Available online at www.sciencedirect.com
ScienceDirect
Animal Feed Science and Technology
148 (2009) 12–33
ANIMAL FEED SCIENCE AND TECHNOLOGY
www.elsevier.com/locate/anifeedsci

Seasonal variations in the chemical composition and dry matter degradability of exclosure forages in the semi-arid region of northern Ethiopia

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Received 17 August 2007; received in revised form 28 January 2008; accepted 13 February 2008

Abstract

The present study was conduced at two sites (Tembien and Wukro) in the semi-arid region of Tigray in northern Ethiopia to investigate the seasonal dynamics in the chemical composition and dry matter digestibility of grass and browse species of exclosures. The browse species studied in Tembien and Wukro had a mean crude protein (CP) value of 166 and 117 g/kg dry matter (DM), respectively. The mean *in vitro* dry matter digestibility (IVDMD) coefficient and predicted metabolizable energy (ME) density of the browse species were 0.72 and 9.83 MJ/kg DM, respectively at Tembien, 0.62 and 8.38 MJ/kg DM, respectively, at Wukro. Neutral detergent fibre (NDF) and acid detergent fibre (ADF) values of the browse species varied from 192 to 437 and 127 to 391 g/kg DM, respectively. Acid detergent lignin (ADL) values ranged from 36 to 190 g/kg DM. The mean CP of the grass species in Tembien and Wukro during the long rainy season was 76 and 73 g/kg DM, respectively and values declined below a critical maintenance level during the dry and short rain seasons.

Abbreviations: ADF, acid detergent fibre; ADL, acid detergent lignin; CP, crude protein; DM, dry matter; IVDMD, *in vitro* true dry matter digestibility; ME, metabolizable energy; N, nitrogen; aNDF, amylase treated neutral detergent fibre; OM, organic matter; Spp., species.

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0377-8401/$ – see front matter
doi:10.1016/j.anifeedsci.2008.02.003

Mean IVDMD and ME values for the two sites were 0.41 and 0.47, and 5.38 and 6.11 MJ/kg DM, respectively. The NDF, ADF, and lignin values of the grass species were generally above 700, 400, and 70 g/kg DM, respectively. The CP, IVDMD and ME values of the mixed grass samples differed ($P<0.05$) among harvesting months and values ranged from 20 to 103 g/kg DM, 0.47 to 0.72 MJ/kg DM, and 6.16 to 9.91 MJ/kg DM, respectively. The browse species could be used as useful dry season protein supplements to the N deficient native grass species. Especial emphasis should be given to propagate *Maerua angolensis* and *Cadaba farinosa* at community nursery sites. Harvesting in September, rather than the current extended harvest period that took place in October and November, can considerably improve the feeding value of native grass hay for smallholder ruminant production systems.

Keywords: Browse; Crude protein; Grass; Digestibility; Supplement; Tigray

1. Introduction

Browse and grass species of communal grazing lands of sub-Saharan Africa are important sources of feed for smallholder ruminant production systems (Le Houérou and Corra, 1980; Dicko and Sikena, 1991; Woodward and Reed, 1995). For instance, such native feed resources in Tigray region of northern Ethiopia are estimated to contribute almost half of the total feed supplies (BoANRD, 1997). However, land degradation triggered by population expansion and over exploitation of the natural resources is a major threat to sustainable land use in Ethiopia (Hurni et al., 2005). For example, the natural forest cover in the Highlands of Ethiopia has decreased from 35% in the early 20th century to 16% in the 1990s (EFAP, 1994), and to 12% in 2005 (FAO, 2006). Communal grazing lands are also rapidly degrading (Feolil et al., 2002; Tewolde-Berhan, 2006) and soil loss may be excessive (Hurni, 1987).

In the semi-arid region of Tigray in northern Ethiopia, rehabilitation of degraded communal grazing lands is implemented through a network of exclosures constructed since the early and late 1990s (Aerts et al., 2006; Emiru et al., 2004). Crude estimations show that with the construction of exclosures about 262,000 ha of land has been successfully rehabilitated (Betru et al., 2005), leading to increased grass and browse production (Asefa et al., 2003; Mengistu et al., 2005). Originally, these exclosures were designed in a pure conservationist approach and their usefulness as livestock feed for the local community was seldom explicitly stated and in recent years the public pressure to balance ecological needs and livestock feed demands has increased (Betru et al., 2005). However, there is a need to evaluate the usefulness of such exclosure model as a means of providing feed supply for smallholder ruminant livestock production systems. It is essential to characterize the seasonal dynamics in the nutritive value of forages in exclosures before promoting them. Previous studies have given more emphasis to introduced/improved species than native vegetation (Abdulrazak et al., 2000; Ammar et al., 2004). The specific objectives of the present study were to: (1) evaluate the nutritive value of indigenous browse and grass species in exclosures harvested at different times of the year, and (2) quantify seasonal variations in the feeding value of native grass in exclosures.