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EFFECT OF SERICEA LESPEDEZA HAY ON GASTROINTESTINAL NEMATODE INFECTION IN GOATS

G.S. Dykes, T.H. Terrill, S.A. Shaik, J.E. Miller, B. Kouakou, G. Kannan, J.M. Burke, R. M. Kaplan, and J.A. Mosjidis[1]

Abstract

Gastrointestinal nematode (GIN) parasitism is the greatest threat to economic sheep and goat production in the southern USA, and there is widespread prevalence of GIN resistance to broad-spectrum anthelmintics in this region. A natural alternative for controlling GIN in small ruminants is feeding hay of sericea lespedeza [SL, *Lespedeza cuneata* (Dum.-Cours. G. Don)], a perennial warm-season legume high in condensed tannins. To determine the level of SL needed to reduce GIN infection, a confinement study was completed with 32 Spanish/Boer/Kiko cross yearling bucks offered one of four diets with 75% hay and 25% concentrate (n = 8, two pens per treatment, 4 goats/pen). The hay portion of each diet consisted of a combination of ground SL (0, 25, 50, and 75% of the diet) and bermudagrass [BG, *Cynodon dactylon* (L.) Pers.; 75, 50, 25, and 0% of the diet]. The bucks were allowed to acquire a natural GIN infection on pasture prior to moving to the pens. After a 3-wk adjustment period, the goats were stratified by fecal egg count (FEC) and packed cell volume (PCV), randomly assigned to treatments and pens, and then fed the treatment diets for six weeks. During the experimental period, fecal and blood samples were collected from individual animals weekly to determine FEC and PCV, respectively. Goats fed SL hay at 25, 50 and 75% of the diet had lower ($P<0.05$) FEC than control animals (75% BG hay), with a greater reduction as percent SL in the diet increased. There was also a dose response for PCV, with 75% SL-fed goats tending to have higher ($P<0.10$) PCV than the 25% SL and control animals, while the 50% SL goats were intermediate. The optimum level of SL hay in the diet for reducing GIN infection of small ruminants appears to be 50-75%, with some benefit even at 25% of the diet. Ground SL hay has potential as a natural supplement to or replacement for chemical anthelmintics.

Introduction: Demand for goat meat and milk products is increasing in the USA, particularly in large metropolitan areas. Goat production is a growing industry in the Southeast, but infection with GIN, particularly the blood-feeder *Haemonchus contortus*, seriously threatens the industry. Since their introduction in the 1960s, broad-spectrum synthetic anthelmintics have been the primary defense against GIN infection in small ruminants in the USA and

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around the world, but this strategy can no longer be relied on due to the widespread development of anthelmintic resistance in sheep and goat parasites (Prichard, 1994). Recent reports from Virginia (Zajac and Gipson, 2000) and Georgia (Terrill et al., 2001; Mortensen et al., 2003) indicate that anthelmintic resistance in goats has become highly prevalent in the southern USA.

A natural alternative to synthetic anthelmintics for controlling GIN infection in animals is the use of tannin-rich plants. Grazing forages high in condensed tannins (CT) has been shown to reduce the number of parasite eggs in sheep and goat feces (Niezen et al., 1995; Min and Hart, 2003; Paolini et al., 2003a), and there have been recent reports of anthelmintic activity of CT forages fed as dried hay (Paolini et al., 2003b; Lange et al., 2005; Shaik et al., 2006). Reduced FEC and worm burden have been reported for goats fed hay of the CT forage sericea lespedeza , a warm-season perennial legume that is well-adapted to the southern USA. When fed as the primary component of the diet (75% of feed offered), SL hay reduced FEC in goats by 80% compared with animals fed bermudagrass hay (Shaik et al., 2004; 2006). The anthelmintic efficacy of lower amounts of SL hay in the diet of small ruminants has not been determined. The purpose of the current study was to determine if significant anthelmintic effects could be achieved by feeding SL hay to goats at 25 and 50% of the diet offered.

Materials and Methods: A confinement feeding study with yearling goat bucks was completed at the Fort Valley State University Agricultural Research Station, Fort Valley, GA, USA, from October through November, 2005. Prior to starting the trial, the goats acquired a natural GIN infection by grazing perennial summer grass pasture for approximately 6 months. After being moved into feeding pens, all the goats were fed ground BG hay (75% of feed offered) plus concentrate (25% of feed offered) during a 3-wk adjustment period, during which feces and blood samples were collected from individual animals weekly for FEC and PCV analysis, respectively. At the end of this period (0 sample time), 32 yearling Spanish x Boer x Kiko cross bucks were assigned to diet and pen based upon FEC and PCV (n = 8, 2 pens per treatment, 4 goats/pen). The goats were offered one of four diets of 75% hay (combination of SL and BG) and 25% commercial goat concentrate (16% CP, Purina Mills, LLC, St. Louis, MO) for six additional weeks. The hay portion of the dietary treatments were 75% BG (control), 75% SL, 50% SL + 25% BG, and 25% SL + 50%BG. All diets were offered on a 3.5% BW basis, and the goats were given access to water *ad libitum*.

Throughout the trial, fecal and blood samples were collected from individual animals weekly (sample times 1 – 6) for FEC and PCV analysis, respectively. Eggs were counted using a modified McMaster procedure (Hansen and Perry, 1994), and PCV was determined using a micro-haematocrit centrifuge and reader. The egg count and PCV data were analyzed using repeated measured analysis (SAS, 1992), with significance declared at $P<0.05$.

Results: The treatment and time main effects were significant ($P<0.05$) for FEC data. There were no differences in FEC among treatment groups during the first two weeks of the experimental period (Sampling times 0-2, Table 1). After three weeks (Sampling time 3),

goats fed SL hay at 25, 50 and 75% of the diet had lower ($P<0.05$) FEC than control animals (75% BG hay), with a greater reduction as percent SL in the diet increased (45.3, 66.3, and 74.5% reduction, respectively). Reduced ($P<0.05$) FEC was observed for the goats fed SL hay at 50 and 75% of diet offered in two out of the last three sampling times compared with control goats, with 84.6 and 91.9% reduction, respectively, by the end of the trial. The 25% SL-fed goats also had lower FEC than control animals on two out of the final three sampling times, but the differences were not significant. For PCV data, the time main effect and treatment x time interaction were both significant ($P<0.05$). Packed cell volume was not affected by the dietary treatments through the first four weeks of the experiment. In weeks 5 and 6 (Sampling times 5 and 6), PCV of the 75% SL-fed goats tended to be higher ($P<0.10$) than the 25% SL and control animals, while the 50% SL goats were intermediate (Table 2).

Discussion: All three levels of SL hay in the diet reduced the effects of GIN infection in goats, with greater effects as the dietary percentage of SL increased. Positive effects of feeding SL hay to parasitized animals at 75-80% of the diet has been reported previously for both sheep and goats (Lange et al., 2005 Shaik et al., 2004; 2006). Shaik et al. (2006) reported an 80% reduction in FEC in goats fed SL compared with BG hay after 1 week. Lange et al. (2005) reported a similar immediate drop in FEC in sheep fed SL hay compared with BG hay. Comparable reductions in FEC were observed for both the 50 and 75% SL-fed goats in the current experiment, but the effect was not as immediate. The reason for this delay in the effect on egg production is not clear, but may be related to the time of year the current trial was completed. The previous experiments were completed during the summer months, while the current trial was completed during October and November. The primary infection in summer is *H. contortus* throughout much of the USA, while other nematode species, such as *Teladorsagia* (Ostertagia) *circumcincta* and *Trichostrongylus colubriformis* often increase relative to *H. contortus* in fall and winter. Shaik et al (2006) reported a greater effect of SL hay on *H. contortus* infection than on *T. circumcincta* and *T. colubriformis* infection in goats.

The increase in PCV of the 75% SL hay-fed goats compared with control animals is higher than previous reports for sheep and goats (Lange et al., 2005; Shaik et al., 2006). Despite differences relative to control animals, Shaik et al (2006) reported a slight decline in PCV in SL-fed animals during the experimental period. In the current trial, PCV of the highest SL group increased from 20.0 to 28.3%, while the 50% SL group increased from 18.0 to 22.8% (Table 2). This indicates a likely effect of SL hay on adult worm numbers in the gastrointestinal tract, although worm counts were not done. Other authors have reported reduced worm counts in the abomasum and small intestine of goats fed SL hay at 75-80 % of the diet (Shaik et al., 2006).

Conclusion: The optimum level of SL hay in the diet for reducing GIN infection of small ruminants appears to be 50-75%, with some benefit even at 25% of the diet. Ground SL hay has potential as a natural supplement to or replacement for chemical anthelmintics.

Literature Cited:

Hansen, J., and B. Perry. 1994. The epidemiology, diagnosis and control of helminth parasites of ruminants: A handbook. International Livestock Research Institute, Nairobi, Kenya.

Lange, K.C., D.D. Olcott, J.E. Miller, J.A. Mosjidis, T.H. Terrill, and J.M. Burke. 2005. Effect of the condensed tannin containing forage, sericea lespedeza, fed as hay, on natural and experimental challenge infection in lambs. 4th International Conference on Novel Approaches to the Control of Helminth Parasites of Livestock, 10-12 January, 2005, Merida, Yucatan, Mexico, p. 38.

Min, B.R., and S.P. Hart. 2003. Tannins for suppression of internal parasites. J. Anim. Sci. 81(E. Suppl. 2):E102-E109.

Mortensen, L.L., L.H. Williamson, T.H. Terrill, R.A. Kircher, M. Larsen, and R.M. Kaplan. 2003. Evaluation of prevalence and clinical implications of anthelmintic resistance in gastrointestinal nematodes in goats. JAVMA 223:495-500.

Niezen, J.H., T.S. Waghorn, W.A.G. Charleston, and G.C. Waghorn. 1995. Growth and gastrointestinal nematode parasitism in lambs grazing either lucerne (*Medicago sativa*) or sulla (*Hedysarum coronarium*) which contains condensed tannins. J. Agric. Sci 125:281-289.

Paolini, V., J.P. Bergeaud, C. Grisez, F. Prevot, P. Dorchies, and H. Hoste. 2003a. Effects of condensed tannins on goats experimentally infected with *Haemonchus contortus*. Vet. Parasit. 113:253-261.

Paolini, V., P. Dorchies, and H. Hoste. 2003b. Effects of sainfoin hay on gastrointestinal nematode infections in goats. Vet. Record 152:600-601.

Pritchard, R. 1994. Anthelmintic resistance. Vet. Parasitol. 54:259-268.

SAS Institute. 1992. SAS/STAT Software: changes and enhancements. Release 6.07, SAS Technical Report, SAS Institute, Cary, NC.

Shaik, S.A., T.H. Terrill., J.E. Miller, B. Kouakou, G. Kannan, R.K. Kallu, and J.A. Mosjidis. 2004. Effects of feeding sericea lespedeza hay to goats infected with *Haemonchus contortus*. South African J Anim. Sci. 34: 234-236.

Shaik, S.A., T.H. Terrill, J.E. Miller, B. Kouakou, G. Kannan, R. M. Kaplan, J.M. Burke, and J. Mosjidis. 2006. Sericea lespedeza hay as a natural deworming agent against *Haemonchus contortus* infection in goats. Vet. Parasitol. (In Review).

Terrill, T.H., R.M. Kaplan, M. Larsen, O.M. Samples, J.E. Miller, and S. Gelaye. 2001. Anthelmintic resistance on goat farms in Georgia: Efficacy of anthelmintics against gastrointestinal nematodes in two selected goat herds. Vet. Parasitol. 97:261-268.

Zajac, A, and T.A. Gipson. 2000. Multiple anthelmintic resistance in a goat herd. Vet. Parasitol. 87:163-172.

Table 1. Nematode egg count in feces of parasitized goats fed four different levels of ground sericea lespedeza or bermudagrass hay and a small amount of concentrates.

Diet, %[a]			Sampling time[b]						
SL	BG	SP	0	1	2	3	4	5	6
			Nematode egg count per gram feces[c]						
0	75	25	2033	2900	2100	3383[d]	1717[d]	1667[de]	3516[d]
			±576	±671	±806	±578	±423	±540	±793
25	50	25	2140	3200	1930	1850[e]	1260[de]	2410[d]	2340[d]
			±446	±520	±625	±401	±328	±418	±614
50	25	25	1770	2680	1420	1140[e]	930[de]	970[e]	540[e]
			±446	±520	±625	±401	±328	±418	±614
75	0	25	1807	2029	1479	864[e]	607[e]	1114[e]	286[e]
			±407	±475	±570	±366	±299	±382	±561

[a]%SL=percentage sericea lespedeza; %BG=percentage bermudagrass; and %SP= percentage supplement.

[b]Sampling time 0=Start of experimental period; Sampling times 1-6=weeks 1-6 of experimental period.

[c]LSMeans ± Standard error.

[d,e]Column means with unlike superscripts differ ($P<0.05$).

Table 2. Blood packed cell volume of parasitized goats fed four different levels of ground sericea lespedeza or bermudagrass hay and a small amount of concentrates.

Diet, %[a]			Sampling time[b]						
SL	BG	SP	1	2	3	4	5	6	7
			Blood packed cell volume[c]						
0	75	25	16.6	18.7	21.4	20.7	18.3	18.8	19.5
			±2.0	±2.3	±2.5	±2.5	±2.2	±2.2	±2.7
25	50	25	17.0	17.2	17.3	16.8	17.7	18.1	18.1
			±1.8	±2.1	±2.3	±2.2	±2.0	±2.0	±2.5
50	25	25	18.0	16.3	19.0	19.9	19.3	22.3	22.8
			±1.8	±2.1	±±2.3	±2.2	±2.0	±2.0	±2.5
75	0	25	20.0	21.0	24.7	23.3	24.2	25.3	28.3
			±2.0	±3.0	±3.2	±3.2	±2.9	±2.9	±3.5

[a]%SL=percentage sericea lespedeza; %BG=percentage bermudagrass; and %SP= percentage supplement.

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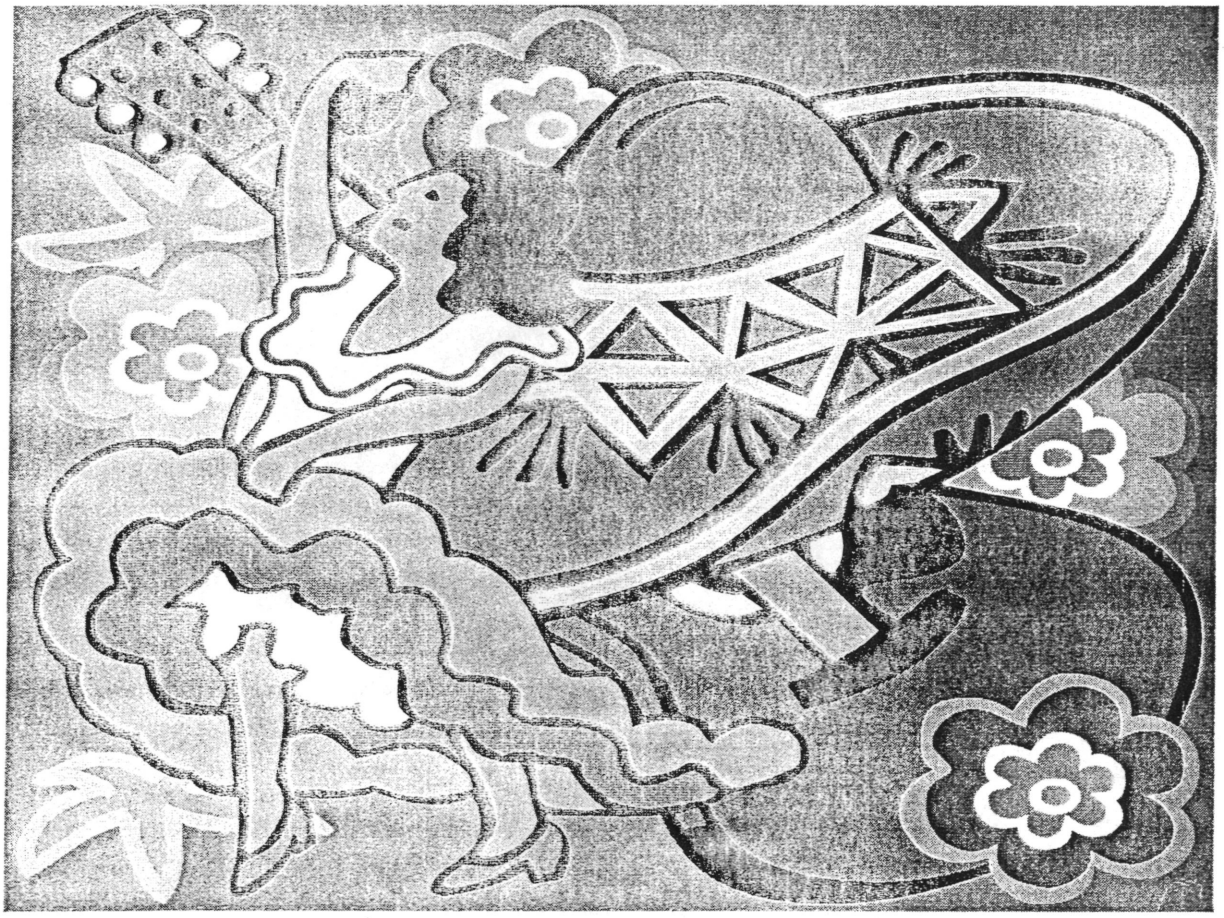

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