European Association for Animal Production, Dublin 2007, Session 11, Paper 13
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Effect of breed on growth rate and body measurements in young steers

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Introduction

Profitability in beef production can be influenced by the growth rate of the animal. Body dimensions or linear measurements are used to supplement body weight as a measure of productivity (Gilbert et al., 1993) or as indicators of growth rate and live weight (LW) (Brown et al., 1973). The objective of this study was to compare growth rate and body measurements of Aberdeen Angus × Holstein-Friesian, Belgian Blue × Holstein-Friesian, Holstein and Friesian male cattle in their first year of life.

Materials and Methods

In 2006, 174 calves from 61 commercial dairy herds were purchased and transferred to Grange Research Centre at 2 to 8 weeks of age. The calves were Aberdeen Angus (AA; n=59) and Belgian Blue (BB; n=59) crossbreds from Holstein-Friesian dams, and Holsteins (HO; n=28) and Friesians (FR; n=28) from Holstein and Friesian dams, respectively. A total of 41 sires were represented in the dataset, comprising of 10 AA, 12 BB, 7 FR, and 12 HO. Calves were reared indoors on milk replacer, concentrates and hay before being turned out to pasture where they were offered up to 2 kg concentrate per head daily. They were treated with ivermectin (Qualimec, Janssen Animal Health) at 3, 8 and 13 weeks post turn-out for the control of gastrointestinal parasites. All calves were weighed monthly. Average daily gain (ADG) from arrival to housing (mean = 186 days) was calculated by fitting a linear regression of LW on age in PROC REG (SAS, 2006). Prior to first housing, body measurements, namely height at withers, chest girth, length of back, chest depth and pelvic width were recorded.

Mixed model methodology in PROC MIXED (SAS, 2006) was used to determine the effects of breed on ADG, LW at housing and body measurements. Body measurements were firstly analysed using the actual data and then on a per 100 kg LW basis. Sire and herd were included as random effects. For the analysis of ADG and LW at first housing, week of birth was included as a factor in the model. Furthermore, in the analysis of LW an interaction between breed and fortnight of age was also included in the model to account for the different growth patterns of the different breeds; fortnight of age was included as a repeated effect with a first order autoregressive correlation structure assumed among records within animal. For analysis of the body measurements, age at measurement was included as a covariate. Least squares means for the effect of breed were calculated and compared following the Tukey adjustment for multiple comparisons.

Results and Discussion

Table 1 shows the effect of breed on LW prior to first housing and ADG from arrival to housing. The results show that BB were heavier ($P<0.05$) than AA with no significant difference between the other breeds. There were differences in ADG with FR gaining faster ($P<0.05$) than both AA and BB while the HO was intermediate but not different ($P>0.05$) from the other breeds (Figure 1). In terms of actual body measurements, FR and HO were taller than the AA and BB and also had greater chest depth. There were no differences ($P>0.05$) between AA and BB, or between FR and HO except for pelvic width where FR and BB had greater ($P<0.05$) values than HO and AA, respectively. Friesians had numerically the greatest values for all measurements except chest depth where HO was greatest, but the differences were generally not significant.

In terms of body measurements per 100 kg LW (Table 2), the AA were taller, longer and had greater chest girth and depth than BB ($P<0.05$). The dairy strains were intermediate between, and not significantly different from AA and BB. Correlations between LW and body measurements (Table 3) show the strong relationship that exists between both variables.

Conclusions

Growth rate and linear body measurements were influenced by breed. Friesians and HO did not differ significantly for any of the traits measured whereas AA and BB differed for all traits except ADG and pelvic width. FR expressed a higher growth rate than both beef breeds with the difference increasing with age. Based on body measurements per kg LW, BB were most and AA were least compact. Linear body measurements were strongly associated with live weight.

Table 1. Effect of breed type on LW (kg), ADG (kg/d) and body measurements (mm).

	AA	BB	FR	HO	SE	Sig
Live weight[1]	174[a]	187[b]	184[ab]	181[ab]	4.6	**
Average Daily Gain	0.60[a]	0.64[a]	0.79[b]	0.67[ab]	0.03	***
Height at withers	981[a]	995[a]	1048[b]	1046[b]	9.2	***
Chest girth	1312[a]	1347[ab]	1387[b]	1372[b]	13.8	**
Length of back	864[a]	871[ab]	904[bc]	881[ac]	8.9	*
Chest depth	483[a]	484[a]	509[b]	510[b]	4.5	***
Pelvic width	324[a]	342[bc]	359[b]	329[ac]	4.0	***

[1] At housing; [abc] Means with a superscript in common are not significantly (P>0.05) different

Table 2. Effect of breed type on LW (kg), ADG (kg/d) and body measurements (mm/100 kg).

	AA	BB	FR	HO	SE	Sig
Live weight[1]	174[a]	187[b]	184[ab]	181[ab]	4.6	**
Average Daily Gain	0.60[a]	0.64[a]	0.79[b]	0.67[ab]	0.03	***
Height at withers	575[a]	522[bc]	535[ac]	565[ac]	13.6	*
Chest girth	763[a]	705[bc]	703[ac]	743[ac]	15.0	**
Length of back	505[a]	458[bc]	461[ac]	472[ac]	11.2	**
Chest depth	282[a]	253[bc]	259[ac]	276[ac]	6.4	**
Pelvic width	190	180	182	176	4.0	NS

[1] At housing; [abc] Means with a superscript in common are not significantly (P>0.05) different

Figure 1. Growth pattern of breeds from arrival to housing. Error bars represent one pooled standard error.

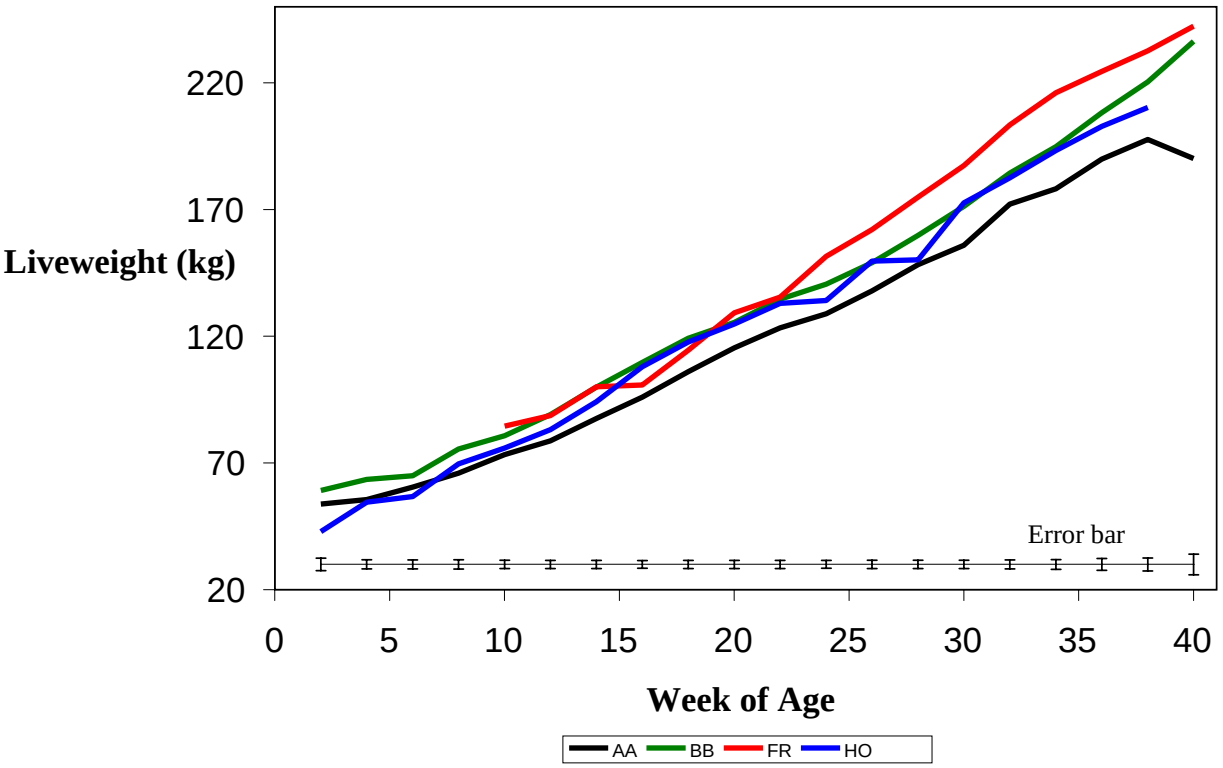

Table 3. Correlations between LW and body measurements

	AA	BB	FR	HO
Height at withers	0.78	0.85	0.72	0.80
Chest girth	0.97	0.92	0.95	0.91
Length of back	0.83	0.80	0.82	0.79
Chest depth	0.93	0.92	0.86	0.67
Pelvic width	0.84	0.75	0.74	0.62