In practical terms these standards require levels of CP in diets for cattle growing at 1 kg/day to be around 15 per cent of the DM at 150 kg LW falling to around 10 per cent at 400 kg and above. For feeding systems based on grass and grass silage these levels are almost always exceeded.

## References


BLAXTER K.L., 1974. In *Nutr. Conf. Feed Manuf.*, Nottingham, **7**, 3. Butterworths, London.

GRIFFITHS T.W., 1977. *Ir. J. agric. Res.* **16**, 11.

GRIFFITHS T.W., 1978. *Anim. Prod.* **26**, 233.

LOFGREEN G.P., GARRETT W.N., 1968. *J. Anim. Sci.* **27**, 793.

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD, 1975. Energy allowances and feeding systems for ruminants. *Tech. Bull.* **33**, HMSO, London.

ROWETT RESEARCH INSTITUTE, 1975. *Feedingstuffs Evaluation Unit*, First Report.

ROWETT RESEARCH INSTITUTE, 1978. *Feedingstuffs Evaluation Unit*, Second Report.

VAN ES A.J.H., 1975. *Livestock Prod. Sci.* **2**, 95.


---

# Netherlands energy and protein feeding standards for growing and fattening cattle


A.J.H. VAN ES

*Research Institute for Livestock Feeding and Nutrition, Lelystad, The Netherlands*


## Energy

In 1977 the system of feed evaluation based on Starch Equivalent was replaced by two new systems, one for dairy cows including young animals for the dairy herd, and one for other growing cattle. Detailed information on the new systems has been published (VAN ES, 1978) ; in this contribution only the major elements will be dealt with.

In both systems (Table 1) firstly the content of ME of the feedstuffs was calculated from measured or predicted contents of digestible nutrients (DO or DXP, DXL, DXF and DXX).

Next, for growing cattle, the approach of HARKINS *et al.* (1974) was followed, in which different efficiencies $k_m$ and $k_f$ are used for the maintenance and production parts of metabolism. Both $k$-values were related to $q$: for $k_m$, based on our own work and the literature; for $k_f$, after BLAXTER (1974):

$$k_m = 0.554 + 0.00287\ q \text{ and } k_f = 0.0078\ q + 0.006$$

A value of 110 kcal ME per $W^{3/4}$ was used as the maintenance requirement of growing cattle kept loose and in groups at the farm. Daily energy gain RE was computed from body weight and daily liveweight gain using the equation given in Table 1, derived from various studies (VAN ES, 1978). Together this information allowed the animal production level (APL) of an animal to be calculated at a given liveweight and daily gain, and thus also the efficiency of the utilisation of the ME for maintenance and gain $k_{m,f}$. Multiplication of ME by $k_{m,f}$ gave the net energy content of a ration for growth. Its prediction equation still contained APL, so the net energy content of the same ration would vary with the rate of gain. In most cases the APL of growing cattle is close to 1.5, so it was decided (as in the case of France and Switzerland) to use only one APL value equal to 1.5 to calculate the net energy contents of feedstuffs. Any errors made at lower or higher rates of gain than the 0.9 kg/d applying to an APL of 1.5 were largely compensated for by slight changes in the

TABLE 1

SURVEY OF THE EQUATIONS USED IN THE VEM AND VEVI FEEDING VALUE SYSTEMS

$$GE/T = 5.77\ XP/T + 8.74\ XL/T + 5.00\ XF/T + 4.06\ XX/T + (-0.15\ \text{'sugars'}/T)^{3}$$

$$GE/T = 4\ 400\ (\text{forages}^{2})$$

$$ME/T = 4.1\ (\text{or } 3.8)^{4}\ DXP/T + 9.0\ DXL/T + 3.3\ DXF/T + 3.5\ DXX/T + (-0.15\ \text{'sugars'}/T)^{3}$$

$$ME/T = 3.4\ DO/T + 1.7\ (\text{or } 1.4)^{4}\ DXP/T\ (\text{forages with } DO/DXP < 7)$$

$$ME/T = 3.7\ DO/T\ (\text{corn silage})$$

$$ME/T = 3.6\ DO/T\ (\text{other forages})$$

$$q = 100\ ME/GE$$

$$VEM/T = 0.6\ [1 + 0.004\ (q - 57)]\ (0.9752/1.65)\ ME/T$$

$$RE = (500 + 6\ W) \times \Delta W/(1 - 0.3\ \Delta W)$$

$$APL = 1 + RE/(78.87\ W^{\frac{3}{4}})$$

$$VEVI/T = \frac{0.006 + 0.0078q}{\dfrac{-0.548 + 0.00493q}{(0.554 + 0.00287q)1.5} + 1}\ \frac{ME/T}{1.650}$$

[2]Green fodders, conserved green fodders, but not roots, tubers, straw or chaff.

[3]Only if feedstuff contains 8% or more 'sugars'.

[4]If sheep data are used to predict ME/T in cattle.

Abbreviations

| | |
|---|---|
| W; ΔW | - liveweight (kg); daily liveweight gain (kg) |
| T | - dry matter (kg) |
| GE; DE; ME; | - gross energy; digestible energy; metabolisable energy (kcal[1]) |
| O; XP, XL; XF; XX | - organic matter; crude protein; crude fat; crude fibre; N-free extract (g) |
| DO; DXP; etc. | - digestible organic matter; digestible crude protein, etc. (g) |
| q | - ME as a percentage of GE |

TABLE 1 (Continued)

| | |
|---|---|
| $k_m$, $k_f$, $k_l$ | - efficiency of the utilisation of ME for maintenance, growth and fattening, and lactation, respectively |
| RE | - energy retained in the body (kcal/day) |
| $NE_l$ | - net energy lactation (kcal) |
| APL | - animal production level, multiple of maintenance |
| VEM | - feed unit lactation |
| VEVI | - feed unit growth |
| FCM | - fat corrected milk (kg) |

[1]To convert kcal to kJ multiply by 4.184. (Thermochemical calorie contains 4.184 Joules according to 'Quantities, Units and Symbols'. Symbols Committee of the Royal Society, London, 1971).

daily requirements. To simplify the use of the net energy values by the farmer, rather than values expressed in kcal of kJ, the feed unit concept was used: a quantity of 1.650 kcal net energy for growth, approximately present in 1 kg barley, was chosen as the unit of the system, the feed unit for growth (VEVI).

Daily requirements for VEVI by growing cattle of different liveweights and daily gains were worked out. The calculated values were compared with the results of feeding trials performed in the Netherlands with bulls on rations of corn silage and concentrates. At the higher liveweights the feeding trials suggested somewhat higher requirements, which was the reason for the calculated requirements being increased by 0 - 10 per cent (Table 2). The other correction in Table 2 was caused by working with one APL of 1.5 instead of the actual APL, as mentioned above.

For young growing cattle reared to become dairy cows it was thought unwise to use a different unit, as the feed evaluation unit, from the one for dairy cows, the VEM, as both types of cattle are usually kept on the same farm. The VEM unit was developed especially

TABLE 2

CORRECTED DAILY REQUIREMENTS FOR VEVI OF GROWING CATTLE KEPT FOR MEAT PRODUCTION AT DIFFERENT LIVEWEIGHTS AND RATES OF GAIN

| Liveweight (kg) | | Liveweight gain (kg/day) | | | |
|---|---|---|---|---|---|
| | | 0.75 | 1.00 | 1.25 | 1.50 |
| | Correction | - 2% | + 2% | + 5% | + 8% |
| 200 | + 0% | 3 500 | 4 100 | 4 800 | 5 800 |
| 300 | | 4 900 | 5 800 | 6 900 | 8 200 |
| 400 | | 6 300 | 7 400 | 8 800 | 10 600 |
| 500 | + 10% | 7 600 | 9 000 | 10 700 | 12 900 |
| 600 | | 8 900 | 10 500 | 12 600 | 15 200 |

Values rounded to the nearest 100

for dairy cows which show nearly the same effect of q on the utilisation of ME for maintenance and for milk production. The requirements of the young stock were first computed after the VEVI system, then appropriate corrections were applied to the resulting figures for using the VEM rather than the VEVI unit. Here again the corrected calculated data were compared with results of feeding trials and found to be low by some 15 per cent. Maybe this was due to the fact that a female animal tends to deposit more fat than a male. The RE equation in Table 1, used to predict energy retention from weight and daily gain, was mainly based on data for bulls. So, in this case also, an appropriate correction was made (Table 3).

TABLE 3

CORRECTED DAILY REQUIREMENTS FOR VEM OF GROWING CATTLE REARED TO BECOME DAIRY COWS AT DIFFERENT LIVEWEIGHTS AND RATES OF GAIN

| Liveweight (kg) | | Liveweight gain (kg/day) 0.3 | 0.5 | 0.7 |
|---|---|---|---|---|
| | Correction | - 12%*, + 15% | - 8%*, + 15% | - 5%*, + 15% |
| 200 | | 2 900 | 3 300 | 3 800 |
| 300 | | 3 900 | 4 500 | 5 100 |
| 400 | | 4 900 | 5 600 | 6 400 |

Values rounded to the nearest 100

*Correction for APL and VEVI to VEM conversion

The energy system for growing cattle still has several weak points. The equation to predict RE from liveweight and daily liveweight gain is based on a limited number of data. The equation used to calculate $k_f$ has a fairly high error of prediction, New information on these points will certainly improve the precision of the system, and can easily be built in by changing some coefficients.

## Protein

The feed requirements for protein are still expressed in digestible crude protein (DXP) and date from several series of feeding trials and studies in the literature (De Boer and Hamm, 1977). Recently in our country the validity of using DXP was discussed in view of proposals to change to physiologically better systems. It was generally agreed that the approach of the new proposal was scientifically far better than the DXP concept. However, so far the new proposals were thought not yet suited to practical application. The quantitative information of the major elements on which they are based, i.e. degradability of feed protein, rate of synthesis of microbial protein, rate of absorption of amino acids from the small intestine, and requirements for absorbed amino acids by growing cattle, is still far from precise. Compared to working with *total* crude protein, using DXP was considered more appropriate as this unit takes into account the losses of metabolic faecal nitrogen which for low quality feeds are considerable.

Table 4 gives the present DXP standards for growing cattle. Those for bulls apply to rations consisting of forage (corn silage) and 2 - 3 kg concentrates, those for the other category to rations mainly consisting of forage. The animals in the latter category are supposed to calve at an age of about 2 years.

The main data on the feed requirements of the animals and the feeding values of the feedstuffs are presented in a booklet (CVB, 1978) which is updated annually.

TABLE 4

DXP REQUIREMENTS OF BULLS (CATEGORY A) AND OF YOUNG CATTLE TO BE USED LATER FOR MILK PRODUCTION (CATEGORY B)

| Bodyweight (kg) | Category A daily gain in kg | | | Category B daily gain in kg | |
|---|---|---|---|---|---|
| | 0.75 | 1.00 | 1.25 | 0.5 | 0.7 |
| 200 | 410 | 460 | 520 | 340 | 380 |
| 300 | 480 | 530 | 580 | 400 | 440 |
| 400 | 510 | 570 | 620 | 440 | 480 |
| 500 | 530 | 580 | 630 | | |
| 600 | 540 | 590 | 640 | | |

## References


BLAXTER K.L., 1974. Metabolisable energy and feeding systems for ruminants. In : *Proc. Nutr. Conf. Feed Manuf.* 7 (H. Swan and D. Lewis, eds.) Butterworth, London, p. 3-25.

BOER F. DE and HAMM G.G.H., 1977. Protein requirements and NPN-supplementation in fattening bulls. *Proc. ECE-FAO Symposium on recent developments in the use of new sources of protein,* Geneva.

CVB (Centraal Veevoederbureau in Nederland) 1978. Voedernormen voor de Landbouwhuisdieren en Voederwaarde van Veevoeders. *Verkorte Tabel,* 29th ed., 32pp.

Es A.J.H. VAN, 1978. Feed Evaluation for ruminants. 1. The systems in use from May 1977 onwards in the Netherlands. *Livest. Prod. Sci.* 5, p. 331-345.

HARKINS J., EDWARDS R.A., McDONALD P., 1974. A new net energy system for ruminants. *Anim. Prod.* 19, p. 141-148.


# Swedish energy and protein feeding standards for growing and fattening cattle


I. OLSSON

*Swedish University of Agricultural Sciences,*
*Division of Ruminants Research,*
*S-755 90 Uppsala, Sweden.*


## Introduction

The majority of beef meat in Sweden is produced by rearing calves from the dairy herds. These calves are mainly purebred Swedish Red and White or Swedish Friesian cattle. A small proportion of Swedish cows (approximately 10 per cent) are used for suckler calf production. In this type of production, different beef breeds (mainly Hereford and Charolais) are frequently used for crossing with the dairy breeds.