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Growth and slaughter characteristics of Ankole cattle and its Boran and Friesian crossbreds

D. Asizua[1], D. Mpairwe[1#], F. Kabi[1], D. Mutetikka[1] and J. Madsen[2]
[1] Department of Animal Science, Faculty of Agriculture, Makerere University, P.O. Box 7062, Kampala, Uganda
[2] Department of Large Ruminant Production, University of Life Sciences, Copenhagen, Denmark

Abstract

One hundred and forty four bulls comprising 48 animals of each breed, i.e. purebred Ankole (ANK) and its crossbreds with Boran (AXB) and Friesian (AXF) were assigned to three feeding systems (FS) to evaluate their performance for improved beef production. The bulls, averaging 191 ± 9.6 kg live weight and 18 months of age, were arranged in a completely randomized design in a 3 X 3 factorial treatment arrangement. The feeding systems comprised: T1 (Grazing alone), T2 (Grazing + concentrate) and T3 (feedlot finishing with maize stover plus 60% concentrate fed *ad libitum*). Both genotype and feeding system affected growth and slaughter characteristics. The AXF crossbreds had higher average daily gain (ADG) (620 g/day) than ANK (560 g/day) and AXB (500 g/day). Average daily gain was higher in T3 (850 g/day) than in T2 (550 g/day) and T1 (270 g/day). Hot carcass weight and dressing percentage varied in a descending order of 145, 132, 110 kg and 52, 51 and 50% for T3, T2 and T1, respectively. Similar trends were observed for non-carcass components although there were no differences between T3 and T2. Except for external non-carcass components, genotype did not affect slaughter characteristics. The results of this study indicated that the indigenous Ankole cattle have a great potential for beef production when finished in a feedlot even without crossbreeding.

Keywords: Indigenous cattle, feedlot, performance
[#] Corresponding author. E-mail: dmpairwe@agric.mak.ac.ug

Introduction

Uganda's beef industry has for long relied on indigenous cattle genotypes raised under extensive management systems, in the rangelands. The Ankole cattle which constitute more than half of the indigenous cattle population are a key component of the livelihood of pastoral communities. However, with increasing interest in dairy and improved beef production, crossbreeding with Friesian and improved Boran breeds is growing. The Ministry of Agriculture Animal Industry and Fisheries estimated the exotic/crossbred cattle population at 1.3 million, accounting for 17.3% of the total cattle population (about 7.6 million) in the country (MAAIF, 2006) compared to 4.4% in 1997. This exposes the indigenous cattle population to further threats of extinction. A few studies have evaluated the performance of the Anloke cattle for improved beef production (Kabi, 2003; Mpairwe *et al.*, 2003) but concentrated on nutritional management. Other studies have concentrated on milk production potential (Grimaud, 2007; Hatungumukama, 2007), grazing behaviour (Huber *et al*., 2008) and fitness traits (Ndumu *et al.*, 2008).

The Ankole cattle have also been victims of the overall perception that indigenous tropical cattle breeds have low potential for improved beef production. But the successes achieved in the South African beef industry through use of Nguni cattle (Strydom, 2008; Strydom *et al.*, 2008) bears commendable evidence for utilisation of these animals for beef production. This study was conducted to test whether the Ankole cattle and its crossbreds with Boran and Friesian are not similar in performance under supplementation of the traditional grazing system and feedlot finishing.

Materials and Methods

The study was conducted between July and December, 2007 on a private ranch located in Nakaseke district which lies within the cattle corridor of Uganda at an altitude of 1080 m and latitude 1° 0" 0' North and longitude 32° 19" 60' East. Total mean annual rainfall ranges between 800 - 1233 mm. Total rainfall for 2007 was 1263 mm while rainfall between July and December was 639 mm. The area is characterized by open dry savannah with *Combretum* spp. as the main tree species and sparsely distributed *Acacia* spp.

A 3 X 3 factorial treatment structure was used to randomly allocate 144 young bulls (191 ± 9.6 kg initial weight); 48 pure Ankole (ANK), 48 Ankole-Boran (AXB) and 48 Ankole-Friesian (AXF) crossbreds aged 18 months on average, to three feeding systems: solely grazing (control, T1), grazing with concentrate supplementation overnight (T2) and fully confined feedlot finishing (T3) with bulls fed *ad libitum* on maize stover and concentrate. The grazing pastures comprised of *Sporobollus* spp., *Brachiaria* spp., *Cymbopogon* spp., *Themeda* spp., *Panicum* spp., *Chloris* spp. and *Hyparrhenia* spp. sparsely distributed in open dry savannah. The concentrate comprised 70% maize bran, 20% cotton seedcake and 10% molasses. All bulls had free access to rock salt and water. Daily feed offer included an additional 10% of previous day's intake per pen of four bulls and concentrate accounted for 60% of the daily offer for bulls in T3. The trial lasted for 120 days excluding a 28 day adaptation period.

Grazing bulls were released to graze by 08:30 and the grazing supplemented group returned for concentrate feeding by 17:30. Concentrate in T3 was offered in two equal proportions at 08:30 and 16:30 while maize stover chopped at less than 6 cm lengths was offered in small batches throughout the day.

Bulls were weighed in three consecutive days to establish initial weights. Subsequent weights were taken every 14 days. All weights were taken before a day's morning offer of feeds. Average daily live body weight gain was determined as a proportion of total weight change over the period on feed (120 days). At the end of the feeding trial, eight bulls per treatment were selected for slaughter. Bulls were transported for eight hours to a commercial abattoir located about 120 km from the ranch and were slaughtered after an overnight fasting. Measurements taken at slaughter included: slaughter weights and hot carcass weights, and hot carcass dressing percentage were computed as a percentage of the hot carcass weight to the slaughter weight. Weights of skin with tail, feet, heart, lungs with trachea, kidney without fat, liver with gall bladder, empty stomach (rumen, reticulum, omasum and abomasum) and empty intestines (small and large intestines) with caecum were taken and recorded as non-carcass components. Omental fat, mesenteric fat, kidney fat, pericardial fat and scrotal fat were also weighed and recorded. Omental and mesenteric fat were summed as digestive tract fat while kidney and cardiac fat were summed as pluck fat. Total internal fat was computed as the sum of the digestive tract fat and pluck fat.

Maize stover and concentrate sub-samples were collected per batch of chopping and mixing respectively and each merged to form monthly samples for chemical analysis. Pasture samples were collected each month through on spot observation of the grazing behaviour of bulls and herbage samples cut in close simulation of the height of harvest by bulls at random sites in the grazing area. Dry matter (DM), crude protein (CP), ether extracts (EE), calcium (Ca), phosphorus (P) and total ash were analysed according to the procedures of AOAC (1990). Neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL) were analysed by the procedures of Van Soest *et al.* (1991). Gross energy (GE) was analysed using the bomb calorimeter (GALLENKAMP Autobomb, UK).

Data was analysed using the general linear model (GLM) procedures of Statistical Analysis Systems (SAS, 2003) using a factorial treatment arrangement. The least square means generated were separated using standard error of the mean and the probability of difference between means.

Results and Discussion

The chemical composition of the concentrate supplement, maize stover and pastures are presented in Table 1. Gross energy, crude protein and ether extracts were higher in concentrate supplement than pasture and maize stover in that order.

The Least squares means for effects of genotype and feeding system on growth performance are presented in Table 2. Genotype affected average daily gain (ADG), live weight change (LWC) and final live weight (FLW), but not ($P > 0.05$) genotype-feeding system interaction. The AXF had higher ($P < 0.05$) ADG, LWC and FLW than the AXB. The ANK bulls had similar ($P > 0.05$) ADG, LWC and final weight to that of AXF and AXB. The higher growth rate of the AXF could be attributed to their large frame and heavier mature size (Owens *et al.*, 1993).

Feeding system significantly affected growth performance (Table 2). Bulls in the feedlot (T3) had a faster ($P < 0.001$) growth rate than the grazing and supplemented (T2) and sole grazing (T1) bulls. The corresponding mean weight gains were 0.85, 0.55, 0.27 kg/head/day for T3, T2 and T1, respectively. The higher growth rate in the supplemented bulls (T3 and T2) was attributed to the higher energy and protein intake from the concentrate supplement.

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Table 1 Chemical composition (g/kg DM) of feeds with standard deviation

	Concentrate	Maize stover	Pasture
Dry matter	905 ± 4.4	889 ± 22.5	879 ± 9.4
Gross energy (MJ/kg DM)	17.4 ± 0.6	15.2 ± 1.0	15.3 ± 0.9
Crude protein	150.8 ± 9.9	53.0 ± 6.7	90.0 ± 11.9
Neutral detergent fibre	285.5 ± 13.8	692.6 ± 34.2	558.1 ± 22.7
Acid detergent fibre	76.0 ± 5.0	405.6 ± 18.9	346.6 ± 16.1
Acid detergent lignin	26.4 ± 0.7	63.2 ± 5.1	59.2 ± 5.4
Ether extract	94.2 ± 3.8	4.2 ± 0.6	9.8 ± 1.6
Ash	52.2 ± 2.2	103.5 ± 6.1	80.2 ± 4.7
Calcium	1.5 ± 0.2	0.3 ± 0.05	4.5 ± 1.2
Phosphorus	4.2 ± 0.4	7.8 ± 0.9	8.2 ± 1.1

Table 2 Least squares means for growth performance as affected by genotype (Gen) and feeding systems (FS)

	Genotype				Feeding system				Significance	
	ANK	AXB	AXF	s.e.	T1	T2	T3	s.e.	Gen	FS
Initial weight (kg)	185.4	202.0	185.2	8.4	199.7	197.2	175.7	8.4	ns	ns
Final Weight (kg)	258.1^{ab}	251.2^{b}	265.8^{a}	3.5	223.6^{c}	257.5^{b}	293.9^{a}	3.3	*	***
Weight change (kg)	66.7^{ab}	59.8^{b}	74.4^{a}	3.5	32.2^{c}	66.1^{b}	102.5^{a}	3.3	*	***
Average daily gain (kg)	0.56^{ab}	0.50^{b}	0.62^{a}	0.30	0.27^{c}	0.55^{b}	0.85^{a}	0.03	*	***

ANK – Ankole; AXB - Ankole-Boran; AXF - Ankole-Friesian.
[a, b, c] Means within rows with different superscripts differ (P <0.05); ***- P <0.001; *-P <0.05; ns-non significant.
s.e. – Standard error of the mean.

Results for slaughter characteristics are presented in Tables 3. Genotype and genotype-feeding system interaction did not affect (P >0.05) slaughter weight, empty body weight, hot carcass weight and hot carcass dressing percentage. Genotype, however, affected some non-carcass components such as skin plus tail and scrotal fat (P <0.01), feet (P <0.05) and total gastrointestinal tract (GIT) (P <0.01). Heavier skin plus tail were also obtained in the ANK and AXB bulls than the AXF and this was associated with the dewlap, large umbilical flap and extra skin covering humps which significantly contribute to the weight of the skin in indigenous tropical cattle breeds. The AXF bulls had heavier weights of feet than ANK and AXB and this was attributed to their larger frame size as was noted by Owens *et al.* (1993).

Feeding system affected (P <0.001) slaughter weight, hot carcass weight and hot carcass percentage (P <0.05). Skin plus tail, feet, heart, liver, lungs, kidney, spleen, scrotal fat, internal fat were also affected by feeding system. Supplemented bulls (T3 and T2) had heavier body parts than control bulls (grazing alone, T1) and this was attributed to deposition of protein and energy in growing animals which according to Geay (1984) and Webster (1986) increases with increasing levels of supply of these two nutrients.

Conclusion

The lack of statistical difference between the pure bred Ankole cattle ANK and AXF on growth characteristics reflects the potential of the genotype for beef production without crossbreeding. The increasing performance of bulls with increasing level of management and nutrient supply reveals that the achieved performance levels in this study were lower than the true potential of these genotypes when subjected to *ad libitum* nutrient supply.

Table 3 Least squares means for the slaughter characteristics of the different feeding systems and genotypes

	Genotype (Gen)				Feeding system (FS)				Significance	
	ANK	AXB	AXF	s.e.	T1	T2	T3	s.e.	Gen	FS
Carcass components										
Slaughter weight	248.7	250.2	255.0	3.8	220.2^{c}	257.1^{b}	276.5^{a}	4.0	ns	***
Hot carcass weight	126.7	129.3	130.8	2.4	109.6^{c}	132.3^{b}	145.0^{a}	2.5	ns	***
Hot carcass dressing %	50.9	51.6	51.2	0.6	49.9^{b}	51.4^{ab}	52.3^{a}	0.6	ns	*
External non-carcass components										
Skin plus tail	22.9^{b}	25.0^{a}	20.0^{c}	0.61	19.8^{c}	22.3^{b}	25.9^{a}	0.64	***	***
Feet	6.6^{b}	6.5^{b}	6.9^{a}	0.09	6.2^{c}	6.7^{b}	7.2^{a}	0.1	**	***
Internal non-carcass components										
Heart	1.1	1.1	1.2	0.03	1.02^{b}	1.14^{a}	1.20^{a}	0.03	ns	***
Liver	4.0^{b}	4.1^{ab}	4.4^{a}	0.12	3.58^{b}	4.30^{a}	4.57^{a}	0.12	*	***
Lungs	4.5	4.5	4.7	0.16	3.98^{b}	4.67^{a}	4.97^{a}	0.15	ns	***
Kidney	0.69	0.66	0.68	0.02	0.56^{b}	0.62^{b}	0.85^{a}	0.022	ns	***
Spleen	0.72	0.66	0.64	0.03	0.55^{b}	0.71^{a}	0.76^{a}	0.025	ns	***
Total GIT[1]	19.4^{b}	19.8^{b}	21.2^{a}	0.47	19.3^{b}	20.7^{a}	20.4^{ab}	0.43	*	ns
Internal fat[2]	3.4	3.9	4.0	0.23	3.0^{b}	3.5^{b}	4.9^{a}	0.21	ns	***
Scrotal fat	0.48^{b}	0.56^{a}	0.37^{c}	0.03	0.3^{c}	0.4^{b}	0.6^{a}	0.03	***	***

ANK – Ankole; AXB - Ankole-Boran; AXF - Ankole-Friesian.
$^{a\,b\,c}$ Means within rows with different superscripts differ (P <0.05); ***- P <0.001; **-P <0.01; *-P <0.05; ns-non significant; s.e. – standard error of the mean; [1] Total GIT comprised rumen, reticulum, omasum, abomasums, small and large intestine and caecum; [2] Internal fat contained omensal fat, mesenteric fat, kidney fat and pluck fat.

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