European Association for Animal Production (EAAP) Meeting, Uppsala, 2005
Session NCSH2.12

Relative energy requirements of beef bull breeds

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Introduction

Feed energy requirements of cattle are often presented according to mature size (Agricultural Research Council, 1988). However, it may be more useful to present requirements according to breed which is known to affect requirements independent of size or weight. Taylor, Thiessen and Murray (1986) concluded that the efficiency with which an animal uses energy to support maintenance requirements is lower in cattle breeds with higher milk production potential. These authors reported that the maintenance requirement of dairy breeds is about 0.2 times greater than that of beef breeds. Garrett (1971) found with growing steers that requirements for maintenance and gain were proportionately 0.15 higher for Holstein than for Herefords. However, there is little information on the relative energy requirements within beef breeds. The objective of the present exercise was to estimate the energy requirements of different beef cattle breeds by using the feed intake and performance data from the Irish National beef bull performance test station at Tully.

Materials and Methods

The data used was for purebred beef bulls, which were tested between July 1997 and June 2004. A total of 28 batches of bulls comprising of 112 Aberdeen Angus (AA), 87 Hereford (H), 255 Charolais (C), 432 Limousin (L) and 251 Simmental (S) were used. These animals had been suckled by their dams on the farm of origin and entered the test station shortly after weaning at about 6 to 7 months of age remaining there for approximately 6 months. Initially, the bulls were offered a low daily allocation of concentrates which was increased gradually over time until *ad libitum* concentrate intake was reached. The animals were also given 1.5 kg of hay or 1.0 kg of hay plus 0.5 kg of lucerne daily as a source of roughage. Feed energy requirements (UFV/day) were estimated for each breed by regression of daily energy intake on mean liveweight and liveweight gain during the final period (varied from 98 to 168 days) on test using the GLM procedure of SAS (2001). Batch was included in the model as a covariate. Using the multiple regression equations generated estimated energy requirements of the five breeds were then computed for bulls of 500 kg liveweight and gaining 1.5 kg daily. Ultrasonic scanning of the eye muscle at the 12/13 rib was carried out on each bull at approximately 500 kg liveweight to obtain muscle area, fat depth and fat area.

Results and Discussion

The average weight of the bulls during the test period varied from 442 kg for the AA to 512 kg for the S (Table 1). The average age at the completion of the test was quite similar for all breeds. Weight gain per day of age at the start of the test period which is an indicator of performance during the suckling period was greatest for the S (1.60 kg/day), followed by C (1.55 kg/day) with the AA, H and L quite similar (~1.40 kg/day). These differences probably reflect the combined affect of the growth potential and the dam milk production potential of the different breeds. Final weight per day of age at the end of the test period is a reflection of the mature size of the breed and the growth potential of the animal and was lowest for the AA (1.44 kg/day) followed by the L (1.47 kg/day) and H (1.49 kg/day) with values greatest for the S and C (~1.64 kg/day). Feed conversion rates were poorest for the AA, H and S which were quite similar and best for C and L. Fat area and fat depth at the 12/13 rib were greatest for AA and H and lowest for C, L and S. Muscle area was lowest for AA and H (~90 cm^2) intermediate for S (101.8 cm^2) and highest for C (107.2 cm^2) and L (109.2 cm^2).

Estimated energy requirements of AA, H, C, L and S bulls at 500 kg liveweight and gaining 1.5 kg daily were 10.2, 10.1, 9.3, 9.1 and 9.8 UFV per day, respectively (Table 2). Corresponding requirements relative to the Charolais breed (C=100) were 110, 109, 100, 98 and 105. Relative metabolisable energy requirements reported by the Agricultural Research Council (1988) for bulls were 100, 111 and 124 for breeds of large, medium and small mature size respectively. AFRC (1993) described AA as early, H as medium and C, L and S as late-maturing breeds. Relative values reported by INRA (Jarrige 1989) for large beef breeds (C and L) and Friesians were 100 and 120 respectively. The results of the present evaluation show that the energy requirements of the early maturing AA and H breeds (of small/medium mature size) are about 0.1 greater than the breeds of large mature size (C and L) when compared at a similar liveweight. The 0.05 higher requirements for the Simmental compared with the Charolais and Limousin may be a reflection of the higher milk production potential of that breed (i.e. less efficient at partitioning nutrients towards tissue accretion). These results are in agreement with data in the literature (Garrett 1971; Taylor, Moore and Thiessen 1986; Taylor, Thiessen and Murray 1986; Agricultural Research Council 1988; Jarrige 1989) which shows that animals of larger mature size have lower energy requirements for maintenance and growth and that increased milk production potential results in increased requirements.

Conclusion

These data show across breed and within class (small, medium and large mature size) differences in energy requirements. Consequently, these data suggest that tables describing energy requirements for cattle should specify breed as both mature size and milk production potential can affect requirements.

References

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Table 1. Liveweights, weight gains, feed intake, feed conversion rates and scanned eye muscle measurements for 5 bull breeds

	Aberdeen Angus	Hereford	Charolais	Limousin	Simmental	Significance
Number of bulls	112	87	255	432	251	***
Average wt. on test (kg)	442	463	508	460	512	***
Age at end of test(days)	375	382	384	384	378	**
Initial wt. for age (kg/ day)	1.388	1.395	1.551	1.405	1.599	***
Final wt. for age (kg/day)	1.438	1.492	1.628	1.469	1.649	***
Average gain on test (kg/day)	1.555	1.680	1.782	1.602	1.747	***
Intake(UFV/day)	9.29	9.65	9.58	8.73	10.16	***
FCE (UFV/kg gain)	6.06	5.81	5.45	5.54	5.95	***
Scan wt. (kg)	491	510	515	498	515	***
Fat Depth (cm)	0.56	0.57	0.26	0.26	0.31	***
Fat Area (cm^2)	4.88	4.87	2.12	2.04	2.48	***
Muscle Area (cm^2)	89.7	92.0	107.2	109.2	101.8	***

Table 2. Estimated energy requirements (UFV/day) of 500kg bulls gaining 1.5kg/day from the present study and comparison with existing data

	Aberdeen Angus	Hereford	Charolais	Limousin	Simmental	Friesian
Present study: UFV/day	10.2	10.1	9.3	9.1	9.8	
Present study: relative	110	109	100	98	105	
ARC (1984): relative	124^{S}	111^{M}	100^{L}			
Jarrige (1989): relative			100			120

L, M and S = Large, medium and small mature size as defined by AFRC (1993)