Livestock Science 182 (2015) 112–117

Contents lists available at ScienceDirect

Livestock Science

journal homepage: www.elsevier.com/locate/livsci

Growth performance and carcass characteristics of Tanzania Shorthorn Zebu cattle finished on molasses or maize grain with rice or maize by-products

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ARTICLE INFO

Article history:
Received 27 April 2014
Received in revised form
7 June 2015
Accepted 3 November 2015

Keywords:
Weight gain
Carcass characteristics
Feedlot
Agro-processing by-products

ABSTRACT

Forty five steers (2.5–3.0 years of age and 200 ± 5 (SEM) kg body weight) were allotted randomly into five diets to assess the effects of finishing Tanzania Shorthorn Zebu (TSZ) cattle in feedlot using diets based on either molasses or maize grain combined with maize or rice by-products. The diets were hay and concentrate mixtures of hominy feed with molasses (HFMO), rice polishing with molasses (RPMO), hominy feed with maize meal (HFMM), rice polishing with maize meal (RPMM) and a control of maize meal with molasses (MMMO). All concentrate mixtures contained cotton seed cake, mineral mixture, salt and urea. Both hay and concentrate were fed *ad libitum* and with free access to drinking water for 90 days. Feed intake, body weights and carcass characteristics were recorded. The daily total dry matter intake (DMI, kg/day) was greater ($P < 0.05$) in molasses based diets (7.64 for RPMO and 7.35 for HFMO) than in maize grain based diets (6.94, 6.73 and 6.19 for RPMM, MMMO and HFMM, respectively). Energy intake was highest ($P < 0.05$) in HFMO (86 MJ/day) and lowest in RPMM (69 MJ/day). Crude protein intake was highest in HFMO (867 g/day) and lowest in RPMO (725 g/day). Feed conversion ratio (kg feed DMI/kg gain) was lower ($P < 0.05$) for steers fed on HFMM (7.87) and HFMO (8.09) than those fed on MMMO (10.4), RPMM (11.0) and RPMO (11.5). Steers fed on HFMO had the highest ($P < 0.05$) daily weight gain (919 g/day), total weight gain (83 kg), final live weight (283 kg), empty body weight (268 kg) and hot carcass weight (151 kg). The proportion of internal fat to empty body weight (2.7%) in steers fed on HFMO was higher ($P < 0.05$) than those from other diets. Nevertheless, all carcasses showed relatively high fat cover (1.1–1.6 cm). It is concluded that agro-processing by products are good feed resources for finishing TSZ cattle in feedlots with formulations based on molasses being superior over those based on maize meal, and hominy feed being superior over rice polishing. A combination of molasses and hominy feed (HFMO) could be used successfully as an alternative to maize meal in finishing TSZ cattle in feedlot.

1. Introduction

Tanzania Shorthorn Zebu cattle (TSZ) make up 95% of the total cattle population in Tanzania and are mainly used for beef production. The herd is extensively managed on rangelands and is heavily affected by seasonal variation in feed supply. Finishing TSZ in feedlots using locally available protein and energy feeds from agro-processing by products could be a cost-effective option for improving their growth and carcass characteristics. Many agro-processing by-products such as hominy feed, rice polishing, cotton seed cake and molasses have substantial value as feedstuffs for ruminants (Sindhu et al., 2002). Rice polishing and hominy feed provide both energy and protein and have been found to give consistent results in ruminants when combined with molasses and urea (Larson et al., 1993). Tanzania produces substantial quantities of agro processing by-products from cereal grain mills, sugar and oilseed-processing factories (Nandonde, 2008). However, the potential use of these feedstuffs for finishing TSZ cattle in Tanzania is not well documented.

Maize grain is an energy dense feedstuff with 13.6 MJ ME/kg DM (Doto et al., 2004) and is commonly used in feedlot rations in developed countries giving high growth performance (Peter et al., 2000; Gaebe et al., 1998) and good carcass characteristics (Andrae et al., 2001). The major limitation on its use for cattle fattening in

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http://dx.doi.org/10.1016/j.livsci.2015.11.001
1871-1413/

Tanzania is the competition with humans for food and its high cost. On the other hand, molasses has high potential to replace maize grains in the feedlot diets for beef cattle as source of readily fermentable energy, having 12.7 MJ ME/kg DM (Drennan et al., 1995) comparable to levels found in maize grains. Studies using molasses on Brahman cross and Laisind steers have shown growth rates of 1.06 and 0.73 kg/day, respectively (McCrabb et al., 2000; Cuong et al., 2010). Another study by Hunter (2012) has shown gain of up to 1.4 kg/day by Brahman steers fed on diet with 45% molasses levels. Although the use of maize meal in combination with molasses to finish TSZ cattle has been successful in Tanzania (Mwilawa, 2012), there is a need for alternatives to maize meal to reduce feed costs and competition with humans. Thus, the aim of this study was to evaluate the effects of different combinations of agro-processing by-products with molasses or maize meal on growth performance and carcass characteristics of TSZ cattle finished under feedlot.

2. Materials and methods

2.1. Site description

The study was carried out at Kongwa National Ranch, located at 82 km from Dodoma municipality at an altitude of 1067 m above sea level. The area is semi-arid, receiving 254–660 mm of rainfall per annum and mean daily temperature range between 23 and 32 °C. The vegetation is mainly grass such as Star grass (*Cynodon plectostachyus*), Rhodes grass (*Chloris gayana*), African foxtail grass (*Cenchrus ciliaris*), Urochloa (*Urochloa mosambiensis*) and Purple three-awn (*Aristida purpurea*) and few legumes, mainly Blue-pea (Clitoria ternatea), Tropical Kudzu (Pueraria phaseoloides) with some shrubs of acacia spp.

2.2. Experimental design and treatments

A completely randomized design was used whereby forty five (45) TSZ steers were randomly allotted to five dietary treatments making a total of nine animals per treatment. The treatments were five diets compounded to contain molasses or maize grain with rice or maize by-products. The molasses based diets were hominy feed with molasses (HFMO) and rice polishing with molasses (RPMO) whereas, the maize grain based diets were hominy feed with maize meal (HFMM) and rice polishing with maize meal (RPMM). The maize meal mixed with molasses (MMMO) formed intermediate control diet.

2.3. Source of experimental animals

Forty-five steers (2.5–3.0 years of age, 200 ± 5 (SEM) kg body weight) were selected from a group of Tanzania Shorthorn Zebu cattle (TZS) purchased from auction markets in Dodoma region and kept at Kongwa ranch. These animals were allowed to graze on the pasture available at the ranch area for a period of one month for back grounding and were vaccinated against Contagious Bovine Pleural Pneumonia (CBPP) and Foot and Mouth Disease (FMD). At the start of experiment, the animals were de-wormed using albendazole 10% (Batch No. 1106, Eagle Vet. Tech. Co. Ltd. Chungnam, Korea) with a dosage of 7.5 ml per 50 kg body weight. Thereafter, animals were controlled against external parasites every 10 days by hand spraying using Vectocid^{R} (Batch No. 5209, ceva santeanimale la ballestriere, libourne cedex France, dilution 1 ml in 1 l of water).

Table 1
Ingredient composition of compounded concentrates (kg/100 kg).

Ingredients	Concentrate mixtures				
	MMMO	HFMO	RPMO	HFMM	RPMM
Maize meal	38	–	–	38	38
Hominy feed	–	40	–	50	–
Rice polishing	–	–	41	–	51
Molasses	47	47	47	–	–
Cotton seed cake	13	11	10	10	09
Mineral mix	1	1	1	1	1
Urea	0.5	0.5	0.5	0.5	0.5
Salt	0.5	0.5	0.5	0.5	0.5

MMMO, maize meal with molasses; HFMO, hominy feed with molasses; RPMO, rice polishing with molasses; HFMM, hominy feed with maize meal; RPMM, rice polishing with maize meal.

2.4. Sources of experimental feedstuffs and formulations

The experimental feedstuffs were grass hay and formulated concentrate diets. The grass hay was a mixture of grass with few legumes harvested from the pasture farm at Kongwa ranch. The ingredients for concentrate mixture were molasses purchased from Mtibwa sugar estate, maize meal, hominy feed and rice polishing purchased from Kibaigwa grain market, Dodoma, cotton seed cake purchased from Singida region, and mineral mixture, salt and urea purchased from local Agricultural input suppliers in Dodoma region. The grass hay was used as roughage for all treatments. Concentrates (Table 1) were formulated using literature values for nutritive composition of feedstuffs, mainly the Tanzania Feedstuff Table for Ruminants (Doto et al., 2004).

2.5. Management of experimental animals and feeding

Following back grounding period all animals were tagged using metal ear tags, weighed and allocated to the five dietary treatments. All animals had a preliminary period of 7 days, during which the initial weight of each animal was recorded as the average weights taken for the last three consecutive days of the preliminary period. The animals were then weighed fortnightly for 90 days and at the end of the experiment the final weight of each animal was obtained by taking the average live weights recorded for three consecutive days. Throughout the experimental period, animals were housed in individual pens and were fed individually with grass hay and concentrate in separate feeders allowing refusal rate of 20% and 10% for grass hay and concentrates, respectively. Access to drinking water was *ad libitum*. The amount of grass hay and concentrate on offer and refusals were weighed daily, whereby the separate intakes were obtained by difference. Average daily gain was calculated as final weight minus initial weight divided by the number of days on the experiment. Feed conversion ratio was calculated as the amount of feed consumed (kg DM) per kg body weight gain.

2.6. Slaughtering procedures

The final weight recordings were made at Kongwa ranch one day before the animals were transported to the slaughter house. Animals were transported by truck for two hours to Dodoma abattoir (82 km) in Dodoma municipality, in two batches and slaughtered within an interval of one day. The animals were fasted for 24 h prior to slaughter with access to fresh water. The animals were stunned using electrical stunner, slaughtered and suspended on an overhead rail system for bleeding, de-hiding and evisceration. The head was removed at the atlanto-occipital joint, the forefeet were severed at the knee joint between the carpal and