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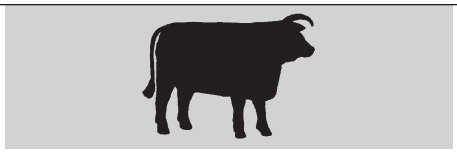

Evaluation of ammoniated wheat straw during a receiving and growing period for beef cattle[1]

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ABSTRACT

Two experiments were conducted to determine the effects of including ammoniated wheat straw in diets for beef cattle on growth performance and digestibility. Treatments consisted of diets containing 70% (DM basis) concentrate containing 40% (DM basis) wet corn gluten feed with 30% (DM basis) roughage from wheat straw (STRW), anhydrous ammonia–treated wheat straw (AMMN), or a 50:50 prairie hay and alfalfa hay blend (CONT). Experiment 1 used 288 crossbred steer calves (271 ± 28 kg) in a randomized complete block design in which steers were fed their experimental diets for 56 d. Final BW, ADG, and G:F were greater for calves fed CONT than for those fed either STRW or AMMN ($P < 0.05$). Experiment 2 used 6 ruminally fistulated Holstein heifers (288 kg) in a 3 × 3 Latin square design. Heifers fed CONT consumed less ($P < 0.05$) DM, OM, and ADF compared with those fed AMMN and STRW. Feeding heifers CONT improved ($P < 0.05$) digestibility of DM and OM but decreased ($P < 0.05$) digestibility of ADF. Ruminal pH was lowest ($P < 0.05$) for heifers fed CONT. The results of this experiment suggest that wheat straw and ammoniated wheat straw are equivalent roughage sources but inferior to a 50:50 blend of alfalfa hay and prairie hay when fed to growing calves at 30% of the dietary DM.

Key words: ammoniation, beef cattle, growth, wheat straw

INTRODUCTION

Drought conditions in the past have created a shortage of grass type hays that are used as the primary roughage source in receiving and growing cattle diets. Wheat straw is typically overlooked as a feedstuff candidate for growing cattle because of its low energy, CP, voluntary intake, and digestibility (Anderson, 1978). The low nutritive value of wheat straw, combined with the added resources necessary to harvest and remove it from the field, limits the appeal of wheat straw as an ingredient in receiving and growing beef cattle diets. Wheat straw typically can be purchased at a lower cost than traditional grass hay. Chemical treatment of wheat straw is a practice long used to improve nutritive value and increase palatability and acceptance in beef cattle diets. Anhydrous ammonia treatment of wheat straw offers significant benefit to the producer because equipment expenses are minimal and large quantities of wheat straw can be treated at one time with minimal labor. Treatment of wheat straw with anhydrous ammonia offers improvements in digestibility and intake (Garrett et al., 1974; Horton and Steacy, 1979; Waggoner and Jaeger, 2014). Although research previously has been conducted to evaluate the efficacy of feeding ammoniated wheat straw as the primary dietary energy source to mature cows with low energy requirements, there is no information that explores the effects of including this feedstuff in receiving and growing diets for beef cattle at levels similar to our experiment. The objective of these experiments was to determine the efficacy of including wheat straw or ammoniated wheat straw as a replacement for a traditional prairie hay and alfalfa hay blend in receiving and growing diets for beef cattle.

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Table 1. Composition (% of DM) of diets containing wheat straw (STRW), ammoniated wheat straw (AMMN), or a 50:50 blend of prairie hay and alfalfa (CONT) during Exp. 1 and Exp. 2

	Diet		
Item, % of DM	CONT	STRW	AMMN
Ingredient			
Dry-rolled corn	23.57	23.57	23.57
Supplement[1]	6.43	—	6.43
Supplement[2]	—	6.43	—
Alfalfa hay	15.00	—	—
Prairie hay	15.00	—	—
Wheat straw[3]	—	30.00	—
Ammoniated wheat straw[4]	—	—	30.00
Wet corn gluten feed	40.00	40.00	40.00
Nutrient composition, analyzed			
DM	73.0	73.4	72.2
CP	15.7	14.6	14.5
Ca	0.91	0.72	0.71
P	0.56	0.52	0.52
K	1.22	1.10	1.10
Mg	0.26	0.27	0.25
Ether extract	3.04	2.74	2.65
ADF	16.2	21.8	21.2

[1]Guaranteed value (DM basis) of 15.1% CP, 5.0% Ca, 0.70% P, 0.97% K, 0.99% Mg, and 2.93% ether extract. Provided 31 mg/kg monensin (Rumensin; Elanco Animal Health, Indianapolis, IN). Contained (DM basis) 59.6% wheat middlings, 15.0% dried distillers grains with solubles, 12.3% calcium carbonate, 10.0% microlite, 2.5% salt, 1.7% standardizer, 0.6% molasses, and 0.1% Rumensin. Manufactured by Cargill Animal Nutrition (Minneapolis, MN).

[2]Guaranteed value (DM basis) of 30.3% CP, 5.0% Ca, 0.83% P, 1.26% K, 1.00% Mg, and 2.18% ether extract. Provided 31 mg/kg monensin (Elanco Animal Health). Contained (DM basis) 62.4% cottonseed meal, 13.5% dried distillers grains with solubles, 12.2% calcium carbonate, 9.3% microlite, 2.5% salt, 1.5% standardizer, and 0.1% Rumensin. Manufactured by Cargill Animal Nutrition.

[3]Contained 3.5% CP and 55.0% ADF. Mean of samples from 10 bales.

[4]Contained 11.2% CP and 49.4% ADF. Mean of samples from 10 bales.

MATERIALS AND METHODS

Animal care practices used in the following experiments were approved by the Kansas State University Institutional Animal Care and Use Committee protocol 2910.12.

Exp. 1. Receiving and Growing Cattle Performance Experiment

A total of 301 crossbred steers (271 ± 28 kg of BW) were procured from 3 separate sources (Lindsborg, KS; Bolivar, MO; and Seymour, TX) via online live auctions, and 288 of these steers were used in a randomized complete block design to evaluate the efficacy of feeding ammoniated wheat straw (**AMMN**), wheat straw (**STRW**), or a 50:50 prairie hay and alfalfa hay blend (**CONT**) at 30% (DM basis) dietary inclusion (Table 1) to beef steer calves during a receiving and growing period. Calves were fed experimental diets once daily for 56 d. Inclusion of untreated wheat straw in the STRW diet necessitated the use of an alternative supplement containing 30.3% CP, whereas both CONT and AMMN diets contained a supplement containing 15.1% CP to maintain isonitrogenous diets (Table 1). Feed bunks were evaluated at approximately 0700 h, and feed was mixed using a drag-style feed mixer (Roto-Mix, Dodge City, KS), offloaded into individual tubs, and weighed using a platform scale to ensure accuracy (±0.05 kg). Feed was delivered by hand at 0900 h each day in an amount sufficient to allow for approximately 0.1 kg of feed refusal per animal per d.

Calves arrived during a 3-d period from June 4 through June 6, 2013, at the Kansas State University Beef Stocker Unit and were blocked by source (n = 3). Upon arrival, calves were weighed individually, administered a visual dangle-style ear tag, moved to soil-surface pens (9.1 × 15.2 m) with a 9.1-m concrete fence-line bunk with ad libitum access to long-stemmed prairie hay and water, and housed overnight. Thirteen animals were excluded from the experiment because of preexisting health conditions. The day following arrival (d 0), calves were stratified within block by arrival BW to groups of 12 calves and randomized to pen and treatment within block with a total of 24 pens providing for 8 replications per treatment. Blocks were of unequal size, with calves from Texas, Kansas, and Missouri comprising 12, 6, and 6 pens, respectively. All calves were vaccinated with a modified-live vaccine against infectious bovine rhinotracheitis; bovine virus diarrhea Types 1 and 2; parainfluenza 3; killed vaccine against bovine respiratory syncytial virus (Zoetis, Exton, PA); Bar-Vac 7, a 7-way modified-live vaccine against a broad spectrum of clostridial bacteria (Boehringer Ingelheim, St. Joseph, MO); and Nuplura PH, a *Mannheimia haemolytica* bacterial extract-toxoid (Novartis Animal Health, Larchwood, IA). On d 0, the cattle were also dewormed using 14 mL of Safe-Guard (fenbendazole 10% suspension; Merck Animal Health, Summit, NJ) oral drench and given a subcutaneous injection of 6 mL of Zuprevo (180 mg/mL tildipirosin; Merck Animal Health). Calves were revaccinated on d 28 with the same vaccines as in initial processing. Calves were monitored daily by trained personnel;