(European Association for Animal Production Meeting, Antalya 2006, Session C33.52)

Beef production from Holstein-Friesian, Montbeliarde and Norwegian Red young bulls

M.G. Keane, gerry.keane@teagasc.ie
Grange Beef Research Centre, Teagasc, Grange, Dunsany, Co. Meath, Ireland.

Introduction

Montbeliarde and Norwegian Red dairy cattle have been imported into Ireland and their male progeny are reared for beef. The objective of this study was to compare Holstein-Friesian (HF), Montbeliarde (MB) and Norwegian Red (NR) young bulls for growth, feed intake and carcass traits.

Material and Methods

A total of 36 (12 per breed) young bulls were reared to slaughter at 18 months. They were the pure bred progeny of HF, MB and NR cows and four bulls per breed. Mean birth dates were March 2, February 16 and February 19 for HF, NR and MB, respectively. All were turned out to pasture together on May 6 for 176 days (grazing period). On October 29, they were housed in a slatted floor shed. For the following 119 days (store period) they were offered grass silage (mean analysis: 198 g/kg dry matter (DM), 139 g/kg DM crude protein (CP), 698 g/kg *in vitro* DM digestibility, pH 3.9) plus 1.0 kg/day concentrates (870 g/kg rolled barley, 67.5 g/kg soya bean meal, 47.5 g/kg molasses and 15 g/kg mineral/vitamin premix). During this period, 6 animals per breed type were tied in individual stalls and silage intake was measured for 7 weeks. From February 26, the concentrate allowance was increased gradually to 4 kg/day and remained at this level until April 6 (growing period). Then, over a 3-week period the animals were adjusted to a finishing diet of concentrates *ad libitum* (650 g/kg rolled barley, 210 g/kg maize meal, 120 g/kg soya bean meal, 20 g/kg mineral/vitamin premix) plus 1 kg/day silage DM for 130 days. All were slaughtered together. After slaughter, cold carcass weight, weight of perinephric plus retroperitoneal fat, carcass grades and carcass length and depth were recorded. The data were analysed using general linear model procedures.

Results

The breeds differed in silage intake scaled for mean live weight but only the difference between MB and HF was significant (Table 1). During the store period, NR gained faster ($P<0.05$) than MB and HF and they also tended to gain faster during the pasture period. Consequently, they had a higher ($P<0.05$) rate of gain from turn out to the end of the store period. There were no significant differences in gain during the growing or finishing periods or in slaughter weight per day of age. Finishing gains were high indicating expression of compensatory growth following moderate gains earlier. Slaughter weights were similar for MB and HF but tended to be higher for NR.

Kill-out proportion was significantly higher for MB than for NR and for NR than HF. Carcass weight was similar for MB and NR but was lower ($P<0.05$) for HF (Table 2). Carcass grades did not differ significantly between the breeds. Per kg carcass weight, perinephric plus retroperitoneal fat did not differ between NR and HF but was lower ($P<0.05$) for MB. Carcass measurements scaled for carcass weight were similar for MB and NR and significantly greater for HF indicating poorer carcass compactness.

Discussion

The higher intake of HF compared with MB agrees with many other studies which have shown that Holstein-Friesians have higher intakes than beef and dual purpose breeds (Beranger and Micol, 1980; Keane, 2003). While the intake of NR was not significantly different from that of the other two breeds it was numerically (6%) lower than that of HF. This agrees with the findings of Kirkland *et al.* (2005) who reported a significantly (9%) lower intake for Norwegian Reds compared to Holstein-Friesians.

There was no difference in growth rate at any time between MB and HF so the weight difference at slaughter was the same as at calf arrival. In contrast, NR which tended to gain faster at pasture and gained significantly faster during the store period were 41 ($P<0.05$) and 33 kg heavier than MB and HF, respectively at the start of finishing. However, they tended to grow more slowly during finishing so their weight advantage had declined to 27 and 23 kg, respectively at slaughter. These results do not entirely agree with those of Kirkland *et al.* (2005) who found no difference in growth rate between Holstein-Friesian and Norwegian Red dairy cattle. However, that comparison did not commence until the animals were about 200 kg live weight by which time much of the growth difference between the breeds in the present study had occurred.

The lifetime growth patterns for the three breeds indicate that NR grew faster up to about 300 kg live weight and then entered the slower plateau growth phase. Support for this view is provided by the carcass and offal fat data. Growth rate slows as fat deposition increases (Robelin and Tulloh, 1992), and although differences were not significant, mean carcass fat score and weight of perinephric plus retroperitoneal fat were higher for NR than for MB and HF. Kirkland *et al.* (2005) also found that Norwegian Red cattle tended to have a higher carcass fat score than Holstein-Friesians.

The high rate of gain of all three breeds during finishing reflected the fact that the animals were entire males and were expressing compensatory growth following sub-optimal growth earlier. From calf turnout to the start of finishing, mean daily gain was only 0.72 kg compared with a potential of more than 1 kg/day (Keane, 1979).

Differences between Holstein-Friesians and other breed types in kill-out proportion have been reported previously (Kempster, Cook and Southgate, 1988), and there are also kill-out differences between Holstein-Friesian strains (Keane, 2003). The kill-out difference between NR and HF observed here is in agreement with the findings of Kirkland *et al.* (2005).

Mean carcass conformation score was commercially acceptable for MB and NR but a proportion of HF carcasses fell into "P" conformation class. Poor carcass conformation is an acknowledged problem with Holstein-Friesians and is exacerbated when carcasses are light (Keane, 2003). Kirkland *et al.* (2005) reported a bigger difference in conformation between Norwegian Red and Holstein-Friesian cattle than observed here due mainly to a lower Holstein-Friesian value. Despite the light carcasses, carcass fat

score was acceptable for all three breeds, probably a reflection of their high feeding level and growth rate during the finishing period.

The large difference in carcass compactness between HF and the other two breeds as indicated by carcass measurements scaled for carcass weight was not reflected in carcass conformation score. Poorer carcass compactness of Holstein-Friesians compared with other breeds and crosses has been documented previously as has poor agreement between carcass conformation score and compactness (Keane, 2003).

Conclusions

Substitution of HF by MB dairy cows in Ireland would reduce feed intake and increase carcass weight of the male progeny used for beef production. The increased carcass weight would reflect a higher kill-out proportion rather than to an increased growth rate or slaughter weight. Substitution of HF by NR dairy cows would not affect intake but would increase carcass weight due both to a higher growth rate and a higher kill-out proportion. From a beef production perspective MB is preferable to NR and both are preferable to HF.

Table 1. Intakes and live weight gains of Holstein-Friesian (HF), Montbeliarde (MB) and Norwegian (NR) young bulls

	HF	MB	NR	s.e.	P value
Silage intake (g/kg LW)	20.8[a]	18.1[b]	19.5[ab]	0.52	0.02
Live weight gains (g/day) for:					
Arrival to housing	556	502	578	47.7	0.29
Store period	550[a]	609[a]	740[b]	44.7	0.02
Growing period	1171	1023	1240	101.0	0.31
Finishing period	1846	1868	1766	75.9	0.68
Slaughter weight per day of age (g)	996	969	1013	27.4	0.38
Slaughter weight (kg)	528	524	551	13.5	0.17

LW = Live weight

Table 2. Carcass weights and traits of Holstein-Friesian (HF), Montbeliarde (MB) and Norwegian Red (NR) young bulls

	HF	MB	NR	s.e.	P value
Carcass weight (kg)	258[a]	280[ab]	284[b]	8.1	0.05
Kill-out (g/kg)	488[a]	533[c]	514[b]	3.3	0.001
Carcass weight per day of age (g)	487	517	521	16.1	0.10
Conformation[1]	1.89	2.14	2.03	0.109	0.27
Fat score[2]	2.89	2.95	3.23	0.129	0.15
Per kg carcass					
Perinephric + retroperitoneal fat (g)	29.0[a]	22.0[b]	28.7[a]	2.17	0.05
Carcass length (cm)	0.508[a]	0.461[b]	0.465[b]	0.009	0.003
Carcass depth (cm)	0.181[a]	0.159[b]	0.164[b]	0.005	0.006

[1]Scale 1 (poorest) to 5 (best); [2]Scale 1 (leannest) to 5 (fatness). LW = Live weight

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