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Voluntary intake of prairie hay contaminated with sericea lespedeza (*lespedeza cuneata*) by beef cows

Abstract

Sericea lespedeza (*Lespedeza cuneata*) is a noxious weed that infests approximately 600,000 acres of native tallgrass range in the Kansas Flint Hills. Intake of *sericea lespedeza* by grazing beef cattle is poor due to the presence of condensed tannins in the plant. Condensed tannins reduce protein digestion by beef cattle and may decrease plant palatability because of their astringence. Prolific seed production, in combination with little or no grazing pressure, has contributed to the rapid spread of *sericea lespedeza* in the Flint Hills. Increasing grazing pressure on *sericea lespedeza* may reduce seed production and slow its invasion; however, the difficulties associated with measurement of intake by grazing beef cattle have hampered development of workable research models. Detailed study of the appetite-suppressing effects of *sericea lespedeza* under controlled conditions is essential to develop appropriate strategies to increase grazing pressure on this plant. Such information could lead to a degree of biological control of this noxious weed using the most economically important grazer (i.e., beef cattle) in the Flint Hills.

Keywords

Kansas Agricultural Experiment Station contribution; no. 11-171-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 1047; Cattlemen's Day, 2011; Beef; Intake; *Sericea Lespedeza*; Prairie hay

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Voluntary Intake of Prairie Hay Contaminated with *Sericea Lespedeza* (*Lespedeza Cuneata*) by Beef Cows

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Introduction

Sericea lespedeza (*Lespedeza cuneata*) is a noxious weed that infests approximately 600,000 acres of native tallgrass range in the Kansas Flint Hills. Intake of *sericea lespedeza* by grazing beef cattle is poor due to the presence of condensed tannins in the plant. Condensed tannins reduce protein digestion by beef cattle and may decrease plant palatability because of their astringence.

Prolific seed production, in combination with little or no grazing pressure, has contributed to the rapid spread of *sericea lespedeza* in the Flint Hills. Increasing grazing pressure on *sericea lespedeza* may reduce seed production and slow its invasion; however, the difficulties associated with measurement of intake by grazing beef cattle have hampered development of workable research models. Detailed study of the appetite-suppressing effects of *sericea lespedeza* under controlled conditions is essential to develop appropriate strategies to increase grazing pressure on this plant. Such information could lead to a degree of biological control of this noxious weed using the most economically important grazer (i.e., beef cattle) in the Flint Hills.

Feeding *sericea lespedeza* as sun-cured hay to confined beef cattle would be a feasible way to study the intake-limiting properties of this plant. This approach has not been attempted to date because previous research indicated that allowing *sericea lespedeza* to sun-cure after harvest sharply decreased the amount of extractable condensed tannins in the plant and the capability of condensed tannins to bind proteins. Based on these reports, it was doubtful whether sun-cured *sericea lespedeza* hay would produce the aversion in confined beef cattle that is commonly observed in free-ranging beef cattle exposed to the fresh plant. Therefore, the objective of our study was to compare intake of tallgrass prairie hay by beef cows when hay was either uncontaminated or heavily contaminated by *sericea lespedeza*.

Experimental Procedures

Tallgrass prairie forage contaminated with *sericea lespedeza* was harvested from a single pasture in Greenwood County, KS. The forage was sun-cured, packaged in bales, and stored at the Kansas State University Commercial Cow-Calf Unit. Forage was harvested in late July, corresponding to the budding stage of *sericea lespedeza*. Concentrations of condensed tannins in the plant typically are greatest at this stage of growth. Plant-species composition on the study site was estimated using a modified step-point technique; *sericea lespedeza* comprised 19.3% of all plants encountered during the procedure. Aboveground biomass of *sericea lespedeza* averaged 893 lb/acre.

Uncontaminated tallgrass prairie forage was harvested in Pottawatomie County, KS, in late July. Species composition of contaminated and uncontaminated forages were simi-

lar in all respects except for the presence of sericea lespedeza in the contaminated forage. Bales of each forage type were sampled to determine crude protein and acid detergent fiber concentrations and paired based on similarity in those values. Average protein and acid detergent fiber concentrations in contaminated and uncontaminated hays are shown in Table 1. Purposeful selection for similarity in protein and fiber concentrations between forage types was intended to prevent confounding of differences in forage quality with effects on intake. Bales of contaminated and uncontaminated hays selected for the study were ground separately through a 4-in. screen.

Twenty-four mature beef cows (average initial weight = 1022 ± 153 lb; average initial body condition score = 4.2 ± 0.8) were used in the study. Cows were housed in a single pen and were fed individually using a Calan gate system (American Calan, Inc., Northwood, NH). Cows were stratified by body weight and body condition score and assigned randomly to be fed either contaminated (C) or uncontaminated (UC) hay.

Cows were trained to use the Calan gate feeding system over a period of approximately 30 days. During this time, all cows were fed UC free choice. When forage intake stabilized at approximately 2.5% of body weight, the trial was initiated. All cows were fed UC free choice for the first 5 days of the trial. At that point, cows assigned to C were abruptly switched to prairie hay contaminated with sericea lespedeza. All cows were offered hay free choice according to their respective treatments for the next 10 days. Hay was offered at 6 a.m. and 6 p.m. daily. Refusals were collected daily at 5:30 a.m. Daily voluntary hay intakes (dry basis) were determined by subtracting daily refusals from the total amount of hay offered. Intakes were expressed as a percentage of initial cow body weight.

Results and Discussion

Average daily voluntary dry matter intake (DMI) of C and UC are shown in Figure 1. Both groups of cows were fed UC during the first 5 days of the trial (i.e., days -5 to -1). No differences ($P \geq 0.38$) in DMI occurred during this period. C was substituted for UC on day 0, after which voluntary DMI immediately began to diverge (treatment \times time interaction, $P < 0.01$). From day 0 to day 4, average voluntary DMI of C and UC were within 0.2 to 0.5% of body weight of one another. Thereafter, daily average voluntary DMI of cows assigned to C declined sharply such that by day 9 of the study, cows assigned to UC were eating 7 times more forage dry matter than those assigned to C.

The immediate decline in voluntary DMI that occurred during the first 5 days (day 0 to day 4) after the abrupt switch to C was interpreted to indicate that palatability of sericea lespedeza had a negative but relatively minor influence on consumption. Conversely, the precipitous drop in intake of C that followed (days 5 to 9) appeared to be driven by significant post-ingestive consequences of sericea lespedeza ingestion. This effect may have been associated with a ruminal buildup of tannin-protein complex, preceding a general decrease in the activity of ruminal cellulolytic microorganisms.

Implications

Results of this study suggest that tallgrass prairie hay heavily contaminated with sericea lespedeza may be a useful model for the study of the appetite-suppressing effects of that plant. Furthermore, the major source of appetite suppression by sericea lespedeza in

sun-cured form was attributed to the post-ingestive consequences of anti-nutritional factors, possibly condensed tannins, rather than anti-palatability factors. Whether these generalizations can be extrapolated to actively growing sericea lespedeza under grazing conditions is unknown.

Table 1. Concentration of acid detergent fiber (ADF) and crude protein in tallgrass prairie hay contaminated with sericea lespedeza and in uncontaminated tallgrass prairie hay (dry matter basis)

Item	% Crude protein	% ADF
Prairie hay contaminated with sericea lespedeza	5.5	41.0
Uncontaminated prairie hay	5.4	39.8

NUTRITION

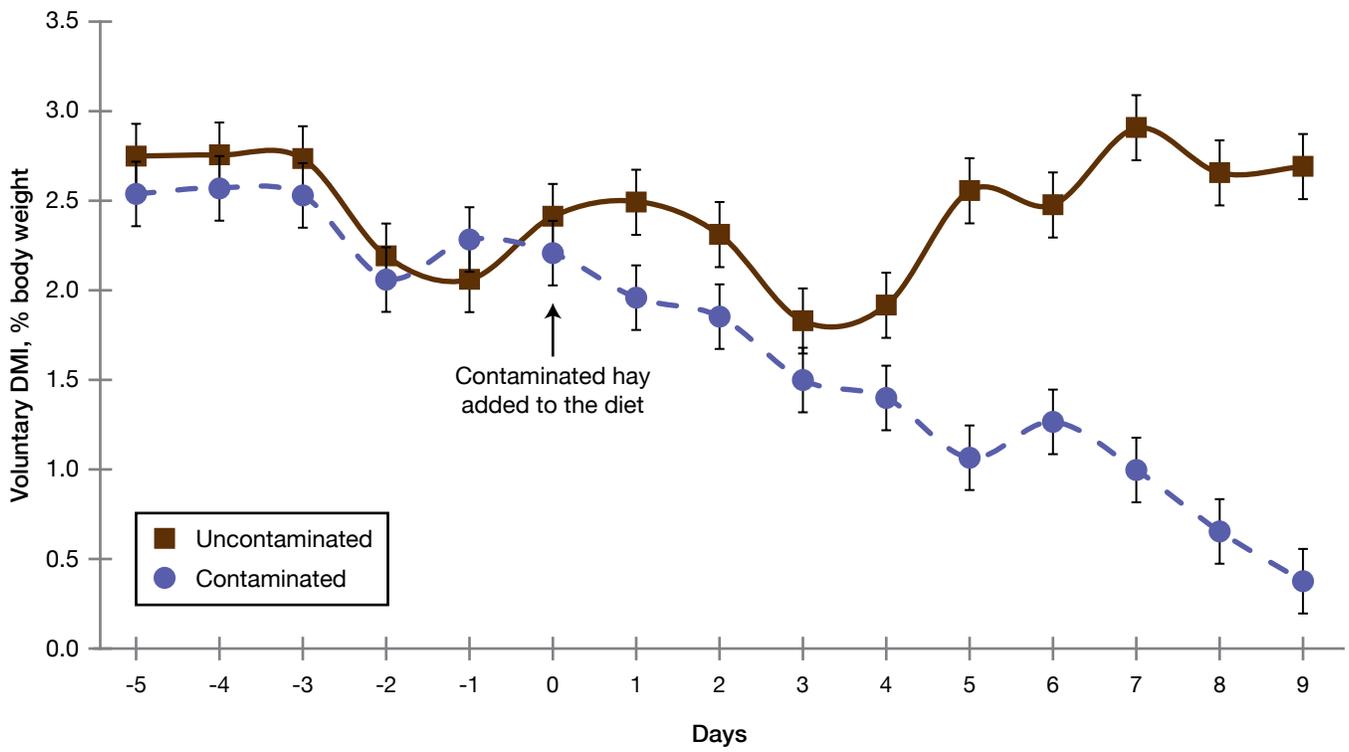


Figure 1. Effects of sericea lespedeza contamination on voluntary dry matter intake (DMI) of tallgrass prairie hay by beef cows.