Characteristics of Ankole Longhorn cattle and their production environments in South Western Uganda: milk offtake and body measurements

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Summary

Characteristics of lactation performance, based on AM milk offtake and conformation, of Ankole cattle were studied during one year in 37 herds with 606 recorded cows in Mbarara district in southwestern Uganda. Recording of AM milk offtake was undertaken in eight areas of Mbarara district which represent different production systems and vegetation types.

The 467 cows with complete lactation cows yielded, on average, a total AM offtake of 252 and 325 kg over first and second or higher lactations, respectively. These offtakes were higher than other African indigenous populations in pastoral systems. Mean body weight was 292 and 341 kg for first and second or higher parities, respectively. Average body measurements for all parities were 161 cm for heart girth, 129 cm for height at withers and 193 cm for body length.

The daily AM milk offtake varied from 1.1 kg in the Ruhengere area characterized by thorny Acacia thickets to 1.9 kg in the bush-cleared Kanyanya area with improved pastures.

Although the Ankole cows performed best on the improved pastures, their future may relatively be more favourable in the original non-cleared bush areas because of the gradually increasing competition from exotic dairy breeds and their crosses.

Resumen

Se han estudiado durante un año las características de rendimiento de lactación y conformación en base al método de recogida de leche AM, utilizando 37 rebaños de raza Ankole, con 606 vacas en control lechero, en la zona de Mbarara, en el sudeste de Uganda. El control de recogida de leche con sistema AM fue realizado en ocho zonas de Mbarara que representan los distintos tipos de sistema de producción y vegetación existentes.

Las 467 vacas controladas en sistema de lactación completa produjeron una media de 252 a 325 kg en la primera y segunda, o sucesivas lactaciones, respectivamente. Estas producciones fueron superiores a otras poblaciones africanas en sistema pastoral. El peso medio corporal fue de 292 y 341 kg en la primera y segunda, o superior en condiciones de paridad. La media del

tamaño corporal en todo caso fue de 161 cm de circunferencia torácica, 129 cm de altura a la cruz, y 193 cm de longitud corporal.

La producción de leche diaria en sistema AM varió de 1,1 kg en la zona de Ruhengere, caracterizada por la presencia de acacia, hasta 1,9 kg en la zona de pastos mejorados de Kanyanya.

A pesar de su mejor rendimiento en zona de pastos mejorados, el futuro de la raza Ankole puede ser relativamente más favorable en zonas de pastoreo, teniendo en cuenta la creciente competencia gradual proveniente de razas lecheras exóticas y de sus cruces.

Key words: *Lactation characteristics, Body weight, Heart girth, Withers height, Body length, Production system, Vegetation type.*

Introduction

The Ankole Longhorn is an ancient breed belonging to the Sanga group of cattle. The breed is indigenous to the central and eastern regions of Africa and is found in the western and south-western parts of Uganda. It is classified as an intermediate *Bos indicus* (lateral horned Zebu) and *Bos taurus* (Hamitic longhorn) breed type with a small cervicothoracic hump. It has a relatively large body frame and characteristically long, large horns that curve outwards and upwards (Sacker and Trail, 1966). The Ugandan population size is unofficially estimated to be roughly 2.9 million heads.

The Ankole Longhorns, having been developed mainly through natural selection, have the ability to survive and reproduce under the climatic stresses of the wooded savannah of south-western Uganda and the surrounding areas where diseases and parasites are prevalent. Traditional cattle production is based on pastoral grazing without supplementary feeding or regular water availability. This has enabled cattle keepers to utilise this bovine genetic resource under a low input production environment for food and agriculture.

However, the recent development of opportunities in milk marketing has changed the situation in some areas. The infrastructure has been improved by the establishment of a good road connection between Mbarara and Kampala. This has in combination with the organization of milk collection and processing, led to a market outlet for milk to Kampala.

A study, described in detail by Ndumu (2000), was undertaken with the purpose of recording a sample of the population in Mbarara district. Eight areas representing different types of production environments were included.

The objective of the study was to evaluate the lactation performance and body characteristics of the breed in relation to the production environment characteristics including types of production systems, management practices and vegetation.

Characteristics of Cattle Production and the Areas

The study areas lie on the open and wooded savannah grassland of south-western Uganda and cover the counties of Isingiro North, Nyabushozi and Kashari (Figure 1). The topography is one of undulating hills, which are dissected by numerous broad drainage channels and fairly steep valleys. The elevation is about between 1 375 m to 1 525 m above sea level.

The grass layer is heterogeneous and is dominated by *Themeda triandra*. *Bracheria decumbens*, Digitaria spp., *Hyparrhenia filipendula* and *Chloris gayana* are also abundant. Indigenous legumes of the Desmodium spp. are common, while an obnoxious lemon grass, *Cymbopogon afronadus*, has extensively encroached on the natural grazeable species.

The traditional cattle production based on pastoral grazing has been influenced by a recent improvement in infrastructure as well as the organization of milk collection and processing which has led to new market

outlets. These new opportunities for commercial milk production have again encouraged cattle keepers to gradually improve their management practices, including bush clearance for improvement of the pastures.

The areas are now characterized by differences in ecological conditions and, in particular, differences in vegetation (Table 1). In the Ruhengere area grazing takes place among the thorny Acacia thickets which have hardly been cleared to provide for adequate pasture. In contrast in Kanyanya there is very little Acacia thicket and the main weed, *Cymbopogon afronadus*, is easier to clear. After their clearance *Hyparrhenia ruffa* natural pastures tend to flourish, especially during the rainy season, and the cattle do not experience the difficulty of having to manoeuver through a thorny bush in search of pasture. The vegetation cover of Masha and Rushere is similar, although many large anthills covered with thicket vegetation pose an additional problem of bush encroachment for the farmers in Rushere. Kashongi represents an area of transition between two livestock production systems, i.e. the pastoral and agro-pastoral with the Acacia thickets more sparsely distributed. Most farmers in Kanyaryeru have access to vast areas for grazing, despite the presence of Acacia thickets and they are endeavouring to clear more of the thickets. The livestock system in Mutonto is mainly agro-pastoral, with competition for land for crop agriculture and livestock grazing.

Materials and Methods

Sampling areas and herds

The Ankole population in the areas with access to milk outlets is unofficially estimated to be roughly 0.5 million heads of which approximately 45% are cows (Ndumu, 2000).

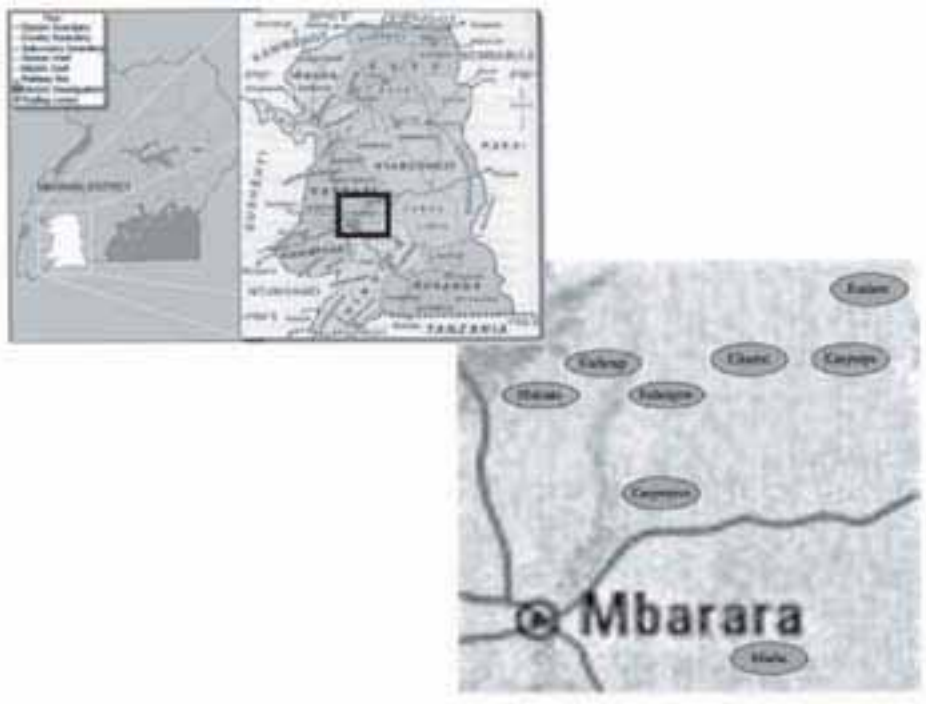

Figure 1. Location of areas in Mbarara district.

A two-stage cluster sampling design was used for two main reasons. Firstly, a proper sampling frame for the existing cattle population could not be easily established due to the reminiscent nomadic practices of some cattle keepers in the district. Secondly, this method was useful in minimizing the costs of undertaking the survey.

The first stage was to select suitable study areas within the three counties in Mbarara district. This was deliberately based on ease of accessibility to the areas and herds given the poor road network, the limited time and resources available for the survey.

The second stage involved deliberate sampling in order to choose herds that satisfied the following criteria:

1. Herds in an area were within a radius of a 7 km bicycle journey from the centre where the recording assistant operated.
2. Cattle owners who agreed to have cows ear-tagged and the milk of individual cows recorded once every two weeks.

Thirty seven herds were selected from eight areas within the district (Table 1). Kanyaryeru and Mutonto are in the Kashari county and Masha in the Isingiro county while the remaining five areas belong to the Nyabushozi county. Between two and seven herds were selected from each area.

Thirty five herds satisfied the criteria for milk recording (Table 1).

Recording

Herds were visited every two weeks and the morning milk yields of six hundred and six cows were recorded by eight recording assistants during the period January to December 1997. Of these, 467 cows were recorded from the beginning to the end of lactation. Milk fat content for 486 of the cows in 33 of the herds was determined once using the Gerber method.

Two hundred and ninety eight cows in 17 herds were weighed individually once using the Barlow) electronic mobile weigh bridge. Body measurements were also taken on heart girth and body length of 285 cows

Figure 1. An Ankole herd.

Table 1. Characteristics of production system and vegetation type plus l east squares means for daily AM milk offtake and lactation length of parity 2+ cows in eight areas in Mbarara district.

Area	Production system	Vegetation	No. of cows (herds)	Milk offtake (kg ± S.E.)	Lactation length (days)
Kanyanya	Pastoral	*Cymbopogon afronadus*	89 (6)	1.92±0.09	220
Kanyaryeru	Pastoral	Cleared thickets	95 (5)	1.67±0.10	219
Kashongi	Pastoral-agro-pastoral	Cleared thickets	75 (7)	1.65±0.09	218
Rushere	Pastoral	*Acacia thickets* and shrub anthills	26 (2)	1.30±0.17	234
Masha	Pastoral	*Acacia thickets*	13 (2)	1.45±0.18	219
Mutonto	Agro-pastoral	Cleared thickets	62 (5)	1.26±0.11	224
Kikaatsi	Pastoral	*Cymbopogan afronadus*	55 (5)	1.24±0.11	215
Ruhengere	Pastoral	*Acacia thicket*	52 (5)	1.09±0.11	230

in 16 herds and height at the withers of 273 cows in 15 herds.

Statistical analyses

The analysis of total and average daily morning lactation milk offtake, length of complete lactations, fat percentage, body weight, heart girth, height at withers and body length was undertaken using the mixed model (REML) procedure of Genstat (2000). Lactation number was considered as two categories: parity 1 and parity 2+. The statistical model was:

$$y_{ijkl} = \mu + A_i + h_{ij} + P_k + e_{ijkl}$$

where:

y_{ijkl} = observation l in herd *j* within area *i*, in parity *k*
μ = mean
A_i = fixed effect of area *i* (*i* = 1,8)
h_{ij} = random effect of herd *j* in area *i*
P_k = fixed effect of parity *k* (*k* = 1,2+)
e_{ijkl} = random residual effect

Least squares estimates were then adjusted by subtracting the overall least squares mean from the overall mean of the raw data. This was done to ensure that the least squares estimates provided realistic estimates of the real-life situation. The means provided directly from the least squares analysis assume equal numbers of parity 1 and 2+ cows.

Results

The statistical analyses revealed a considerable difference between parities 1 and 2+ for milk offtake, lactation length and body weight (P<0.001) (Table 2). The difference between parities for fat percentage was not significant. Body length was also greater for parity 2+ than parity 1 cows (P<0.001) but differences between parities for heart girth and height at withers were insignificant.

The 79 parity 1 cows represent a replacement rate of 17% of the 467 cows.

The effects of area (Table 1) and herd within area were highly significant for total and daily AM milk offtake as for lactation

Figure 2. Grazing Ankole cattle.

Table 2. Summary statistics for lactation and conformation traits.

Trait	Parity	No. of cows	Least squares mean	S.D.[a]
Total AM offtake (kg)	1	79	252	63
	2+	388	326	85
Daily AM offtake (kg)	1	79	1.29	0.25
	2+	388	1.48	0.30
Lactation length (d)	1	79	199	25
	2+	388	221	24
Fat (%)	mean	486	5.25	1.65
Body weight (kg)	1	51	292	21
	2+	247	341	35
Heart girth (cm)	mean	285	161	6.2
Height at withers (cm)	mean	272	129	4.4
Body length (cm)	1	48	185	15
	2+	237	194	10

[a]Standard deviations within herds. These are shown here separately for the two parities. They were pooled for the least squares analysis of variance.

length ($P < 0.001$). Body weight, heart girth and height at withers also differed significantly among areas ($P < 0.001$). There were no significant differences among areas for body length

Discussion

Milk production

De Leeuw and Wilson's (1987) summary of demographic and production characteristics of five livestock systems showed that despite the variety of the functions, most traditional African cattle owners keep cattle primarily to assure a supply of milk and secondarily to accumulate stock as a form of investment. This situation probably reflects the traditional system of subsistance cattle production in areas with original environments. However, the areas within the Mbarara district represent different types of production systems, management practices and vegetation types.

Under pastoral grazing conditions the Ankole cows in their second or subsequent lactation produced a total AM milk offtake of 326 kg over an average period of 221 days (Table 2). Using a factor of 0.72 for the estimation of PM milk offtake (Bunge and Kamya, 1951) total milk offtake for parity 2+ cows could be estimated approximately as 561 kg. The actual factor to be used in the present situation is not known and therefore could be different.

The daily AM offtake estimated for Ankole cattle in this study, namely 1.48 kg is considerably higher than daily milk offtakes during the wet season for the pastoral systems of Mali, Nigeria and Kenya of 0.86, 0.70 and 1.08 kg, respectively, as reported by De Leeuw and Wilson (1987). They are also substantially higher than the milk yield reported from other tropical indigenous populations under pastoral conditions (e.g. Marchot, 1983, Johnson *et al.*, 1984, Nicholson, 1984). These differences may partly be due to the unique market system in Mbarara district.

The higher milk offtake in the present data might be due to a higher genetic potential of the Ankole cattle compared to other African breeds. However, considering the range in mean milk offtakes across areas (Table 1), the present results are for the most part more likely to be due to improved management practices, e.g. bush clearance and improved pastures.

The mean fat percentage of 5.25% (Table 2) falls within the range reported for some indigenous cattle breeds in parts of Africa (Olaloku and Oyenuga, 1973; Belete, 1982).

The differences in performance characteristics among the areas reflect the differences in ecological conditions, vegetation type and management practices (Table 1). The natural vegetation is originally determined by the ecological conditions, but livestock grazing influences the prevailing vegetation. The overall improvement of management practices, e.g. bush clearance etc., results in changes in the vegetation type. The Ruhengere area with its thorny Acacia thickets represents a system where grazing has influenced the natural vegetation but changes in management practices have so far had a low impact on the pastures. The Kanyanya herds may have benefited from being raised in a bush cleared area virtually free of thicket, with *Hyparrhenia ruffa* vegetation providing the most improved pastures.

The differences in milk offtake among the areas (Table 1) reflect some of the impact from the major vegetation types and management practices. The Kanyanya herds had the highest offtake in the apparent most favourable area, whereas the Ruhengere herds had the lowest offtake in the most adverse area. The vast areas available for grazing, despite the presence of Acacia in Kanyaryeru, also appeared to promote an above average offtake. The competition between crop agriculture and livestock grazing for land in the agro-pastoral livestock system in Mutonto could explain the below average AM offtake there.

Body measurements

The Ankole cows (Figure 2 and 3) in this study (Table 2) were generally heavier than Zebu, but similar to the Sanga breeds (Furnemont, 1982; Alberro, 1983**;** Gregory *et al.*, 1985). They were heavier than Ankole cattle found in Rwanda under rural conditions but lighter than those reared on a research station in Rwanda (Furnemont, 1982) and others managed under experimental conditions at the Ruhengere field station in Mbarara district (Gregory *et al.*, 1985).

From a study of the traditional uses of indigenous cattle genetic resources in Uganda, the Ankole cattle breed is rated at 40 (on a score scale of 0 – 100) for the supply of meat (Mbuza, 1995). Consequently, any future considerations on breed improvement need to take into account the dual purpose nature of this breed.

Future development

The observed differences among areas probably reflect the ongoing development brought about by the recent changes. From the original production environment seen in the Ruhengere area with its thorny Acacia thickets, the improvement of pastures has led to a new situation in Kanyanya with naturally flourishing *Hyparrhenia ruffa* pastures.

It remains to be seen which of the production systems and vegetation types yield the best prospects for sustainable milk production. An alternative genetic stock comprising pure exotic dairy breeds and their crosses has already appeared in the Mbarara district and these cattle may displace the Ankole in the most favourable pastures, e.g. in the Kanyanya area, whereas the rough area of Ruhengere may favour the indigenous cattle. The Ankole cattle may be threatened by gradual replacement by exotic dairy breeds in the areas with a good milk outlet. However, as these areas only contain roughly 0.5 millions out of 2.9 millions heads in the Ugandan population the breed seems far from being endangered in the near future. In addition the breed is also present in the neighbouring countries.

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