EFFECT OF ENSILING ON ANTI-PARASITIC PROPERTIES OF SERICEA LESPEDEZA

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Abstract

A study was designed to determine the effects of feeding ensiled sericea lespedeza (SL; Lespedeza cuneata) on gastrointestinal nematode (GIN) and coccidia (Eimeria spp.) infections in young goats. A 28-day confinement study was completed with 36 nine-month-old Spanish bucks (53.8 ± 8.1 lbs) fed 3 diets consisting of SL silage, chopped SL hay, or ground bermudagrass (BG; Cynodon dactylon) hay (70% of the diet) and a grain mixture formulated to balance dietary protein and energy (30% of the diet). Fecal and blood samples were collected every 7 days to determine GIN eggs per gram (EPG), coccidial oocysts per gram (OPG; fecal samples), and packed cell volume (PCV; blood). Both SL diets significantly reduced \( P < 0.05 \) EPG and OPG compared to control (BG diet) animals, with greater effects on the OPG numbers. The SL hay diet was slightly more effective against GIN and coccidia than the SL silage, but the differences were not significant. There was no treatment effect on PCV values. As leaf loss during hay making can be substantial with SL, cutting and ensiling at a higher moisture level may be an effective way to capture more leaves while maintaining the anti-parasitic efficacy of this crop.

Introduction: Infection with gastrointestinal nematodes (GIN) and coccidia (Eimeria spp.) remains one of the primary constraints to sustainable production of small ruminants world-wide, and with resistance to synthetic anthelmintics now reaching epidemic proportions in sheep and goat GIN, alternative (non-synthetic) control strategies are being explored. One of these is using sericea lespedeza (SL; Lespedeza cuneata) as a nutraceutical plant in the diet of ruminants. This warm-season perennial legume contains a high concentration of ‘prodelphinidin-type’ tannins, which have been associated with excellent efficacy against Haemonchus contortus, a highly pathogenic blood-feeding GIN. With growing interest in SL as a natural anthelmintic, particularly by organic livestock producers, a number of studies have been completed documenting the anti-parasitic efficacy of SL in fresh (grazed) and dried (hay, leaf meal, pellets) forms in both sheep (Lange et al., 2006; Burke et al., 2012a, b) and goats (Min et al., 2004; Shaik et al., 2006; Terrill et al., 2007; 2009). While the anti-parasitic value of ensiling condensed tannin (CT)-containing forages has been reported in a few species (Heckendorn et al., 2006), this has not been evaluated for ensiled SL. The objective of the current investigation was to determine the \textit{in vivo} efficacy of ensiled SL against GIN and coccidia in young goats.

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Materials and Methods: ‘AU Grazer’ SL was harvested from a well-established (9-year) pasture at the Fort Valley State University Agricultural Research Station in Fort Valley, GA, in August, 2014. The forage was cut and chopped to approximately 0.5 inch lengths using a forage harvester. Half the chopped material was immediately packed into 35 gallon black plastic trash bags and tied after manually removing as much air as possible. The bags were then placed inside a second bag, tied, and stored in a barn to allow the bagged material to ensile. The other half of the chopped material was spread out on 100 x 25 foot plastic sheeting and sun-dried for 72 hours, with daily turning to facilitate uniform drying. The dried material was then collected and placed in 55 gallon clear plastic trash bags for storage.

In April and May, 2015, a 28-day confinement feeding trial was completed using 36 nine-month-old intact male Spanish kids (53.8 ± 8.1 lbs) fed 3 isonitrogenous and isocaloric diets consisting of 70% roughage and 30% grain mixture. The roughage portion of the treatment diets consisted of SL silage, SL hay, and ground bermudagrass (BG; *Cynodon dactylon*) hay. The animals were assigned to treatment groups based upon initial fecal egg counts (FEC) and fed their ration in round feed troughs with bars designed to prevent the animals from standing in the troughs. The kids were fed in pens (3 goats per pen) with their rations provided at 3.5% of body weight. All animals were provided *ad libitum* clean water throughout the trial using automatic nipple waterers.

Fecal and blood samples were collected from individual animals on Days 0, 7, 21, and 28 of the trial. Fecal samples were analyzed to determine GIN eggs per gram (EPG) and coccidial oocysts per gram (OPG) using a McMaster technique (Whitlock, 1948). Blood samples were collected into 3 mL EDTA vacutainer tubes and analyzed for packed cell volume (PCV) using a microhaematocrit centrifuge and reader. FAMACHA© scores (van Wyk and Bath, 2002) were also taken on individual animals every 7 days. Animal weights were taken at the start of the trial.

The EPG, OPG, PCV, and FAMACHA© data were analyzed by repeated measures analysis in a completely randomized design using the mixed model procedure of SAS (SAS, 2008). Treatment, period (sampling date), and the treatment x period interaction were included in the model. The EPG and OPG data were log-transformed [ln(EPG + 1), ln(OPG + 1)] prior to statistical analysis. These data were reported as least square means, with statistical inferences based upon log-transformed data analysis.

Results and Discussion: Both SL hay and SL silage diets reduced GIN and coccidial egg excretion (EPG and OPG, figures 1 and 2) in young kids compared with goats on the control (BG hay) diet. Treatment (P < 0.02), period (P < 0.001), and treatment x period interaction (P < 0.03) effects were all significant for EPG data, while treatment and period (P < 0.001) effects were significant for OPG data. For the goats on the SL hay treatment diet, there were significant reductions in EPG counts on Day 14 (P < 0.001) and Day 21 (P < 0.01), with a trend for lower EPG on Day 28 (P = 0.082). The SL hay-fed kids had lower OPG than control animals (BG hay diet) on Day 7 (P < 0.02) and Days 14, 21, and 28 (P < 0.001). These results with SL hay confirm previous reports of the anti-parasitic properties of dried SL for both sheep (Lange et al., 2006) and goats (Shaik et al., 2006). In a study with unground (long) SL and BG hays fed to young goats at 70% of the diet, Shaik et al. (2006) reported an 80% reduction in FEC in SL-fed animals after 7 days, with these differences maintained to the end of the experiment. Other studies have shown similar results for SL hay fed to goats in ground form (Terrill et al., 2009),
SL leaf meal (Terrill et al., 2008), and SL whole plant and leaf only pellets (Terrill et al., 2007; Kommuru et al., 2014), with initial significant differences occurring at between 7 to 28 days post feeding. In the current study, reductions in FEC relative to control in goats fed SL hay ranged from 75% to 85% (Figure 1). The reductions in coccidial OPG in SL hay-fed goats (86% to 91%) confirm results from feeding trials with SL pellets for both sheep (Burke et al., 2013) and goats (Kommuru et al., 2014).

There was a differential effect of the SL silage diet on goat parasites, with a greater effect on coccidia (OPG; 79% to 84% reduction relative to control) than GIN (EPG; 57% to 72% reduction relative to control). However, there was a significant reduction in EPG in kids on the SL silage diet compared with the control diet on Day 14 (P < 0.02) and a trend for reduced EPG on Day 21 (P = 0.058). Feeding an ensiled SL diet to the kids significantly reduced their OPG values relative to control on Day 14 (P < 0.02), Day 21 (P < 0.02), and Day 28 (P < 0.03). These results with ensiled SL compare favorably with other reports on the anti-parasitic potential of ensiled CT-containing legumes. Heckendorn et al. (2006) reported 58% and 48% reductions in *H. contortus* EPG in young lambs fed sainfoin (*Onobrychis viciifolia*) hay and silage, respectively, compared with a non-tannin control forage.

There were no treatment effects on blood PCV or FAMACHA© scores in the kids, with treatment group averages ranging from 19.5 to 20.7 for PCV and 2.1 to 2.4 for FAMACHA© scores. This is likely due to the short duration of this study (28 days), as a number of authors have reported a lag in changes in anemia indicators (PCV and FAMACHA©©) compared with egg excretion reduction due to the effect of SL in the diet of sheep and goats (Terrill et al., 2012).

Based upon these results, ensiling of SL did not appear to affect its anti-parasitic effectiveness against either GIN or coccidia. The small differences in efficacy between SL hay and SL silage may have been related to intake of each diet by the goats. The kids immediately consumed their ration of SL hay, but took a few days to get used to the SL silage. After the first week of the trial, both SL treatment groups consumed all of their rations. In this trial, all of the leaves were collected after cutting of fresh SL for both the hay and silage treatments. Normally, leaf loss during baling can be a problem when making SL hay due to the very rapid drying of SL leaves compared to the stems. Cutting and ensiling SL at a higher moisture level may be an effective way to capture more leaves while maintaining the anti-parasitic efficacy of this crop.

**Literature Cited:**


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Figure 1. Least squares means of gastrointestinal nematode egg counts (eggs/g, EPG) in feces of Spanish kids fed sericea lespedeza (SL) hay, SL silage, or bermudagrass hay (control) diets.

Figure 2. Least squares means of coccidial oocyst counts (oocysts/g, OPG) in feces of Spanish kids fed sericea lespedeza (SL) hay, SL silage, or bermudagrass hay (control) diets.