
(3) *total batch size × fraction of energy feed = pounds of energy feed*
(3,000 × .829 = 2,487)

(4) *total batch size × fraction of protein feed = pounds of protein feed*
(3,000 × .171 = 513)

YOUR DESIRED BATCH SIZE ____________ **(lb)**

YOUR DESIRED CRUDE PROTEIN ____________ **(%)**

% Protein in Energy Feed ___



___ Parts Energy Feed in Mix

(___ – ___ = ___)

% Protein in Supplement ___

___ Parts Protein Supplement in Mix

(___ – ___ = ___)

___ **Total Parts in Grain Mix**

COMPOSITION OF GRAIN MIX

(1) *parts energy feed ÷ total parts in grain mix = fraction or percent of energy feed*

(_____ ÷ _____ = _____ or _____%)

(2) *parts protein feed ÷ total parts in grain mix = fraction of percent of energy feed*

(_____ ÷ _____ = _____ or _____%)

(3) *total batch size × fraction of energy feed = pounds of energy feed*

(_____ × _____ = _____)

(4) *total batch size × fraction of protein feed = pounds of protein feed*

(_____ × _____ = _____)

Example — Using a Mixture of Home Grown Feeds

Feeds	Proportions Available	Crude Protein %	Calculating Crude Protein in Mixture
Oats (32 lb/bu)	1/4	12	.25 × 12 = 3.0
Corn (56 lb/bu)	1/2	9	.5 × 9 = 4.5
Barley (48 lb/bu)	1/4	13	.25 × 13 = 3.25
			10.75

Thus, there is 10.75% crude protein in a combination of 1/4 oats (.25), 1/2 corn (.50), 1/4 barley (.25) by weight. Round off to 11% and use 11 in center of Pierson square to calculate amount of this mixture to use with your protein supplement. Same procedure can be used when two or more roughages are fed.

Thumb Rules

MINERALS

1. *Add 1% trace mineral salt to a grain mix, or add 1/2% trace mineral salt to a total mixed ration (TMR).*
2. *Add 1% dicalcium phosphate or proper mineral mix to a grain mix, or 1/2% mineral mix to a TMR, or more specifically:*
   - *a) Rations high in corn silage should be supplemented with a high calcium (Ca) (15-20%) and low phosphorus (P) (6-12%) mineral (2:1)*
   - *b) Alfalfa diets should be supplemented with a high P (14-18%) and low Ca (0-8%) mineral.*
   - *c) Rations consisting of 1/2 corn silage and 1/2 alfalfa should be supplemented with a low Ca (10%) and moderate P (12-18%) mineral (1:1)*

FEEDING

3. *Maximum grain consumption in a milking parlor is 12-18 lb/cow/day (6-9 lb/milking).*
4. *For good rumination and to attain maximum intake feed 3 to 5 lb (or more) of long stemmed hay/cow/day.*
5. *Provide continuous access to a fresh water source.*
6. *It takes 1.24 lb of high moisture corn to equal nutrients in 1.0 lb of dry corn.*
7. *Dry matter intake = (2+(.02 × ___ lb milk)) × ___ cwt body wt*
8. *Use proper "lead factor" at Step 1 — TABLE A.*

This ration estimation only evaluates energy and protein needs. More complete ration balancing programs are available using the MSU Computer Programs: Telplan 31 or Telcal 56:3 (TI-59 Calculator) available through your local County Extension Service Office.

DAIRY RATION ESTIMATION

MILK & REQUIREMENTS — TABLE A

Milk, lb/day	TDN	Protein
25.	19	3.3
30.	20	3.7
35.	22	4.1
40.	24	4.5
45.	26	4.9
50.	30	5.3
55.	32	6.0
60.	34	6.4
65.	36	6.8
70.	38	7.3
75.	40	7.7
80.	42	8.1
85.	44	8.5
0	13	2.1

TABLE A

FEED SOURCES

TABLE B — Haylage and Alfalfa Quality

	Haylage						ALFALFA QUALITY					
	lb fed when percent moisture Is						Average		Good		Excellent	
Hay, lb fed	40	45	50	55	60	65	TDN	Protein	TDN	Protein	TDN	Protein
4.	5	6	7	8	9	10	2.0	.5	2.2	.6	2.4	.7
6.	9	10	11	12	14	15	3.0	.7	3.3	.9	3.6	1.1
8.	12	13	14	16	18	21	4.0	1.0	4.4	1.2	4.8	1.4
10.	15	16	18	20	23	26	5.0	1.2	5.5	1.5	6.0	1.8
12.	18	19	22	24	27	31	6.0	1.5	6.6	1.8	7.2	2.2
14.	21	23	25	28	32	36	7.0	1.7	7.7	2.1	8.4	2.5
16.	24	26	29	32	36	41	8.0	2.0	8.8	2.4	9.6	2.9
18.	27	29	32	36	41	46	9.0	2.2	9.9	2.7	10.8	3.2
20.	30	33	36	40	45	51	10.0	2.4	11.0	3.0	12.0	3.6
22.	33	36	40	44	50	57	11.0	2.6	12.1	3.3	13.2	4.0
24.	36	39	43	48	54	62	12.0	2.9	13.2	3.6	14.4	4.3
26.	39	42	47	52	59	67	13.0	3.1	14.3	3.9	15.6	4.7
28.	42	46	50	56	63	72	14.0	3.4	15.4	4.2	16.8	5.0
30.	45	49	54	60	68	77	15.0	3.6	16.5	4.5	18.0	5.4
32.	48	52	58	64	72	82	16.0	3.8	17.6	4.8	19.2	5.8
34.	51	56	61	68	77	87	17.0	4.1	18.7	5.1	20.4	6.1
36.	54	59	65	72	81	83	18.0	4.3	19.8	5.4	21.6	6.5
38.	57	62	68	76	86	98	19.0	4.6	20.9	5.7	22.8	6.8
40.	60	65	72	80	90	103	20.0	4.8	22.0	6.0	24.0	7.2

TABLE B

TABLE C — Corn Silage

lb fed	TDN	Protein	+ NPN
15.	3.3	.4	.6
20.	4.4	.5	.8
25.	5.5	.7	1.0
30.	6.6	.8	1.2
35.	7.9	.9	1.4
40.	8.8	1.0	1.6
45.	9.9	1.2	1.8
50.	11.0	1.3	2.0
55.	12.1	1.4	2.2
60.	13.2	1.6	2.4
65.	14.3	1.7	2.6
70.	15.4	1.8	2.8
75.	16.5	2.0	3.0

TABLE C

TABLE D — High Moisture Corn (30%)

	Shelled		W/Cob	
lb fed	TDN	Protein	TDN	Protein
4.	2.6	.3	2.4	.2
6.	3.9	.4	3.6	.4
8.	5.3	.6	4.8	.5
10.	6.6	.7	6.0	.6
12.	7.9	.9	7.2	.7
14.	9.2	1.0	8.4	.8
16.	10.6	1.1	8.4	1.0
18.	11.9	1.3	10.8	1.1
20.	13.2	1.4	12.0	1.2
22.	14.5	1.6	13.2	1.3
24.	15.8	1.7	14.4	1.4
26.	17.2	1.8	15.6	1.6
28.	18.5	2.0	16.8	1.7
30.	19.8	2.1	18.0	1.8
32.	21.1	2.3	19.2	1.9
34.	22.4	2.4	20.4	2.0
36.	23.8	2.6	21.6	2.2
38.	25.1	2.7	22.8	2.3
40.	26.4	2.8	24.0	2.4

TABLE D

GRAIN MIX — TABLE E

Protein Needed/Cow/Day, lb.

		protein % of grain mix:										
lb TDN	lb fed	12	14	16	18	20	22	24	32	38	44	55
3.0	4.	.4	.6	.6	.7	.8	.9	1.0	1.3	1.5	1.8	2.2
4.5	6.	.7	8.	1.0	1.1	1.2	1.3	1.4	1.9	2.3	2.6	3.3
6.6	8.	1.1	1.1	1.3	1.4	1.6	1.8	1.9	2.6	3.0	3.5	4.4
7.5	10.	1.2	1.4	1.6	1.8	2.0	2.2	2.4	3.2	3.8	4.4	
9.0	12.	1.4	1.7	1.9	2.2	2.4	2.6	2.9	3.8	4.6		
10.5	14.	1.7	2.0	2.2	2.5	2.8	3.1	3.4	4.5			
12.0	16.	1.9	2.2	2.6	2.9	3.2	3.5	3.8				
13.5	18.	2.2	2.5	2.9	3.2	3.6	4.0	4.3				
15.0	20.	2.4	2.8	3.2	3.6	4.0	4.4	4.8				
16.5	22.	2.6	3.1	3.5	3.9	4.4	4.8	5.3				
18.0	24.	2.9	3.4	3.8	4.3	4.8	5.3	5.8				
19.5	26.	3.1	3.6	4.2	4.6	5.2	5.7	6.2				
21.0	28.	3.4	3.9	4.5	5.0	5.6	6.2	6.7				
22.5	30.	3.6	4.2	4.8	5.4	6.0	6.6	7.2				
24.0	32.	3.8	4.5	5.1	5.8	6.4	7.0	7.7				
25.5	34.	4.1	4.8	5.4	6.1	6.8	7.5	8.2				
27.0	36.	4.3	5.0	5.8	6.5	7.2	7.9	8.6				
28.5	38.	4.6	5.3	6.1	6.8	7.6	8.4	9.1				
30.0	40.	4.8	5.6	6.4	7.2	8.9	8.8	9.6				

lb fed are on "as fed" basis

TABLE E

Values for TDN and protein in TABLES A, B, C and D are expressed as pounds (lb)