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Effect of supplementation of *Sesbania sesban* on reproductive performance of sheep

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ABSTRACT

Two successive experiments were conducted to investigate the long-term effects of supplementation of *Sesbania sesban* on reproductive performance of Ethiopian Menz sheep. Forty ewes and 40 rams ranging in weight and age between 16–20 kg and 14–15 months respectively were fed a teff straw basal diet and supplemented with two levels of Sesbania (0, and 95% of supplementary protein provided by Sesbania and the rest being provided by concentrates) for 7 months. In experiment 1 (mating period), 4 paired female–male groups (diet of the male with or without Sesbania, and diet of the female with or without Sesbania) consisting of 20 animals each were formed and assigned for mating. Ewes that were mated and did not return to heat in subsequent cycles during the 70 days mating period continued in experiment 2 receiving similar supplementary diets (concentrate alone or Sesbania) for the study of pregnancy and lambing. During the mating period, males and animals supplemented with Sesbania were superior ($P<0.05$) in daily feed nutrients intake, whereas daily body weight gain (ADG) was significantly different ($P<0.05$) between treatments but not between sex groups. During pregnancy a significant difference ($P<0.05$) was observed only in nitrogen intake, and ADG of ewes did not differ ($P>0.05$) between treatments. Supplementation with Sesbania promoted an increase in testicular size by 13%. Except semen concentration, the other seminal characteristics were not significant ($P<0.05$) between treatments. The average oestrus cycle length was 19±4.6 days. Mean progesterone profile for cycling ewes on the day of oestrus was 0.4±0.04 and ranged between undetectable levels to 0.75 ng/ml followed by a rise starting on day 4 (1.7±0.16 ng/ml) through day 7 (2.5±0.29 ng/ml) and day 10 (3.6±0.47 ng/ml) to a peak of 3.9±0.45 ng/ml (plateau phase) on day 14. Supplementation with Sesbania improved the proportion of ewes conceived by 17% over supplementation with concentrates. The average birth weight of lambs, and post partum dam weight of ewes was 1.97 kg and 18.6 kg respectively and differed significantly ($P<0.05$) between treatments. We concluded that inclusion of Sesbania up to 30% in the diet of sheep as supplement before and during the period of mating and pregnancy improved testicular growth and semen quality in rams or reproductive performance of ewes without showing negative effects.

1. Introduction

Several studies (Reed et al., 1990; Umunna et al., 1995a,b; Nsahlai et al., 1995; Wiegand et al., 1996; Kaitho et al., 1998; Solomon, 2002) have illustrated that supplementation with *Sesbania sesban* improved significantly intake and digestibility of basal feeds and consequently live weight gain of the animals. On the other hand, like many other fodder trees, *S. sesban* contains anti-nutritional components such as tannins and saponins that may have detrimental effects on growth and reproduction, which may limit its extensive

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utilization. Anti-nutritional compounds in *S. sesban* have shown to cause tubular degeneration, interstitial fibrosis and focal Leydig cell proliferation in male reproductive organs of sheep and goats (Woldemeskel et al., 2001). Kaitho et al. (1998) found that prolonged and uninterrupted intake of *S. sesban* had a negative effect on live weight gain and scrotal circumference changes in sheep and goats, which could be attributed to unidentified phytochemicals such as saponins. Recently evidence (Solomon, 2002) was provided that supplementation of *S. sesban* had adverse effects on reproduction of ewes by compromising manifestation of oestrus and termination of pregnancy due to abortion or death of pregnant ewes. A mummified foetus, giving birth to a lamb with paralyzed hind legs and stillbirth were observed in ewes supplemented with *S. sesban*, most likely due to the interference of some anti-nutritional factors like tannins and saponins.

A recent survey conducted in selected agro-ecological zones of the Ethiopian highlands, showed that there is increased interest by many Government and Non-Government organizations to include multipurpose fodder tees (MPFT) like *S. sesban* in their integrated rural development programs for livestock feed and other agricultural purposes (Mekoya, unpublished report). Despite the growing interest of development organizations and farmers to adopt MPFT, only limited information is available on the effect of long-term feeding of *S. sesban* on the reproduction of sheep. If MPFT have to have an impact on animal production, the need for them to support high fertility and prolificacy are desirable as these parameters of reproduction are pre-requisites for increased animal productivity and sustainable utilization of fodder trees in the farming community. To understand the implications of the reviewed literatures also necessitate the need for further long-term investigation. This study was a continuation of a post-weaning growth and onset of puberty experiment with the objective to elucidate the long-term effects of supplementation of *S. sesban* on the scrotal growth and semen quality of rams, and reproductive performance of ewes.

2. Materials and methods

2.1. The study area

Two successive experiments were conducted at the International Livestock Research Institute (ILRI), Debre Zeit Research Station, situated in the central highlands of Ethiopia at 38° 58′E, 8° 44′N at an elevation of 1850 m above sea level.

2.2. Feeds and feeding

Teff straw (*Eragrostis tef*) used as basal feed was purchased from the surrounding area and stored for subsequent feeding. *S. sesban* (accession 15019) was grown and harvested in the research centre. It was air dried, mixed and packed in sacks for later use. Unchopped teff straw (70% of the dry matter (DM) intake) supplemented with two levels of *S. sesban* (0, or 95% of supplementary protein provided by *S. sesban* and the rest being provided by a mix made of noug cake (*Guizotia abyssinica*), maize husk, wheat bran and maize grain with the same level of protein as *S. sesban*) were used for both experiment 1 and 2 (Table 1). The concentrate feeds served as a positive control. Samples of treatment feeds were analyzed for DM and crude protein (CP) before the commencement of the study to formulate the experimental ration. The supplementary feeds were formulated to contain 10.5% CP and 7.82 MJ/kg DM metabolisable energy (Kearl, 1982), and were *iso*-nitrogenous, *iso*-caloric and had equal levels of Ca and P in the dry matter (Table 1). Di-ammonium phosphate and limestone were used to correct the phosphorous and calcium levels of *S. sesban* and concentrate feeds. Animals were housed in individual pens on slatted floor, fed the basal diet and supplements individually with free access to water. Teff straw was given *ad libitum* by adjusting the level of offer every 2 days to allow a refusal of approximately 20% of the offer. Supplements of *S. sesban* and concentrate feeds were offered as a function of the daily refusal of teff straw to ensure that every animal was getting the 30% supplementary feed in the diet. Supplements were given at 9:00 h and teff straw at 11:00 h. Unconsumed supplements during the offer of teff straw were transferred into buckets and left to be consumed later in the day. Quantities offered and refused were recorded daily to determine intake. Refusals were collected and weighed daily before the morning feeding. Samples from the offer and refusals of teff straw and supplement feeds were collected and at the end of the experiment pooled per animal and sub-sampled for chemical analysis.

Table 1
Proportion of basal feed (teff straw), supplement ingredients and estimated nutrient contents in the formulated ration

	Treatment diets	
	95% LSS	0% LSS
Feed ingredients in the ration (% DM)		
Teff straw	70.00	70.00
S. sesban	28.93	0.00
Noug cake	0.00	13.84
Maize husk	0.00	11.59
DAP	0.76	0.32
Lime stone	0.00	0.54
Urea	0.00	0.56
Maize (grounded)	0.17	0.00
Wheat bran	0.00	3.01
Salt	0.15	0.15
Estimated nutrient contents in the ration		
CP %	10.5	10.5
ME (MJ/kg DM)	7.82	7.82
Ca (%)	0.60	0.60
P (%)	0.36	0.36

LSS = level of *S. sesban* in the treatment diets; DAP = di-ammonium phosphate; ME = metabolisable energy.

2.2.1. Feed analysis

Feed offers and refusals were ground to pass a 1-mm screen using a Wiley mill. DM, organic matter (OM), nitrogen (N) and ash in feed offers and refusals were determined according to AOAC (1990) standard procedures. NDF (neutral detergent fibre), ADF (acid detergent fibre) and lignin in feed offers and refusals were analyzed using the method of Van