Ann. Zootech., 1980. **29**, n° h. s., 383-421.

Belgian energy and protein feeding standards for growing and fattening cattle

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1. Energy

In Belgium, the energy value of feedstuffs for beef cattle is still expressed as starch units. Nevertheless, there are no standards (energy - requirements) proposed to obtain a certain daily liveweight gain at a well defined liveweight interval.

In practice, fattening animals are fed to appetite on a complete dry diet, besides straw or a restricted quantity of hay (to prevent rumen fermentation disorders) on the one side, and on a mixed ration based on roughages and concentrates on the other hand. Therefore energetic feedstuffs are used such as cereals (BUYSSE *et al.*, 1966 ; BUYSSE and EECKHOUT, 1970 ; COTTYN *et al.*, 1976), sugar beet pulp (BOUCQUE *et al.*, 1976 ; 1978), fodder beets (COTTYN *et al.*, 1970) and maize crops (BOUCQUE *et al.*, 1976 ; 1978), which assure a high daily gain. To reach a growth level of 1 100 g per day with store bulls, the fattening diets should have an energy content of at least 60 per cent starch equivalents in the dry matter. As shown in Table 1, an *ad libitum* intake of these diets did not result in fat carcases with Belgian breeds (white blue = BWB, and white red = BWR breed).

2. Protein

Crude protein and digestible crude protein are used to express the protein requirements for beef cattle. The protein requirements described by the CVB (1979)) of the Netherlands are often used. At the National Institute for Animal Nutrition BUYSSE and EECKHOUT (1970) and EECKHOUT and BUYSSE (1972) investigated the protein requirements of rapidly growing young bulls (baby-beef type) of the Belgian white red breed, *ad libitum* fed with cereal based diets supplemented with soyabean meal.

They found that within the liveweight range of 200 - 350 kg, a digestible crude protein content of 10.3 per cent (11.2 per cent crude protein) in concentrate diets (corresponding with 11.9 and 12.8 per cent in the dry matter respectively) resulted in a reduction of the growth rate and an unfavourable feed conversion, while the feed intake was not depressed. Between 350 and 480 kg 10.3 per cent digestible crude protein (11.2 per cent crude protein) in the concentrate diet (based on 82 and 92 per cent cereals) was sufficient for maximum growth ; daily feed intake was significantly higher compared to the 14.2 per cent digestible crude protein level (15.2 per cent crude protein) ; feed conversion was not significantly different. The performances are summarised in Table 2.

BOUCQUE *et al.* (1978; 1979) investigated the impact of the protein content in the ration on the performances of fattening store bulls with dried sugar beet pulp diets and maize silage diets. A content of 7.9 and 8.4 per cent digestible crude protein (12.1 and 12.2 per cent crude protein) in the dry matter and a daily digestible crude protein intake of 6.2 and 6.9 g/kg $W^{0.75}$ resulted in daily gains of 1 108 and 1 269 g for maize silage and dried sugar beet pulp rations respectively. The explanation of this discrepancy must be found in a different energy intake of ca 7 g starch units per kg $W^{0.75}$. There is good evidence that there is also a difference in protein degradability between maize silage and dried sugar beet pulp (MERTENS, 1977). Further research is necessary.

Communication of the Institute No. 424.

TABLE 1

PERFORMANCES OF FATTENING STORE BULLS *ad libitum* FED WITH SEVERAL ENERGETIC DIETS

Breed	BWB	BWB	BWB	BWB	BWR
Diets - basic feedstuff	Maize silage	95.35% beet pulp	Fodder-beets	High moisture maize grain	50-75% rolled barley
- concentrate supplement	1% LW	-	1% LW	1% LW	50-25%
Energy density of diet (% SE in DM)	69.4	74.9	71.3	85.3	77.6
Number of bulls	78	20	30	20	23
Initial weight (kg)	278.1	242.1	277.7	275.6	216.9
Final weight (kg)	565.7	630.2	574.2	563.7	528.8
Experimental days	343.2	305.8	215.6	201.4	237.6
Daily gain (g)	1183	1269	1375	1431	1313
Daily feed intake (kg)					
- complete diet	-	9.12	-	-	8.14
- maize crop	17.67	-	-	7.08	-
- concentrate	4.05	-	4.55	4.04	-
- fodder beets	-	-	21.25	-	-
- grass hay	-	-	0.37	-	-
Nutrient intake (g/kg $W^{0.75}$)					
- dry matter	80.5	81.4	87.2	79.6	80.8
- starch units	55.9	61.0	62.2	67.9	62.7
Dressing percent	63.2	63.3 (n = 10)	62.6	63.1	61.5
Carcase composition (%)					
- meat	-	67.8	65.5	-	64.0
- fat	-	17.6	21.0	-	22.1
- bones	-	14.6	13.5	-	13.9

TABLE 2

PERFORMANCES OF BABY-BEEF BULLS IN RELATION TO THE PROTEIN CONTENT OF CEREAL DIETS

Liveweight range (kg)	Performances	% protein of the concentrate (DM basis)		
		17.4*	15.2	12.8
		16.3**	14.2	11.9
		(n = 12)	(n = 11)	(n = 14)
200 - 350	daily gain (g)	1 446^{a}	1 452^{a}	1 301^{b}
	daily feed intake (kg)	6.02^{a}	6.30^{a}	6.22^{a}
	feed conversion (kg)	4.21^{A}	4.36^{a}	4.81^{B}
350 - 485	daily gain (g)	1 129^{a}	1 199^{a}	1 219^{a}
	daily feed intake (kg)	7.19^{A}	7.77^{b}	8.01^{B}
	feed conversion (kg)	6.42^{a}	6.53^{a}	6.66^{a}
200 - 485	daily gain (g)	1 276^{a}	1 311^{a}	1 255^{a}
	daily feed intake (kg)	6.62^{a}	7.09^{b}	7.10^{b}
	feed conversion (kg)	5.20^{A}	5.42^{AB}	5.67^{B}

a, A,..... values on the same line with different superscripts are significantly different ($P < 0.05$ or < 0.01)

* Crude protein content

** Digestible crude protein content (pepsin)

TABLE 3

EFFECT OF PROTEIN LEVEL ON GROWTH RATE AND FEED EFFICIENCY OF FATTENING STORE BULLS

Diet	95% dried beet pulp		Maize silage a.l. Conc.: 0.75% LW	
Composition of DM (%)				
- crude protein	10.7	12.2	10.1	12.1
- digestible crude protein *	6.9	8.4	6.0	7.9
- starch equivalents	74.6	74.9	68.0	68.2
Number of bulls	20	20	33	33
Initial weight (kg)	240.9	242.1	287.1	287.8
Weight at 140 days (kg)	381.9	433.6	424.7	449.3
Final weight (kg)	565.3	630.2	556.8	584.9
Experimental days	306.8	305.8	270.8	268.2
Daily gain				
- from start to 140 d	1 007^{A}	1 368^{B}	983^{a}	1 154^{b}
- from 140 d to end	1 100^{a}	1 186^{a}	1 010^{a}	1 058^{a}
- from start to end	1 057^{A}	1 269^{B}	996^{a}	1 108^{b}
Daily intake (g/kg $W^{0.75}$)				
- dry matter	76.7	81.4	76.0	78.6
- crude protein	8.2	9.9	7.7	9.5
- dig. crude protein	5.3	6.9	4.6	6.2
- starch units	57.2	61.0	51.8	53.7
Feed conversion (g/kg)				
- crude protein	698	745	720	820
- digestible crude protein	452	516	430	540
- starch units	4870	4580	4830	4630
Dressing percent	61.1^{A}	63.3^{B}	63.1^{a}	63.9^{b}
Carcase composition (%)	(n = 9)	(n = 10)		
- meat	68.5^{a}	67.8^{a}	-	-
- fat	16.8^{a}	17.6^{a}	-	-
- bones	14.7^{a}	14.6^{a}	-	-
Carcase blockiness (kg/cm)	2.6^{A}	2.9^{B}	-	-

a, A .... values on the same line with different superscripts are significantly different ($P < 0.05$ or < 0.01)

* Determined with sheep in digestibility trials.

LAMBOT *et al.* (1979) found comparable results : the optimum crude protein concentration for growth and nitrogen utilisation is about 13.3 - 12.2 and 11.4 per cent at body weights of 250, 350 and 450 kg. The effect of the ration protein content is presented in Table 3.

References

BOUCQUE Ch. V., COTTYN B.G., BUYSSE F.X. 1976, Maize silage with or without NPN, dehydrated whole-crop maize pellets or high moisture maize grain for finishing bulls. *Anim. Feed Sci. Technol.*, **1**, 347.

BOUCQUE Ch. V., COTTYN B.G., AERTS J.V., BUYSSE F.X., 1976. Dried sugar beet pulp as a high energy feed for beef cattle. *Anim. Feed Sci. Technol.*, **1**, 643.

BOUCQUE Ch. V., COTTYN B.G., BUYSSE F.X., 1978. *Bull fattening with dehydrated whole-corn-plant pellets compared with corn silage and high-moisture grain.* Proc. 2nd International Green Crop Drying Congress, August, 1978 p. 327.

BOUCQUE Ch. V., FIEMS L.O., COTTYN B.G., BUYSSE F.X., 1978. *Utilization of some industrial by-products in beef production.* European Congress for Improved Beef Productivity, Paris, 28-29 September 1978.

BOUCQUE Ch. V., 1979. Unpublished data.

BUYSSE F.X., BOUCQUE Ch. V., EECHOUT W., 1966. *Intensive beef production (baby-beef) principally on concentrates.* Communication of the Institute No. 125.

BUYSSE F.X., EECKHOUT W., 1970. Besoins en protéines de jeunes taureaux soumis à un régime d'engraissement intensif. *Rev. Agric. Brux.*, **23**, 703.

COTTYN B.G., BOUCQUE Ch. V., BUYSSE F.X., 1970. La valeur des betteraves fourragères pour la production intensive de viande bovine. *Rev. Agric., Brux.*, **23**, 501.

COTTYN B.G., BOUCQUE Ch. V., BUYSSE F.X., 1976. Complete dry rations based on dried sugar beet pulp and rolled barley for intensive beef production. *Z. Tierphysiol., Tierernährg. u. Futtermittelkde.* **37**, 99.

CVB., 1979. Voedernormen voor de landbouwhuisdieren en voederwaarde van veevoeders. Verkorte tabel. Centraal Veevoederbureau in Nederland.

EECKHOUT W., BUYSSE F.X., 1972. Recherches complémentaires concernant les besoins en protéines de taurillons (baby-beef) engraissés de manière intensive. *Rev. Agric. Brux.*, **25**, 21.

LAMBOT O., BIENFAIT J.M., VAN EENAEME C., NICKS B., CORDIEZ E., 1979. Etude de trois niveaux protéiques dans des régimes à base de maïs déshydraté pour des jeunes bovins en croissance - engraissement. *Ann. Méd. Vét.*, **123**, 195.

MERTENS D.R., 1977. *Importance and measurement of protein insolubility in ruminant diets.* Proc. Georgia Nutrition Conference, p. 30.

Danish energy and protein feeding standards for growing and fattening cattle

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Introduction

In Denmark the energy value of feeds as well as the energy requirements of growing animals and milking cows are still expressed as Scandinavian Feed Units (SFU). One SFU is equivalent to the energy content of 1 kg barley (85 per cent dry matter). The advantages of this system are the additivity of energy values of feeds, the simplicity of estimating ration composition for a given production, and the expected production from a defined ration.

The requirements for protein are expressed as digestible crude protein (DCP).