

Protein feeding standards

The protein feeding recommendations are related to energy intake and liveweight ; daily allowances of apparently digestible crude protein per MJ metabolisable energy are given in Table 3. The recommendations are mainly based on the protein requirements established by NRC, 1970 and results from Swedish and Danish feeding experiments (OLSSON, 1976 ; ANDERSEN *et al.*, 1973). In practice, digestible crude protein is calculated from tabulated digestibility coefficients (ERIKSSON *et al.*, 1976).

References

- ANDERSEN P.E., BROLUND LARSEN J., SØRENSEN M., OSTERGAARD V., 1973. Optimal proteinforsyning till kvaeg. II. *Meddelelse fra Landokonomisk Forsogslaboratorium*, Copenhagen.
- ERIKSSON S., SANNE S., THOMKE S., 1976. *Fodermedelstabeller och utfodringsrekommendationer till idisslare, hästar och svin*. 2nd ed. LT, Stockholm.
- JOHNSSON S., OHLMER B., 1972. Feeding levels, slaughter weights and feed conversion ratio in beef cattle production. *Lantbrukshögskolans meddelanden ser. A*. nr. 180.
- LINDGREN E., 1979. *The nutritional value of roughages determined in vivo and by laboratory methods*. Swedish University of Agricultural Sciences, Department of Animal Nutrition, Report 45, Uppsala.
- LINDHE B., HENNINGSSON T., 1967. Crossbreeding for beef with Swedish red and white cattle. Part. II. Growth and efficiency under standardized conditions together with detailed carcass evaluation. *Landbr. Högsk. Annlr.* 34, 517-550.
- MINISTRY OF AGRICULTURE, FISHERIES AND FOOT (MAFF) Bulletin 33, 1975. *Energy allowances and feeding systems for ruminants*, HMSO, London.
- NORRMAN E., 1977. *Nötkött, produktion och ekonomi*. Helmenius ed., LT, Stockholm.
- NRC, 1970. *Nutrient requirements of beef cattle*. National Academy of Sciences, Washington DC.
- OLSSON I., 1976. Protein for growing beef cattle. *French-Swedish symposium on feeding and utilization of cattle*, Theix, 4-8 October, mimeographed.
- THORBEC G., HENCKEL S., 1976. Energetisk vedligeholdelsesbehov hos kalve. *Statens Husdyrbrugsforsog Meddelelse*, nr. 125.

Energy feeding standards for beef cattle used in Switzerland

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1. — Energy evaluation

The new method for assessing energy value of feeds for beef cattle is based on net energy growth as outlined by VAN ES *et al.* (1978) and BICKEL and LANDIS (1978). The determination of metabolizable energy (ME) and the estimation of net energy of the feed for fattening beef and lamb (NEW = Netto Energie Wachstum, NEV = Énergie Nette Viande) follows the procedures given in table 1. To derive NEW values a combined efficiency of utilization of ME for maintenance and growth was chosen at a production level (intensity of production, i_p) of 1.5. The i_p is defined as the total NE-intake divided by the requirement for maintenance (NE_m).

TABLE 1 Estimation of the net energy value of feed for fattening ruminantsConcentrates:

$$\text{ME/T} = 15.9 \text{ DXP/T} + 37.7 \text{ DXL/T} + 13.8 \text{ DXF/T} + 14.7 \text{ DXX/T} (-0.63 \text{ S/T})$$

Forages, except maize silage:

$$\text{ME/T} = 15.1 \text{ DO/T} \quad \text{if DO/DXP} \quad 7$$

$$\text{ME/T} = 14.2 \text{ DO/T} + 5.9 \text{ DXP/T if DO/DXP} \quad 7$$

Maize Silage:

$$\text{ME/T} = 15.5 \text{ DO/T}$$

All feed:

$$\text{NEW/T} = \text{ME/T} \times k_{m,f}$$

$$k_{m,f} = \frac{1.5 \times k_m \times k_f}{0.5 \times k_m + k_f}$$

$$k_m = 0.554 + 0.287 \times q$$

$$k_f = 0.006 + 0.78 \times q$$

$$q = \text{ME/GE}$$

GE; ME = gross energy; metabolizable energy (MJ)

T = dry matter (kg)

DO; DXP; DXL; DXF; DXX = digestible organic matter; digestible crude protein; digestible crude fat; digestible crude fibre; digestible N-free extract

NEW = energy value of feed for beef cattle and fattening lamb (MJ)

k_m, k_f = efficiency of the utilization of ME for maintenance, growth and fattening resp.

$k_{m,f}$ = combined efficiency of the utilization of ME at $i_p = 1.5$

q = metabolizability of GE at maintenance feeding level

s = mono- and disaccharides

i_p = intensity of production (production level)

2. — Energy requirement

The energy requirement is calculated from feeding experiments, performed at the Swiss Federal Research Station for Animal Production, Grangeneuve with 240 bulls and 175 steers of dual purpose breeds (Simmentaler and Braunvieh) (LEHMANN *et al.*, 1978). Energy retention in the body (RE_f) was estimated in these experiments by measuring the individual intake of ME and assuming a constant energy requirement for maintenance per kg metabolic weight:

$$\text{NEW}_m \text{ (MJ)} = 0.330 \times W^{3/4}$$

$$\text{RE}_f \text{ (MJ)} = 0.165 \times W^{3/4} + (\text{INEW} - 0.495 \times W^{3/4}) \frac{k_f}{k_{m,f}}$$

$$\text{INEW (MJ)} = \text{intake of NEW}$$

RE_f is calculated according to the following equations:

$$\text{RE}_f \text{ bulls (MJ)} = \frac{(4.453 + 0.01407 W)\Delta W}{1 - 0.3\Delta W}$$

$$\text{RE}_f \text{ steers (MJ)} = \frac{(1.8893 + 0.02831 W)\Delta W}{1 - 0.3\Delta W}$$

These equations are derived from the following computations:

$$c_w (1 - 0,3\Delta W) = a + bW$$

$$c_w = RE_f / \Delta W$$

Standard deviation ($S_{x, y}$) and correlation coefficients (r^2) of the regressions for bull data and steer data are $\pm 1,381$, $\pm 1,841$, 0,53 and 0.65 respectively.

TABLE 2 Recommended daily allowances for bulls

Liveweight at slaughter kg	Live-weight kg	Daily weight gain kg	NEW MJ	DxP kg	T kg
420 - 450	150	1.00	24.2	0.46	3.2
	200	1.15	31.4	0.53	4.1
	250	1.30	39.5	0.61	5.1
	300	1.45	48.7	0.68	6.2
	350	1.50	55.4	0.72	7.1
	400	1.45	58.3	0.75	7.4
	450	1.40	60.8	0.79	7.8
450 - 480	150	0.90	22.6	0.43	3.1
	200	1.05	29.5	0.50	4.0
	250	1.20	37.2	0.57	5.1
	300	1.30	44.4	0.62	6.1
	350	1.35	50.5	0.68	6.9
	400	1.40	56.9	0.74	7.8
	450	1.35	59.4	0.77	8.1
480	1.30	60.0	0.78	8.2	
470 - 500	150	0.85	21.8	0.41	3.1
	200	0.95	27.5	0.47	4.0
	250	1.05	33.6	0.52	4.8
	300	1.15	40.0	0.56	5.7
	350	1.20	45.6	0.61	6.5
	400	1.25	51.3	0.66	7.3
	450	1.30	57.3	0.74	8.1
500	1.25	59.5	0.77	8.4	
500 - 530	150	0.80	21.0	0.40	3.1
	200	0.90	26.6	0.45	4.0
	250	0.95	31.5	0.49	4.8
	300	1.00	36.4	0.52	5.5
	350	1.05	41.5	0.56	6.3
	400	1.10	46.7	0.60	7.1
	450	1.12	51.4	0.66	7.8
500	1.15	56.1	0.72	8.4	
520	1.12	56.7	0.73	8.5	

In table 2 and 3 recommended daily energy allowances in MJ NEW are shown for different growth rates and different liveweight at slaughter. The allowances are calculated according to the following equation:

$$NEW (MJ/d) = 0.495 \times W^{3/4} + (RE_f - 0.165 \times W^{3/4}) \frac{k_{m, f}}{k_f}$$

Allowances for heifers are assumed to correspond to the allowances for steers.

TABLE 3 Recommended daily allowances for steers and heifers

Liveweight at slaughter	Live- weight	Daily weight gain	NEW	DxP	T
kg	kg	kg	MO	kg	kg
420 - 450	150	0.95	22.6	0.43	3.4
	200	1.05	30.0	0.51	4.3
	250	1.15	38.1	0.59	5.3
	300	1.20	45.5	0.63	6.4
	350	1.20	51.5	0.66	7.3
	400	1.15	55.3	0.71	7.6
	450	1.10	58.6	0.76	8.0
450 - 480	150	0.85	21.1	0.40	3.3
	200	0.90	27.0	0.46	4.2
	250	1.00	34.3	0.53	5.3
	300	1.05	41.0	0.58	6.3
	350	1.10	48.0	0.64	7.1
	400	1.10	53.4	0.69	8.0
	450	1.05	56.7	0.73	8.3
470 - 500	150	0.75	19.7	0.37	3.3
	200	0.80	25.2	0.43	4.2
	250	0.85	30.9	0.48	5.0
	300	0.90	36.9	0.53	5.9
	350	0.95	43.2	0.58	6.7
	400	1.00	49.6	0.64	7.5
	450	1.02	55.8	0.72	8.3
500 - 530	150	0.65	18.3	0.35	3.3
	200	0.70	23.5	0.40	4.2
	250	0.75	28.8	0.45	4.9
	300	0.80	34.4	0.50	5.7
	350	0.85	40.2	0.54	6.5
	400	0.87	45.5	0.59	7.3
	450	0.90	51.0	0.66	8.0
	500	0.90	55.5	0.72	8.6
520	0.90	57.3	0.74	8.7	

References

- VAN ES A.J.H., VERMOREL M., BICKEL H., 1978. Feed evaluation for Ruminants : New Energy Systems in the Netherlands, France and Switzerland. General Introduction. *Liv. Prod. Sci.* 5, 327 - 330.
- BICKEL H., LANDIS J., 1977. Feed evaluation for Ruminants : III. Proposed Application of the New System of Energy Evaluation in Switzerland. *Liv. Prod. Sci.* 5, 367 - 372.
- LEHMANN E., DACCORD R., KESSLER J., 1979. Fütterungsnormen für Aufzucht und Mast von Rindvieh. In H. SCHNEEBERGER (ed.) *Fütterungsnormen und Nährwerttabellen für Wiederkäuer*. Landw. Lehrmittelzentrale, CH-3052 Zollikofen, pp. 42 - 57.