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The effects of supplemental sericea lespedeza pellets in lambs and kids on growth rate

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ABSTRACT

Sericea lespedeza (SL; *Lespedeza cuneata*), a condensed tannin rich plant, has been used in recent years to aid in the control of gastrointestinal nematodes (GIN) in sheep and goats. Grazing or feeding dried SL leads to a reduction in egg production by GIN and reduces coccidiosis. Growth rates in lambs and kids when fed SL for more than 56 d has not been well characterized. The objective was to determine the effects of feeding SL leaf meal pellets on growth rate in lambs and kids. Lambs or kids weaned between 86 and 108 days of age (day 0) were supplemented with up to 900 g of a control supplement (CO) or SL leaf meal pellets for 56–112 days while grazing grass pastures at the USDA, Agricultural Research Service (ARS) in Booneville, AR or Louisiana State University (LSU), Baton Rouge, LA in 2010 (ARS lambs only), 2011 (lambs only), 2012, and 2013 (kids only). Animals were weighed every 28 days for up to 112 days of supplemental feeding. Data were analyzed using GLM [average daily gain (ADG)], mixed models using repeated measures, or regression. Between days 0 and 56, ADG was greater in 2012 ($P=0.01$) or tended to be greater in 2010 ($P=0.07$) in SL than CO lambs at ARS, but lower in SL than CO ARS lambs ($P<0.001$) and kids in 2012 ($P=0.02$) and 2013 ($P<0.001$), and similar in LSU lambs. During the latter growth phase, ADG was reduced in SL compared with CO fed lambs and kids ($P<0.01$, all), except for LSU lambs in 2011 which were similar between groups. Additional studies are necessary to understand changes in growth rate of SL supplemented lambs and kids. It may be necessary to restrict the period of supplementation to less than 56 days to maximize weight gains in lambs and kids.

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1. Introduction

Sericea lespedeza [SL, *Lespedeza cuneata* (Dum.-Cours. G. Don)] is a warm-season perennial legume adapted to the southern U.S. and rich in condensed tannins (CT; Ball et al., 1996). In recent years, SL has been grazed by sheep and goats to aid in the control of gastrointestinal nematodes (GIN; Burke et al., 2012; Min et al., 2004, 2005), important due to high prevalence of anthelmintic resistance (Howell et al., 2008; Kaplan et al., 2005). It was determined that the AU Grazer variety of SL could be harvested, and the hay or leaf meal fed loose or pelleted to reduce fecal egg counts associated with GIN (Lange et al., 2006; Shaik et al., 2006; Terrill et al., 2007, 2009). More recently, SL was reported to prevent or control *Eimeria* spp. infection or coccidiosis in lambs (Burke et al., 2013).

Abbreviations: ADF, acid detergent fiber; ADG, average daily gain; BW, body weight; CO, control; CT, condensed tannins; CP, crude protein; DM, dry matter; FEC, fecal egg count; GIN, gastrointestinal nematodes; NDF, neutral detergent fiber; PCV, blood packed cell volume; SL, sericea lespedeza

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However, Burke et al. (2012) reported a reduction in body weight gains in lambs and kids after grazing SL compared with grass pastures for 28 days or 56 days, respectively.

Condensed tannins or proanthocyanidins are heterogeneous complexes of oligomers and polymers of flavonoid units linked by carbon–carbon bonds (Hagerman and Butler, 1991). They are able to bind to proteins in the rumen (reviewed by Min et al. (2003) and Waghorn (2008)). The CT bound protein bypasses the rumen and disassociates in the abomasum and the small intestine (Barry et al., 1986; Waghorn et al., 1987). Thus, there is often greater protein availability to the animal which can lead to increased animal performance measured by weight gains. However, over time, weight gains slow and have been reversed in lambs grazing SL compared with bermudagrass (*Cynodon dactylon*; Burke et al., 2012), a warm season grass essentially devoid of CT. Condensed tannins bind not only to proteins, but to polymers such as cellulose and hemicelluloses, as well as pectin and minerals in the rumen, inhibiting their digestion (reviewed by McSweeney et al. (2001)).

Farmers have an interest in long term feeding of SL pellets for parasite control, as it is especially important in the face of anthelmintic resistance and to reduce the use of pharmaceuticals such as in a certified organic system. Thus, it is important to understand lamb and kid performance or weight gain associated with supplementation. The objective of these experiments was to determine the effect of feeding SL pellets to lambs and kids for up to 112 days on body weight gain.

Table 1
Comparison of experiments conducted among ARS and LSU lambs and goats.

Animal group	n	Age at start, days	Supplement, g (as fed)	Maximum days on SL
ARS 2010, Lambs[a]				
CO	20 (15 F; 5 M[b])	124.5	900	–
SL	20 (15 F; 5 M)			112
ARS 2011, Lambs[a]				
CO	20 (15 F; 5 M)	108.9	900	–
SL	19 (13 F[c]; 6 M)			126
ARS 2012, Lambs[a]				
CO	25 (17 F; 8 M)	90.1	900	–
SL	25 (13 F; 12 M)			56
LSU 2011, Lambs				
CO	14 (2 F; 13 M)	85.5	900	–
SL	15 (7 F; 8 M)			112
LSU 2012, Lambs				
CO	15 (8 F; 7 M)	80.0	450	–
SL	14 (5 F; 9 M)			112
ARS 2012, Kids				
CO	16 (M)	80.0	450	–
SL	16 (M)			98
ARS 2013, Kids				
CO	17 (M)	80.0	450	–
SL	16 (M)			56

[a]ARS ram lambs removed on day 70 in 2010 and 2011, and 84 in 2012 so that they did not breed ewe lambs.
[b] F=females; M=males.
[c] One ewe lamb died that became entangled in fence.

2. Materials and methods

The experiments were conducted at the USDA, Agricultural Research Service, Dale Bumpers Small Farms Research Station, Booneville, Arkansas, U.S.A. or at Louisiana State University School of Veterinary Medicine, Baton Rouge, Louisiana, U.S.A. All animal-related procedures were approved by the Animal Care and Use Committee of each research institution.

2.1. ARS lambs

Lambs used in 2010, 2011 and 2012 were part of a larger study in which long term effects of using SL for control of GIN was studied in ewes and their offspring (unpublished). Initially, Katahdin ewes were randomized to treatments; offspring (Katahdin sired) remained in treatment plots to examine population dynamics of GIN.

In 2010, lambs of mixed gender were weaned at 124.5 ± 1.8 days of age (day 0=day of weaning for all experiments) in early June (summer). Lambs (number and gender described in Table 1) were fed a control supplement [CO; 37% cracked corn, 16% wheat middlings, 14% soybean meal, 13% cottonseed hulls, 10% alfalfa pellets, 4% molasses, 4% soybean hulls, 1% limestone, 0.5% salt; nutrients not analyzed in 2010, but diet was formulated to be 16% crude protein (CP) on a dry matter basis] or SL leaf meal pellets (75–90% SL leaf meal; Sims Bros. Inc., Union Springs, AL, USA; nutrients listed in Table 2). The CO and SL ration offered at weaning increased from no supplement (pre-weaning, although it was possible for lambs in this and subsequent years to access the dam's supplement prior to weaning, which was similar to the lamb supplement) incrementally to 450 g/lamb between 0 and 35 days and 675 g/lamb between 35 and 112 days (animals were fed as one CO and one SL group in this and subsequent experiments). This resulted in feeding SL pellets at a mean of 1.7% (day 0) to 2.0% (day 56; highest percent body weight fed) to 1.9% (day 112) of body weight. Lambs were offered free choice trace mineral mix (Land O'Lakes Sheep and Goat Mineral, Shoreview, MN, USA) and water. Lambs grazed separate bermudagrass pastures (the CO pasture was 2.6 ha and the SL pasture was 2.1 ha), where forage availability was not limiting. Forage quality was not determined in 2010, but would be expected to be similar or better than 2011 pastures as there was more precipitation in summer 2010. Body weight of lambs was determined without fasting every 28 days between days 0 and 112. Lambs were naturally infected with GIN; genera included *Haemonchus contortus*, *Trichostrongylus* spp., *Cooperia* spp., and *Oesophogostomum* spp. The mean fecal egg count (FEC) of both groups of lambs ranged between 425 and 2000 eggs/g and mean packed blood cell volume (PCV) of these lambs ranged between 28% and 32%.

In 2011, lambs of mixed gender were weaned at 108.9 ± 1.4 days of age in late May (spring). Lambs (number and gender listed in Table 1) were supplemented with the CO supplement listed above or SL leaf meal pellets