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Mark Ullerich
University of Nebraska-Lincoln

Terry J. Klopfenstein
University of Nebraska-Lincoln, tklopfenstein1@unl.edu

Bruce Anderson
University of Nebraska-Lincoln, banderson1@unl.edu

Michael Trammell
University of Nebraska-Lincoln

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Interseeding legumes into established bromegrass pastures increased both CP content and digestibility of diets, but improved animal performance appears to be an energy response.

Summary

A trial was conducted to evaluate effects of interseeding legumes into smooth bromegrass pastures on animal performance and forage quality. Animal gains on legume/bromegrass treatments were higher than bromegrass alone. Laboratory analysis of diet samples collected from ruminally fistulated steers indicated no difference in the undegradable intake protein content of pastures. Legume/bromegrass treatments had higher IVDMD than the control. Therefore, the increases in gain are attributed to increased energy of legume/bromegrass diets and not undegradable protein content.

Introduction

Forage proteins are degraded rapidly by ruminants and therefore supply relatively small amounts of undegradeable intake protein (UIP). Undegradable intake protein supplements are an alternative way to overcome this metabolizable protein deficiency, but not without a substantial increase in overall production costs. Previous research at the University of Nebraska has shown a response to UIP supplementation of yearling steers during the grazing season but the increased gains were not maintained during the finishing period (*2000 Nebraska Beef Report*, pp. 30-32; *2001 Nebraska Beef Report*, pp. 34-36). Growing legumes in combination with cool season grasses can reduce purchased inputs by contributing nitrogen via fixation, improve nutritive values of the forage produced, and provide more uniform seasonal distribution of forage growth. Ruminal protein degradation appears to be higher for legumes than grasses. It has been proposed that protein in birdsfoot trefoil, a nonbloating perennial, is less readily degraded by microbes in the rumen allowing its protein to be used more effectively by ruminants than the protein in alfalfa and clovers. Therefore, the objectives of this experiment were to evaluate the effects of interseeding legumes into smooth bromegrass pastures on animal performance and forage quality.

Procedure

Forty-eight steers (560 ± 35 lb) were assigned randomly to one of four treatments consisting of established smooth bromegrass pastures interseeded with 1) alfalfa (ALF), 2) birdsfoot trefoil (BFT), 3) kura clover (KC), or 4) fertilized with 50 lb N/acre (CON). Steers rotationally grazed pastures divided into nine paddocks designed to simulate two-, six-, and 36-paddock rotations in a modified nested paddock design, thus providing grazing periods of 18-, six-, and one-day respectively in a 36-day grazing period. The pastures were divided into three blocks with each block containing one pasture of each mixture plus the fertilized smooth bromegrass monoculture. Pastures in blocks one and three were 4.4 acres and pastures in block two were 5.5 acres. Movement of the cattle through the grazing rotation was from the largest paddock (18 days) to the smallest (one day), with each block starting in a different paddock to stagger the growth stage at which plants were first grazed and balance plant growth stage during defoliation across grazing systems.

In addition to the performance data obtained from the grazing steers, four ruminally fistulated steers were assigned randomly to one of four treatments in block two to maintain a constant stocking rate of 3.1 AUM/acre and used to collect diet and omasal samples. The fistulated steers were managed in the same manner as the performance cattle except they were rotated to a different treatment at the start of a new period. Three diet and omasal samples were collected each period via ruminally fistulated steers. Rumen contents were evacuated and an omasal sample was obtained by introducing the arm into the rumen and at least two fingers into the omasum through the reticulo-omasal orifice. The subsequent diet samples collected were representative of animal selectivity while grazing one-, six-, and 18-day paddocks. Forage samples were analyzed for CP (combustion method) and IVDMD. Undegradable intake protein of the diet samples was measured using a modified procedure of Mass (*1998 Nebraska Beef Report*, pp. 90-92). Diet samples were incubated in situ using Dacron bags for a period of time equivalent to the rate of passage, estimated from IVDMD, plus a 10-hour lag. Omasal samples, which have effectively escaped rumen fermentation, were placed in Dacron bags, and bacterial contamination was removed by refluxing the sample in neutral detergent solution. Dry matter passage at the omasum was estimated by the amount of in situ residue.

Diet samples collected from the 36-paddock system would not be representative of average forage quality. In this system, animals were rotated daily and diet samples were collected immediately following their movement into that paddock, allowing for maximum animal selectivity. The diets collected from two- and six-paddock systems were collected approximately midway through the respective grazing periods, allowing

Table 1. Average daily gains and response variables for legume/bromegrass mixtures and smooth bromegrass monoculture.

	Treatment[a]					
Item	ALF	BFT	KC	CON	SEM	P-value[b]
ADG, lb/day	1.90	1.94	2.05	1.72	0.088	.04
CP, %	16.8	16.3	17.4	16.1	0.82	.24
IVDMD, %	62.1[c]	62.9[c]	70.4[d]	62.6[c]	3.3	.09
Diet UIP, % DM	1.48	1.45	1.46	1.39	0.13	—
Omasal UIP, % DM	1.64	1.33	1.35	1.32	0.15	—
Forage UIP, % DM[e]	1.54	1.54	1.26	2.04	.29	—

[a]Smooth bromegrass pastures interseeded with Alfalfa (ALF), birdsfoot trefoil (BFT), kura clover (KC), or fertilized with 50 lb/acre of N (CON).
[b]Contrast of control treatment vs the average of the interseeded legume treatments.
[c,d]Means in he same row with unlike superscripts differ (P<0.05).
[e]Undegradable intake protein of the legume portion of the mixtures and the UIP of the CON.

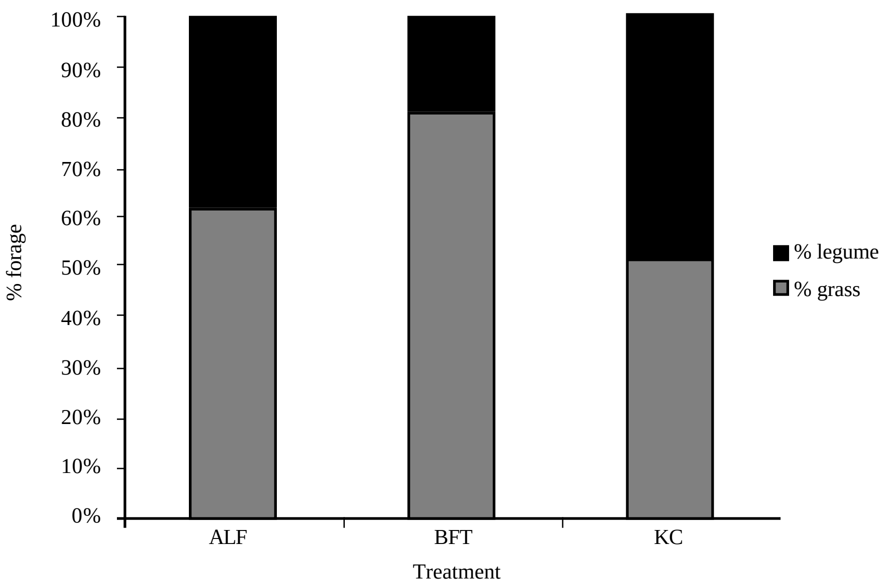

Figure 1. Biomass proportions for legume/bromegrass mixtures.

for average animal selectivity. Since previous research at the University of Nebraska concluded there were no differences in legume persistence, samples collected from the two- and six-paddock systems were thought to be representative of the diets consumed and averaged to evaluate any differences that may exist among treatments.

Biomass samples, clipped approximately 1 inch above ground level, were collected to coincide with the diet samples obtained. Five, seven, and 11 2-foot^2 plots were clipped randomly from 36, six-, and two-paddock systems respectively and separated into grass and legume fractions. By design, biomass data from the 36-paddock system were collected before grazing was initiated and is representative of the available forage without any effects grazing may have on the stand. Both two- and six-paddock system clip samples were taken from the paddock where animals were grazing potentially disturbing the accuracy of the biomass results. Samples were analyzed in the same manner as the diet and omasal samples.

Results

Table 1 summarizes the response variables of interest in this experiment. Crude protein contents of the diets across treatments were not statistically different (P=0.30). The KC treatment was significantly different (P<0.10) when compared to the control (17.4 vs 16.1) and appears to be dependent on the amount of legume present in the stand (Figure 1). In vitro dry matter disappearances were different across treatments (P<0.05). The IVDMD values differed (P<0.10) between legume/bromegrass mixtures and the control diet (65.2% and 62.6 % respectively) with KC being the most digestible (70.7%). There were no differences between ALF, BFT, and the CON IVDMD values indicating digestibility of KC caused this difference. Biomass data from the three legume/bromegrass treatments, shown in Figure 1, support these results. The legume portion of the KC treatment comprised nearly 50% of the stand. This may have allowed the animals greater selectivity of a higher quality diet than the other two mixtures. Since animal selectivity likely had a profound impact on diet quality, a greater proportion of legume increases the animal's ability to select a higher quality diet.

The UIP contents of the diets across treatments were not different (P=0.87). Undegradable intake protein results from omasal samples followed the same trend as the diet samples (P=0.14). Laboratory analyses of the clip samples for UIP also indicate there were no differences (P=0.23) among the legumes for UIP.

The BFT treatment contained less than 20% legume as a proportion of the total biomass (Figure 1). Crude protein and IVDMD values of the BFT treatment were not statistically different from the CON, suggesting diets selected were not different in composition from those of the CON. Therefore, there may not have been enough legume available to elicit a protein response.

Animal gains on legume/bromegrass treatments were higher (P = 0.04) than the control (1.96 lb/day vs. 1.72 lb/day) with KC gaining the most (2.05 lb/day). Because forage proteins are extensively degraded in the rumen, it may be assumed that there is an abundance of DIP. In addition, since no differences in UIP of the treatments were observed, increased digestible energy content of the diets must be responsible for the increase in gains observed in this experiment.

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[1]Mark Ullerich, graduate student; Terry Klopfenstein, professor, Animal Science; Bruce Anderson, professor, Agronomy; Michael Trammell, research technician.