The Professional Animal Scientist 25 (2009):296–299

Apparent Digestibility and Nitrogen Balance in Lambs Fed Matua or Matua-Alfalfa Hay

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ABSTRACT

The nutritive value of Matua prairie grass (Matua), Bromus willdenowii Kunth, for ruminants has not been documented. Therefore, the objective of this study was to investigate the effects of Matua and Matua-alfalfa (Medicago sativa) hay diets on apparent digestibility and N balance in lambs. Fourteen crossbred wether lambs (BW = 38 ± 4.3 kg) were used in a metabolism study. Apparent digestibilities of DM, NDF, ADF, and CP, and N balance were determined. The CP content of Matua-alfalfa mixed hay and Matua hay were11.26 and 10.88%, respectively. Regarding fiber components, NDF was 70.52 and 73.37%, and ADF was 40.99 and 41.94% in the Matua-alfalfa mixed and Matua hays, respectively. Apparent digestibilities of DM, NDF, and ADF were not affected by diet. Apparent digestibility of CP in lambs was 35.24% higher ($P < 0.05$) for the Matua-alfalfa mixed hay than the Matua hay. Fecal and urinary N excretion increased ($P < 0.05$) in the lambs fed Matua versus Matua-alfalfa hay by 28.35 and 7.29%, respectively. Nitrogen retention was 92.27% higher ($P < 0.05$), also as a result of feeding Matua-alfalfa versus Matua hay to lambs. Animal performance may be improved because of improved N utilization and nutritive value through incorporation of alfalfa into Matua stands.

Key words: Matua prairie grass, nutritive value, apparent digestibility, nitrogen balance

INTRODUCTION

Matua prairie grass (Matua), *Bromus willdenowi* Kunth, is a short-lived, cool-season perennial plant with potential for high forage production (Jung et al., 1994). Matua also has the potential to extend the grazing season because it grows earlier in the spring and later in the fall than most other cool-season grass species (LaCasha et al., 1999). Thus, winter feed and hay costs for livestock producers may be reduced by extending the grazing season.

Matua hay was previously evaluated as a potential feed for horses (LaCasha et al., 1999). Matua was intermediate in quality when compared with alfalfa (*Medicago sativa*) and bermudagrass (*Cynodon dactylon*) forages. In addition, in a palatability study, horses preferred Matua to bermudagrass. The authors concluded that Matua is an acceptable forage for horses. Similar results were observed by Guay et al. (2002). However, the digestibility of Matua by ruminants has not been documented.

The value of the addition of legumes to a stand of grass is well known. Legumes generally increase the protein content and digestibility of the grass-legume mixed forage and may also increase the CP content of the non-legume components of the mixture by contributing fixed N to the soil via the rhizobia bacteria-legume complex (Schultz and Stubbendieck, 1983). Therefore, the effect of inclusion of alfalfa into a Matua stand was also of interest. The objectives of this experiment were to investigate the apparent digestibility and N utilization of Matua and Matua-alfalfa hays when fed to lambs.

MATERIALS AND METHODS

Forage Establishment

Based on the results of a previous study (Guay et al., 2007), Matua and a Matua-legume mixture were established for use in a metabolism trial. In the spring of 1999, 2 plots were planted (0.1 ha each), 1 consisting of a pure stand of Matua and the other consisting of a Matua and alfalfa mixture. Matua was established at a seeding rate of 39.2 kg/ha, and 'Triple

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Crown' alfalfa was interseeded at a rate of 11.2 kg/ha (on a pure live seed basis). Hay was harvested from the 2 plots in May, June, and July of 2000, based on growth rate and physiology of the forage. Hay was harvested when 80% of the Matua plants had produced fully emerged seedheads, and alfalfa was in 1/10th bloom. The percentage alfalfa in the mixture was approximately 30%, based on visual estimations. The hay was sun-cured before baling in small square bales (approximately 22.7 kg). Hay was ground to pass through a 38.1-mm screen in a hammer mill. Hay from all harvests were combined and mixed in a Davis horizontal mixer (H. C. Davis Sons MFG Co. Inc., Bonner Springs, KS) for 15 min.

Animals and Management

A metabolism trial was conducted with 14 crossbred (1/8 Finnsheep, 1/8 Rambouillet, 1/4 Dorset, and 1/2 Suffolk) wether lambs (average BW = 38 ± 4.3 kg). The lambs were vaccinated against *Clostridium perfringens* types C and D and tetanus, and treated for internal parasites with Ivomec (MSD, Division of Merck and Co. Inc., Rahway, NJ). The lambs were group-fed tall fescue (*Lolium arundinaceum*) hay for 2 d and then gradually adapted to a diet consisting of 50.4% tall fescue hay, 40.5% ground corn, 5% molasses, 3.5% soybean meal, and 0.6% trace mineralized salt. The lambs were fed this diet for a total of 16 d, until the transition period to the experimental diets during the metabolism trial.

Experimental Period

The lambs were blocked by BW and randomly allotted to the 2 experimental diets within block (1 of 2 rows of stalls within the metabolism barn), which consisted of ground hay obtained from either the Matua or the Matua-alfalfa mixture. The chemical composition of the diets is presented in Table 1. The lambs were placed in metabolism stalls similar to those of Briggs and Gallup (1949), designed to separately collect feces and urine. All experimental procedures were approved by the Virginia Tech Animal Care and Use Committee. Before the beginning of the trial, 1,000,000 IU of vitamin A and 150,000 IU of vitamin D injections were administered intramuscularly, and the lambs were treated again with Ivomec for internal parasites. Once the lambs were placed in the stalls, the 35-d metabolism trial consisted of a 10-d period to allow for adaptation to the stalls, followed by a 5-d transition period to the experimental diets (to prevent rumen upset, the amount of experimental diet was increased by 20% and the amount of the tall fescue-based pretreatment diet was decreased by 20% each day), a 10-d preliminary period (100% of the lambs' DMI consisted of the experimental diets), and a 10-d sample collection period. The lambs were limit-fed 225 g of the ground hay and 5 g of trace mineralized salt twice daily during 2-h feeding periods, at 0700 and 1900 h. This amount of hay fed was determined from the maximum intake of the lambs that consumed the least amount of feed during the adaptation period. Water was available to the lambs at all times, except during the 2-h feeding periods.

Table 1. Chemical composition of Matua and Matua-alfalfa hay diets fed to lambs

	Treatment	
Component, % DM	**Matua**	**Matua-alfalfa**
DM	87.67	87.76
CP	10.88	11.26
NDF	73.37	70.52
ADF	41.94	40.99

Sample Collection and Analysis

Feed samples were collected each day, beginning 2 d before the start of the collection period and continuing until 2 d before the end of the period. Two days of feed samples were composited, subsampled, and stored in plastic bags. At the end of each 2-h feeding period, refusals were collected, weighed, and stored in a plastic bag in a freezer. Feces were collected daily during the 10-d collection period, dried in a forced-air oven (60°C) for 48 h, composited, and stored in plastic bags. Feces samples were weighed before and after drying to determine DM. All feed, refusal, and feces samples were ground to pass through a 1-mm screen using a Wiley mill (Thomas Wiley Laboratory Mill Model 4, Arthur H. Thomas Co., Philadelphia, PA). Urine was collected in 4-L plastic jugs containing 15 mL of a 50% (wt/wt) solution of 95 to 98% H_2SO_4 and water, plus approximately 500 mL of water. Urine was collected daily, diluted to a constant weight of 5,000 g with water, and a 2% (100 mL) aliquot was obtained and refrigerated. At the end of the trial, the composited urine sample from each lamb was mixed, subsampled, and frozen until later chemical analysis.

At the end of the trial, ruminal fluid was collected 2 h postfeeding using a stomach tube equipped with a strainer and a vacuum pump. The ruminal fluid was immediately strained through 8 layers of cheesecloth, and the pH was measured using a pH meter (Accuemet Mini pH Meter, Model AP61, Fisher Scientific Co., Pittsburg, PA). A 5-mL aliquot of ruminal fluid was placed in a 15-mL plastic storage tube containing 1 drop of H_2SO_4 and frozen for later NH_3-N analysis. Blood samples were obtained using 15-mL Vacutainer serum (no additive) tubes (Becton Dickinson Corp., Franklin Lakes, NJ) at 6 h postfeeding by jugular venipuncture. Upon return to