

Energy Estimates

Most feed labs calculate forage energy estimates from Acid Detergent Fibre (ADF) concentrations. Equations vary from lab to lab, so it is important to determine whether differences in reported energy values between labs is due to different ADF values or different equations or both. Typical equations used to calculate Net Energy for Lactation (NE_L) are as follows (see table on following page):

- for forages which are greater than 75% legume:

$$NE_L \text{ (Mcal/kg)} = 2.302 - 0.0262 \times \text{ADF } \%$$

- for forages which are a mixture of grasses and legumes, with neither making up greater than 75% of the total:

$$NE_L \text{ (Mcal/kg)} = 2.398 - 0.028 \times \text{ADF } \%$$

- for forages which are greater than 75% grass:

$$NE_L \text{ (Mcal/kg)} = 2.392 - 0.0273 \times \text{ADF } \%$$

- for small grain (e.g. Barley) silages and greenfeeds:

$$NE_L \text{ (Mcal/kg)} = 1.75 - 0.0076 \times \text{ADF } \%$$

- for Corn silage:

$$NE_L \text{ (Mcal/kg)} = 2.302 - 0.0273 \times \text{ADF } \%$$

The following equations can be used to convert between energy units:

$$\text{Total Digestible Nutrients (TDN, \%)} = [(\text{NE}_L \text{ (Mcal/kg)} + 0.12) / 0.0245]$$

$$\text{Digestible Energy (DE, Mcal/kg)} = \text{TDN } \% \times 0.04409$$

$$\text{Metabolizable Energy (ME, Mcal/kg)} = 1.01 \times \text{DE (Mcal/kg)} - 0.45$$

$$\text{Net Energy for Maintenance (NE}_M\text{, Mcal/kg)}$$

$$= 1.37 \times \text{ME} - 0.138 \times \text{ME}^2 + 0.0105 \times \text{ME}^3 - 1.12$$

$$\text{Net Energy for Gain (NE}_G\text{, Mcal/kg)}$$

$$= 1.42 \times \text{ME} - 0.174 \times \text{ME}^2 + 0.0122 \times \text{ME}^3 - 1.65$$

Appendix A includes a table which can be used to convert energy levels quoted as NE_L to NE_M , NE_G and TDN.

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Energy Estimates
(continued)

Energy values calculated from forage acid detergent fibre concentrations using the equations on the previous page.

Estimates of the energy contributed by concentrate feeds are most commonly based on values published in tables of feed composition. An alternative method of estimating energy values for all feeds was proposed in the 2001 edition of Nutrient Requirements of Dairy Cattle, published by the US National Research Council. This method is based on calculating TDN from estimates of the true digestibility of feed fractions.

ADF %	TDN %	DE -----	ME -----	NE _M Mcal/kg	NE _G -----	NE _L -----
Forages >75% Legume						
25	72.1	3.18	2.76	1.83	1.20	1.65
30	66.8	2.94	2.52	1.63	1.02	1.52
35	61.4	2.71	2.29	1.42	0.83	1.39
40	56.08	2.47	2.05	1.20	0.63	1.25
Mixed Grass/Legume Forages						
25	74.2	3.27	2.85	1.91	1.27	1.70
30	68.5	3.02	2.60	1.69	1.08	1.56
35	62.8	2.77	2.35	1.47	0.88	1.42
40	57.06	2.52	2.09	1.24	0.67	1.28
Forages >75% Grass						
25	74.7	3.29	2.88	1.93	1.28	1.71
30	69.1	3.05	2.63	1.72	1.10	1.57
35	63.5	2.80	2.38	1.50	0.91	1.44
40	58.0	2.56	2.13	1.27	0.70	1.30
Small Grain Forages						
25	68.6	3.02	2.60	1.70	1.08	1.56
30	67.0	2.95	2.53	1.64	1.03	1.52
35	65.5	2.89	2.47	1.58	0.98	1.48
40	63.9	2.82	2.40	1.52	0.92	1.45
Corn Silage						
25	71.0	3.13	2.71	1.79	1.16	1.62
30	65.4	2.88	2.46	1.57	0.97	1.48
35	59.9	2.64	2.22	1.35	0.77	1.35
40	54.3	2.39	1.97	1.12	0.56	1.21

Appendix A. Table for Conversion of Feed NE_L Values to NE_M, NE_G and TDN

NE _L	NE _M	NE _G	TDN	NE _L	NE _M	NE _G	TDN	NE _L	NE _M	NE _G	TDN
1.10	0.96	0.41	49.8	1.43	1.42	0.83	63.3	1.76	1.84	1.21	76.7
1.11	0.97	0.43	50.2	1.44	1.43	0.85	63.7	1.77	1.86	1.22	77.1
1.12	0.99	0.44	50.6	1.45	1.44	0.86	64.1	1.78	1.87	1.23	77.6
1.13	1.00	0.45	51.0	1.46	1.46	0.87	64.5	1.79	1.88	1.24	78.0
1.14	1.02	0.47	51.4	1.47	1.47	0.88	64.9	1.80	1.89	1.25	78.4
1.15	1.03	0.48	51.8	1.48	1.48	0.89	65.3	1.81	1.91	1.26	78.8
1.16	1.05	0.49	52.2	1.49	1.50	0.91	65.7	1.82	1.92	1.28	79.2
1.17	1.06	0.51	52.7	1.50	1.51	0.92	66.1	1.83	1.93	1.29	79.6
1.18	1.07	0.52	53.1	1.51	1.52	0.93	66.5	1.84	1.94	1.30	80.0
1.19	1.09	0.53	53.5	1.52	1.54	0.94	66.9	1.85	1.95	1.31	80.4
1.20	1.10	0.55	53.9	1.53	1.55	0.95	67.3	1.86	1.97	1.32	80.8
1.21	1.12	0.56	54.3	1.54	1.56	0.96	67.8	1.87	1.98	1.33	81.2
1.22	1.13	0.57	54.7	1.55	1.58	0.98	68.2	1.88	1.99	1.34	81.6
1.23	1.14	0.58	55.1	1.56	1.59	0.99	68.6	1.89	2.00	1.35	82.0
1.24	1.16	0.60	55.5	1.57	1.60	1.00	69.0	1.90	2.02	1.36	82.4
1.25	1.17	0.61	55.9	1.58	1.61	1.01	69.4	1.91	2.03	1.37	82.9
1.26	1.19	0.62	56.3	1.59	1.63	1.02	69.8	1.92	2.04	1.38	83.3
1.27	1.20	0.64	56.7	1.60	1.64	1.03	70.2	1.93	2.05	1.39	83.7
1.28	1.21	0.65	57.1	1.61	1.65	1.04	70.6	1.94	2.06	1.40	84.1
1.29	1.23	0.66	57.6	1.62	1.67	1.06	71.0	1.95	2.08	1.41	84.5
1.30	1.24	0.67	58.0	1.63	1.68	1.07	71.4	1.96	2.09	1.42	84.9
1.31	1.26	0.69	58.4	1.64	1.69	1.08	71.8	1.97	2.10	1.43	85.3
1.32	1.27	0.70	58.8	1.65	1.70	1.09	72.2	1.98	2.11	1.44	85.7
1.33	1.28	0.71	59.2	1.66	1.72	1.10	72.7	1.99	2.12	1.45	86.1
1.34	1.30	0.72	59.6	1.67	1.73	1.11	73.1	2.00	2.14	1.46	86.5
1.35	1.31	0.74	60.0	1.68	1.74	1.12	73.5	2.01	2.15	1.47	86.9
1.36	1.32	0.75	60.4	1.69	1.75	1.13	73.9	2.02	2.16	1.48	87.3
1.37	1.34	0.76	60.8	1.70	1.77	1.14	74.3	2.03	2.17	1.49	87.8
1.38	1.35	0.77	61.2	1.71	1.78	1.16	74.7	2.04	2.18	1.50	88.2
1.39	1.36	0.79	61.6	1.72	1.79	1.17	75.1	2.05	2.20	1.51	88.6
1.40	1.38	0.80	62.0	1.73	1.81	1.18	75.5	2.06	2.21	1.52	89.0
1.41	1.39	0.81	62.4	1.74	1.82	1.19	75.9	2.07	2.22	1.53	89.4
1.42	1.40	0.82	62.9	1.75	1.83	1.20	76.3	2.08	2.23	1.54	89.8