Only in somes cases is the nutritional value of a feed determined by digestibility trials with experimental animals.

It has now been proved that Kellner's Starch Equivalent system is not accurate. However, although most of its weaknesses are now apparent, it is still considered the best method of estimating the nutritional value of feeds in Greece since the new systems (ROSTOCK, VAN ES, ARC) are not yet widely known.

Irish Republic energy and protein feeding standards for growing and fattening cattle

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Introduction

There are no officially adopted feeding standards in the Irish Republic but both the Scandinavian Feed Unit and the British Starch Equivalent system have been used. However, when the new system of energy feeding standards (MAFF, 1975) based on metabolisable energy (ME) was adopted in Britain it was not officially adopted in Ireland although the system is being used on a limited scale. A joint committee representing agricultural and veterinary research and education has recommended a system of energy feeding standards similar to, but not identical with, that used in the UK. The proposed system is described in this paper.

A. Energy feeding standards for growth

The system is based on the expression of both the nutritive value of feeds and the nutritive requirements of animals in terms of ME, and uses the megajoule (MJ) as the basic unit of energy. Requirements for ME are obtained from the calculated net energy (NE) requirement for maintenance and growth and the partial efficiency (k) with which dietary ME is used to satisfy these requirements.

Energy requirements for maintenance

Minimum requirement for maintenance — fasting metabolism (FM) is considered to be the NE requirement for maintenance and is related to liveweight (W). Efficiency of utilisation of ME for maintenance (k_m) is related to the metabolisability of the diet (Q):

$$k_m = 0.287 \ Q + 0.55 \tag{2}$$

However, for the range of Q values which are normally found in Ireland k_m lies between 0.68 and 0.76 and a mean value of 0.72 has been taken. The value for FM of 360 kJ ME/kg $W^{0.75}$ has been adopted. An additional allowance for activity (A), mainly locomotion, of 5 per cent has also been included. Metabolisable energy requirements for maintenance (ME_m) are therefore given by:

$$ME_m = \frac{FM}{0.72} + A = 525 \ kJ/kg \ W^{0.75}$$

(Estimates of maintenance requirements made by regression analysis of ME intake on energy and nitrogen retention in housed Friesian cattle have given values of around 480 kJ ME/kg $W^{0.75}$).

Energy requirements for growth and fattening

The ME requirement for body gain is taken as the product of the NE value of the gain in weight and the efficiency with which dietary ME is used for the deposition of body energy.   It was considered that the best available data on the energy value of body weight gain (NE_g) were that of LOFGREEN and GARRETT (1968).   Summarised data on the composition of body gain are:

for steers $NE_g = (0.221 \ g + 0.029 \ g^2) \ W^{0.75}$
(MJ)

where g is empty bodyweight gain (kg).

TABLE 1

RECOMMENDED ME ALLOWANCES FOR GROWING STEERS (MJ/day)

LW	M/D	Maintenance	Liveweight gain			
			0.25	0.5	0.75	1.0
	8		36	43	–	–
200	10	28	35	41	48	55
	12		34	39	45	50
	8		43	52	–	–
250	10	33	40	48	56	64
	12		41	46	53	59
	8		49	60	–	–
300	10	38	46	55	64	73
	12		45	52	61	69
	8		55	67	–	–
350	10	43	52	62	73	83
	12		51	59	70	80
	8		60	73	–	–
400	10	47	58	68	80	92
	12		56	65	75	85
	8		65	80	–	–
450	10	51	63	74	87	100
	12		61	71	82	93
	8		72	88	–	–
500	10	56	69	81	95	–
	12		67	77	89	100

The relationship between the efficiency of utilisation of ME for body energy gain (k_g) and the metabolisability of the diet (Q) has been taken as:

$$k_g = 0.78 \text{ Q} + 0.006 \qquad (4)$$

Total requirements are represented by:

$$ME_{m+p} = ME_m + \frac{NE_g}{k_g}$$

Table 1 gives the ME requirements for steers of different liveweights and gaining at various rates. The Q value of the diets has been expressed in terms of M/D (ME/DM). An arbitrary increase of 10 per cent in these values is suggested for heifers and a decrease of 10 per cent for bulls.

Estimation of the ME values of feeds (MJ/kg DM)

The ME value of concentrates is generally taken from published data (MAFF, 1975 ; ROWETT INSTITUTE, 1975, 1978). For roughages and, in particular, grass silages (which are widely used in Ireland) estimation of ME is based on measurement of *in vitro* DM digestibility values (IVDMD). These are converted to *in vivo* DOMD values and hence to ME using the relationship ME = 0.15 DOMD. The equation suggested for the estimation of the ME of grass silages is :

$$\begin{array}{ll} \text{ME} = 0.12 \text{ IVDMD} + 1.7 \\ \text{(MJ)} \qquad\qquad \text{per cent} \end{array}$$

B. Requirements for protein by growing animals

Again, there are no officially adopted standards for protein requirements in Ireland. Whilst digestible crude protein (DCP) is used it is more normal to refer simply to the crude protein (CP) content of the diet. Metabolic work has consistently shown high correlations between DCP and CP (GRIFFITHS, 1977, 1978).

The following standards are tentative and have been derived from metabolic and comparative slaughter experiments (GRIFFITHS, 1977, 1978). Table 2 gives estimated requirements in terms both of DCP and CP for rates of gains of up to 1 kg per day in cattle between 150 and 450 kg liveweight.

TABLE 2

REQUIREMENTS FOR PROTEIN BY GROWING CATTLE (kg/day)

		Liveweight (kg)						
		150	200	250	300	350	400	450
Maintenance	DCP	0.12	0.13	0.14	0.15	0.16	0.17	0.18
	CP	0.31	0.33	0.34	0.35	0.37	0.38	0.39
0.5 kg/d LWG	DCP	0.25	0.26	0.27	0.29	0.32	0.35	0.37
	CP	0.49	0.50	0.52	0.54	0.58	0.62	0.64
1.0 kg/d LWG	DCP	0.38	0.40	0.43	0.45	0.48	0.50	0.52
	CP	0.66	0.69	0.73	0.76	0.80	0.83	0.85

DCP   Digestible crude protein
CP   Crude protein

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.

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Netherlands energy and protein feeding standards for growing and fattening cattle

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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 $W^{\frac{3}{4}}$ 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