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Animal Science Research Centre - Beef Unit Trial Results – 2017 (c)

Comparison of the performance and meat quality of bulls versus steers

Introduction and Objective:

There have been recent moves by some retailers to move away from bull beef yet the evidence on which this decision has been made is not clear. Current knowledge would indicate that bulls have a number of advantages over steers in terms of efficient beef production; namely:

- Faster rates of growth
- Improved feed conversion efficiency
- Lower methane emissions per kg beef produced
- Faster throughput rates
- Leaner beef
- Higher profit generation potential

However steers are better suited to making use of home grown forages and are generally easier to manage in terms of behaviour. They may also be less susceptible to meat quality issues, with a reduced incidence of dark cutting beef.

The objective of this experiment at Harper Adams University was to compare the performance and meat quality of dairy bred bulls versus steers. With regards to meat quality some studies have evaluated bull versus steer beef with the bulls intensively reared and steers extensively grass finished. The rearing system will influence meat quality with grazing enhancing beef flavour. The bulls and steers in this study were both reared on an intensive cereal beef system.

Animals & Timing:

34 Jan-Feb 2016 born Holstein (n = 24), British Blue x Holstein (n = 6) and Hereford x Holstein (n = 4) male calves weighing approximately 220kg at 5½ months old were randomized into two balanced treatment groups in a randomized block design according to live weight and breed. The Blues and Herefords were bred from the same sire. The steers were castrated by a veterinary surgeon following randomization to their treatment group.

Management:

The calves were offered Wynnstay Prime Beef *ad libitum* from hoppers with straw offered *ad lib* from racks. The concentrates were formulated to contain 14% crude protein (16% CP/kg DM) and 36% starch in the DM (32% as fed) manufactured with the following feedstuffs listed in descending order of inclusion: wheat, barley, wheatfeed, palm kernel, distillers, NIS, molasses and minerals.

The cattle were selected for slaughter at a target fat class 3 and slaughtered at ABP, Shrewsbury.

Results:

Table 1: Animal performance

(kg/head)	Bulls	Steers	s.e.d	P Value	Sig
Start wt	222	221	5.2	0.893	NS
Slaughter wt	580	564	8.8	0.112	NS
Days to slaughter	270	278	7.4	0.326	NS
DLWG	1.33	1.25	0.057	0.195	NS
Age at slaughter (days)¹	432 (14.2)	438 (14.4)	12.0	0.580	NS

¹ Age in brackets = months

NS = not significant, * = P<0.05, ** = P<0.01, *** = P<0.001

The carcasses were classified by Video Image Analysis (VIA).

Table 2: Carcase characteristics

	Bulls	Steers	s.e.d	P Value	Sig
Carcase wt (kg)	299.0	285.6	4.37	0.009	*
Kill out (%)	51.6	50.6	0.35	0.013	*
Carcase DG (kg)	0.72	0.66	0.029	0.049	*
Conformation¹ (1-15)	4.7 (O-/O=)	4.5 (O-)	0.31	0.426	NS
Fat class¹ (1-15)	6.0 (2+)	7.6 (3-/3=)	0.29	<0.001	***
Liver score² (1-5)	1.64	1.29	0.500	0.444	NS

¹ EUROP carcase classification: Conformation: P=1 and E+=15, Fat class: 1- =1 and 5+=15.

² Liver assessment: 1= Healthy liver and 5 = Severe abscesses (due to acidosis).

Table 3: Feed intakes (kg/head) and feed conversion ratio (FCR)

	Bulls	Steers
Total concentrate intake (kg)	2,192	2,188
Daily concentrate intake (kg)	8.12	7.87
FCR (kg feed fresh wt: kg lwt gain)	6.12	6.38
FCR (kg feed DM: kg carcase gain)	9.70	10.26

The FCRs (kg feed: kg liveweight gain) appear relatively high compared to the target of 5.5:1 for cereal fed Holstein bulls but it must be taken into consideration that the experiment did not include the period of growth from 110kg (3 months of age) to 220kg (5½ months of age) for this batch of calves. During this rearing phase the calves recorded a DLWG of 1.35kg having consumed 346kg of concentrates equating to an FCR of 3.15:1. Overall feed intakes from 12 weeks old to slaughter were therefore 2,538kg (fresh weight) per head for the bulls.

Observations on behaviour were carried out by BSc IV student Fraser Parris. The results showed that the bulls spent more time standing and interacting (which included aggressive behaviour) and less time ruminating.

Table 4: Financial performance (£)

	Bulls	Steers	s.e.d	P Value	Sig
Carcase price (£/kg)¹	3.05	3.10	0.048	0.320	NS
Carcase value (£)	913	888	20.4	0.244	NS
Feed cost (£/t)	175	175			
Feed cost (£/head)	384	383			
Margin over Feed (£/head)	529	505	Bulls +£24		
Feed cost/kg live wt gain (£/kg)	1.07	1.10			
Feed cost/kg carcasse gain (£/kg)	1.97	2.09			

¹ Carcasse price standardised to the ABP price grid with a base price of £3.50/kg for steers and £3.45/kg for bulls with deductions for light weight carcasses.

Overall the bulls and steers returned a gross margin of £302 and £278 per head respectively when calculated from being reared as calves through to slaughter. The cattle were sold to ABP with a price grid penalty for bulls of 5p/kg. If the penalty was 14p/kg the margins would be identical.

An assessment of meat quality was kindly carried out by Liz Ford and colleagues of AHDB Beef & Lamb at the AHDB New Product Development Unit, in Cheshire. Two steaks of 2cm thickness were removed from the *Longissimum lumborum* of the left hand side of each animal 48 hours post slaughter at ABP when the pH was also measured. The steaks were then vacuum packed, labelled and boxed and placed in a chill room for a 14 day standard maturation. Following maturation the steaks were frozen and subsequently taken to AHDB Beef & Lamb's NPD unit for Warner-Bratzler Shear Force assessment, using the standard shear force testing protocol for steaks. The samples were also scored for marbling, eye muscle area and muscle colour.

Table 5: Meat quality

	Bulls	Steers	s.e.d	P Value	Sig
pH	5.53	5.46	0.031	0.095	Trend
Longissimus Dorsi Area (cm²)	81.02	68.84	3.529	0.022	*
Lean colour (MSA)¹	3.38	1.93	0.56	0.048	*
Marbling (USDA)²	2.32	2.82	0.240	0.098	Trend
Peak shear force (kg)³	3.58	3.03	0.110	0.002	**

¹ Meat Standards Australia: Lightest = 1 and Darkest =6.

² USDA marbling standards: Slight = 1 and Moderately abundant = 7.

³ Warner-Bratzler Shear Force assessment: Very tender = 1. There is no upper limit or score. Current average values for sirloin steaks from an AHDB retail survey is 3.1. As a guide a score of 5-5.5 would be regarded as tough.

The meat analysis results show a trend for a higher pH for bulls and one of the bulls was identified as a 'dark cutter'. The Longissimus dorsi (eye muscle) area for bulls was significantly (P<0.05) larger than that of steers. However, meat from steers was significantly (P<0.05) lighter in colour and significantly (P<0.01) more tender. Despite a higher toughness score for the bull carcasses they were still very commercially acceptable for the retail trade. There was a trend for the beef from the steers to have more marbling.



Figure above left is Liz Ford of AHDB carrying out the marbling assessment. Figure on the right is the meat colour assessment using the Meat Standards Australia test.

Discussion & Conclusions:

- The bulls recorded significantly higher carcass daily gains (+0.06kg) and carcass weights (+13.4kg). Slaughter live weights were also heavier (+16kg) which was not statistically significant, however, with a superior kill out (51.6 v 50.6%) this resulted in significantly heavier carcass weights.
- The bulls recorded significantly ($P < 0.001$) lower fat classifications (2+ versus 3-/3=). Carcasses classified for conformation R- to O- at ABP with a fat classification of 2= or 2- receive further deductions of between 10 to 20p/kg compared to carcasses classified as 2+ and above. This had a negative effect on carcass value compared to the steers which had a higher fat classification.
- The bulls recorded slightly higher daily feed intakes but due to their superior performance recorded improved FCR's.
- The eye muscle area for the bull carcasses was significantly larger. The meat from the bulls was significantly tougher but can still be regarded as very acceptable for the retail trade, with a slightly lower marbling score. The range in tenderness scores was lower in the bulls than in the steers indicating that the bull beef was a more consistent product. One of the bulls was recorded as a 'dark cutter' (see notes below on dark cutting beef). The meat from the steers was significantly lighter in colour. It was not possible to carry out a flavour and juiciness test, however, it could be suggested that with the higher marbling score and reduced toughness there may be a slightly improved eating experience with the steer beef.
- Based on the costs prevailing at the time of the study the bulls recorded an increase in carcass value of £25 with a higher margin over feed of £24 per bull.

Dark cutting beef

Estimates from work done by AHDB in 2009 would suggest that the incidence of dark cutting beef could be as high as 10% in bulls. There are a number of pre slaughter management strategies that can be implemented to reduce the incidence of dark cutting beef.

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