Animal Feed Science and Technology 169 (2011) 176–184

Contents lists available at ScienceDirect

Animal Feed Science and Technology

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

Effects of groundnut haulms supplementation on millet stover intake, digestibility and growth performance of lambs

N. Abdou[a,b], I.V. Nsahlai[a,*], M. Chimonyo[a]

[a] University of KwaZulu-Natal, Discipline of Animal and Poultry Science, P. Bag X01, Scottsville 3209, Pietermaritzburg, South Africa
[b] National Institute for Agricultural Research of Niger, PB 429 Niamey, Niger

ARTICLE INFO

Article history:
Received 3 January 2011
Received in revised form 4 July 2011
Accepted 7 July 2011

Keywords:
Millet stover
Groundnut haulms
Millet bran
Wheat bran
Intake
Digestibility
Growth performance
Oudah bicolor lambs

ABSTRACT

Supplementing millet stover (MS) with groundnut haulms (GH), millet bran (MB) and wheat bran (WB) can improve its nutritional value and promote live weight (LW) gain of sheep. The purpose of this study was to develop a MS supplementation strategy for smallholder farmers. For 66 d, effects of GH, MB and WB supplementation on MS intake and growth performance of lambs were assessed, after which digestibility was determined over 14 d. Four levels of GH (0, 200, 400, and 600 g) and two others (600 g GH + 100 g MB) and (600 g GH + 75 g WB) were described as GH0, GH200, GH400, GH600, GHMB and GHWB, respectively. GH supplementation had a positive linear effect (P<0.01) on dry matter (DM) and N intake of MS, but MS intake decreased (P<0.05), while DM intake increased (P<0.01), with increasing levels of GH. Millet bran increased intake of DM (P<0.05), organic matter (OM) (P<0.05) and N (P<0.01), while WB increased intake of MS (P<0.05), DM (P<0.05), OM (P<0.01), N (P<0.001) and fibre (P<0.05). GH supplementation had a positive linear effect on digestibility of DM, fibre and N. GH also had a positive linear effect (P<0.001) on LW gain and feed conversion efficiency. The maximum average daily LW gain (80.5 g/d) was with GHWB followed by GHMB (68 g/d). Sheep fed GH0 lost LW (19.1 g/d). Supplementation of MS with GH and either of the brans improved digestibility and intakes of DM, OM, fibre and N. The LW gain and feed conversion efficiency (FCE) also increased when WB was added. It is suggested that, in the dry season, it is practical to supplement sheep with low levels (*i.e.*, 200 g) of GH to support moderate LW gain or with 600 g GH + 75 g WB to support high LW gain.

1. Introduction

Cereal crop residues are poor nutritional quality ruminant feeds used in tropical countries. They are low in protein, soluble sugar and starch, and their digestibility is generally less than 0.55 (Leng, 1990). They are rich in fibre, which decreases their dry matter (DM) digestibility in the rumen, and the N in these residues is often highly indigestible due to its association with lignified fibre. Cereal crop residues also have low levels of vitamins and minerals (Abule et al., 1995; Tolera and Sundstol, 2000; Koralagama et al., 2008).

Poor nutrition is one of the main constraints of livestock productivity in Sub-Saharan Africa as feed resources are limited in quality and quantity (Nsahlai et al., 1998a; Savadogo et al., 2000). Livestock obtain the bulk of their nutrients from the

Abbreviations: ADF, acid detergent fibre; DM, dry matter; FCE, feed conversion efficiency; LWG, live weight gain; GH, groundnut haulms; MB, millet bran; MS, millet stover; NDF, neutral detergent fibre; OM, organic matter; WB, wheat bran.

* Corresponding author. Tel.: +27 33 260 5473; fax: +27 33 260 5067.
E-mail address: Nsahlail@ukzn.ac.za (I.V. Nsahlai).

0377-8401/$ – see front matter © 2011 Elsevier B.V. All rights reserved.
doi:10.1016/j.anifeedsci.2011.07.002

veld, but veld forages are only productive during the short rainy season. Use of irrigated cultivated pastures is restricted and generally not traditionally utilised in smallholder production systems (Koralagama et al., 2008). Thus, an improved livestock system needs to be developed to assist smallholder farmers to increase farm income. Use of legume haulms as a supplement could reduce use of high cost agro-industrial by-products. Indeed, for smallholder farmers, it is sustainable to use crop residues to feed their livestock. In Niger, crop residues, including groundnut haulms (GH), are an important component of animal supplementation (INRAN, 1996).

In Niger, about 0.5 of crop residues is used in animal feeding (FAO, 2000). The remainder is used for construction, fuel for cooking and as fertilizer. The main crop residues used in livestock feeding to improve livestock productivity, and the livelihood of smallholder farmers, are cereal and legume residues. Millet, maize and sorghum stovers are the major cereal residues in Africa, while the legume residues which have been examined include groundnut and cowpea haulms. Reports have shown good performance (*e.g.*, growth and carcass) of sheep fed legume haulms (Anele et al., 2010). In Western Niger, studies on cowpea haulms as the basal diet supplemented with cereal grains have shown acceptable performance in fattening sheep (Singh et al., 2003; Osakwe and Drochner, 2006; Anele et al., 2010). However, there is competition between humans and animals for cereal crops. Indeed, millet and sorghum are the main human foods in Niger, which is continuously exposed to food insecurity. Thus, as an animal feed supplementation technique, this could not be adopted by smallholder farmers.

Millet bran (MB) is commonly produced from processing of millet grain into flour for human food. Thus, it is readily accessible to smallholder farmers. Wheat bran (WB) is an agro-industrial by-product which is affordable and commonly sold in local markets. Use of GH, MB and WB could enhance growth of rumen microbes by providing sources of fermentable carbohydrate and protein. Indeed, these supplements could correct nutritional imbalances of rumen microbes, thereby improving the digestibility and intake of DM.

The purpose of this study was to develop a millet stover (MS) supplementation strategy for smallholder farmers using locally available feeds. The objective was to evaluate effects of GH on intake of MS and growth of lambs. It was hypothesized that increasing levels of groundnut haulms would increase MS intake, and that low levels of MB and WB would provide the nutrients necessary to improve digestibility and growth of sheep.

2. Materials and methods

2.1. Study site

The experiment was conducted in the dry season in the animal production station (Zootechnic station) located at the Regional Centre for Agricultural Research (CERRA) of Maradi, in the Central South of Niger. This site is at 13°27′71″N and 07°06′47″E at an altitude of 347 m, and is situated in the Sudano-Sahelian zone with an annual rainfall of 400–600 mm between June and September. Temperature and rainfall distributions follow a seasonal pattern. The relative humidities from October to June and July to September are <20% and >80% respectively. The mean temperature min/max is 22/36 °C, but it can reach 29/43 °C in April/May. The natural vegetation is Sudano-Sahelian woodland with thorny tree species, regenerating shrubs as well as perennial and annual grasses. In natural depressions, river valleys and around seasonal, ponds larger trees benefit from shallow groundwater and form small areas of dense woodland.

2.2. Animals and housing

Thirty six 12 mo old Oudah bicolour male lambs of 27.0 ± 2.88 kg live weight (LW) were ear tagged and weighed at 08:00 h at the beginning of the experiment after depriving them of feed for 14 h. All lambs were vaccinated with Pestovax (Merck and Co., Readington, NJ, USA) against small ruminant plague and were dewormed with Ivermectin (Merck and Co.) immediately after purchase. Thirty six feed troughs, made of barrels, were used to feed the lambs. Ten days for adaptation were allowed before commencement of the experiment. Lambs were individually housed in the same shed with a floor covered with sand, which was not controlled for temperature or humidity.

2.3. Feeds

Millet stover residues obtained from the CERRA (Centre Régional de Recherche Agricole) at Maradi were stored at the experimental site. The GH was purchased from smallholder farmers of Tarna, a village situated 2 km from the station. The MS was chopped manually with a machete and the GH was crushed after separating the haulms from cloves. The MS and GH had been manually harvested and sun-dried at the time of purchase from the local market. Both MB and WB were produced from processing of millet and wheat grain for household consumption.

2.4. Experimental design

Lambs were sorted based on LW into 6 groups of 6 lambs each. Lambs within each group were randomly placed into the 6 treatments, which were GH supplementation (0, 200, 400, and 600 g/d), 600 g/d GH + 100 g/d MB and 600 g/d GH + 75 g/d WB. These are described as GH0, GH200, GH400, GH600, GHMB and GHWB, respectively.