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# Evaluation of Ammoniated Wheat Straw in Receiving and Growing Diets

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## Abstract

Drought conditions in the past have created a shortage of prairie hay and other grass hays that are used as roughage sources for growing beef diets. Ammoniated wheat straw historically has been available for purchase at a lower than prairie hay. Although some research has been conducted using ammoniated wheat straw as a feedstuff for mature cows, little information is available on the use and outcome its inclusion in beef cattle receiving and growing diets. Our objective was to compare the performance outcomes of newly arrived and growing calves fed total mixed rations containing either ammoniated wheat straw, wheat straw, or a traditional blend of prairie hay and alfalfa hay.



## Keywords

beef cattle





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## Introduction

Drought conditions in the past have created a shortage of prairie hay and other grass hays that are used as roughage sources for growing beef diets. Ammoniated wheat straw historically has been available for purchase at a lower than prairie hay. Although some research has been conducted using ammoniated wheat straw as a feedstuff for mature cows, little information is available on the use and outcome its inclusion in beef cattle receiving and growing diets. Our objective was to compare the performance outcomes of newly arrived and growing calves fed total mixed rations containing either ammoniated wheat straw, wheat straw, or a traditional blend of prairie hay and alfalfa hay.

## Experimental Procedures

Crossbred beef steers (n = 301; initial body weight 598 lb) were purchased from three separate sources (Lindsborg, KS; Boliver, MO; and Seymour, TX) via online live auctions. Cattle arrived at the Kansas State University Beef Stocker Unit over a 3-day period (June 4–6, 2013). Upon arrival, all calves were weighed, ear-tagged, moved to pens with *ad libitum* access to long-stemmed prairie hay and water, and held overnight. The following day, calves were vaccinated with Bovi-Shield Gold 5 (Zoetis, Exton, PA), Nuplura (Novartis Animal Health, Larchwood, IA), and Bar-Vac 7 (Boehringer Ingelheim, St. Joseph, MO); mass-medicated with Zuprevo (Merck Animal Health, Summit, NJ); and dewormed using Safe-Guard (Intervet, Millsboro, DE) oral drench. Animals were revaccinated on day 28 with Bovi-Shield Gold 5, Bar-Vac 7, and Nuplura. Each load was blocked by arrival date and randomly assigned to treatment for a total of 24 pens with 12 cattle in each pen. A portion of the cattle (13 animals) was excluded from the trial due to pre-existing health conditions. All animals were observed daily for clinical signs of disease, any abnormalities or signs of illness were documented, and cattle so identified received appropriate therapeutic treatments as described by standardized operating procedures for the facility. Experimental treatments consisted of diets containing 30% (dry basis) of either wheat straw, ammoniated wheat straw, or a blend of prairie hay and alfalfa hay. Diets (Table 1) were balanced to contain comparable energy content and to meet or exceed the nutrient recommendations for receiving calves as listed in Nutrient Requirements of Beef Cattle (NRC, 7th revised edition, 1996 update).

Feed bunks were evaluated at approximately 7:00 a.m. and feed was delivered at approximately 9:00 a.m. each day in amounts sufficient to allow for approximately 0.25 lb/animal daily of feed refusals the following morning. Feed was weighed into the bunk and the remaining feed in the bunk from the prior day was estimated and recorded daily. Unconsumed feed remaining in the bunk was weighed back on days 28, 56, and 70. Total mixed ration feed samples were taken weekly and ingredient samples were taken at arrival for each load to determine nutrient content and dry matter content.

Calves were fed their respective diets for 56 days, after which they were fed a common diet (control) for an additional 14 days to equalize gut fill. Weights were taken on days 0, 28, 56, and 70. Dry matter intakes, average daily gains, and feed efficiencies were calculated for each period for each pen of calves. Body weights taken after Day 0 were analyzed separately in a mixed model using the MIXED procedure in SAS (SAS Institute, Cary, NC) with treatment as a fixed effects factor, day-0 bodyweight as a fixed covariate, and source of cattle as a random effect. Resulting least squares treatment means for these ANCOVA models were computed at the mean of the day-0 bodyweights. All other response variables were analyzed in a mixed model with treatment as a fixed effect and source of cattle as a random effect.

## Results and Discussion

Growth performance is shown in Table 2. No effects of straw ammoniation were observed compared with the wheat straw diet. Final body weight and average daily gain were not different between ammoniated wheat straw and wheat straw ($P > 0.60$). Our results suggest that in diets containing 40% wet corn gluten feed, feeding 30% of diet dry matter as wheat straw yields performance similar to that obtained by feeding ammoniated wheat straw.

## Implications

Feeding wheat straw at 30% inclusion on a dry matter basis during the receiving and growing period has the same performance as ammoniated wheat straw at a decreased cost.

**Table 1. Composition of diets fed to crossbred beef steers during the receiving and growing phase (100% dry matter basis)**

| | Diet | | |
|---|---|---|---|
| Ingredient, % of dry matter | Control | Straw | Ammoniated straw |
| Dry-rolled corn | 23.57 | 23.57 | 23.57 |
| Supplement | 6.43 | 6.43 | 6.43 |
| Alfalfa hay | 15.00 | | |
| Prairie hay | 15.00 | | |
| Wheat straw | | 30.00 | |
| Ammoniated wheat straw | | | 30.00 |
| Wet corn gluten feed | 40.00 | 40.00 | 40.00 |
| | | | |
| Nutrient content | | | |
| Dry matter, % | 73.0% | 73.4% | 72.2% |
| Crude protein, % | 15.73 | 14.63 | 14.50 |
| Calcium, % | 0.91 | 0.72 | 0.71 |
| Phosphorus, % | 0.56 | 0.52 | 0.52 |
| Salt, % | 0.32 | 0.32 | 0.32 |
| Potassium, % | 1.22 | 1.10 | 1.10 |
| Magnesium, % | 0.26 | 0.27 | 0.25 |
| Fat, % | 3.04 | 2.74 | 2.65 |
| Acid detergent fiber, % | 16.20 | 21.84 | 21.24 |
| NE maintenance, Mcal/100 lb | 81.84 | 81.54 | 83.34 |
| NE gain, Mcal/100 lb | 52.55 | 46.40 | 50.00 |

**Table 2. Growth performance of crossbred steers fed diets containing wheat straw, ammoniated wheat straw, or a blend of prairie hay and alfalfa hay (Control) at 30% inclusion during the receiving and growing periods**

| Item | Control | Wheat straw | Ammoniated wheat straw | SEM | *P*-value |
|---|---|---|---|---|---|
| Initial weight, lb | 616 | 616 | 617 | 23 | 0.64 |
| Day 28 weight, lb | 696 | 698 | 698 | 2.5 | 0.78 |
| Day 56 weight, lb | 800[a] | 780[b] | 782[b] | 3.5 | <0.001 |
| Final weight (day 70), lb | 827[a] | 812[b] | 810[b] | 3.1 | <0.001 |
| Dry matter intake, lb/day | | | | | |
| Day 0 to 28 | 16.54 | 16.85 | 16.53 | 0.32 | 0.52 |
| Day 0 to 56 | 18.76 | 18.37 | 18.60 | 0.38 | 0.60 |
| Day 0 to 70 | 19.69 | 19.02 | 19.28 | 0.62 | 0.19 |
| Day 56 to 70 | 23.42[a] | 21.58[b] | 22.00[b] | 0.43 | <0.001 |
| Average daily gain, lb | | | | | |
| Day 0 to 28 | 3.08 | 3.15 | 3.16 | 0.12 | 0.78 |
| Day 0 to 56 | 3.45[a] | 3.09[b] | 3.14[b] | 0.14 | <0.001 |
| Day 0 to 70 | 3.13[a] | 2.91[b] | 2.89[b] | 0.07 | <0.001 |
| Day 56 to 70 | 1.88 | 2.18 | 1.89 | 0.28 | 0.39 |
| Feed:gain, lb/lb | | | | | |
| Day 0 to 28 | 5.35 | 5.34 | 5.21 | 0.05 | 0.73 |
| Day 0 to 56 | 5.45[a] | 5.94[b] | 5.94[b] | 0.15 | <0.001 |
| Day 0 to 70 | 6.28[a] | 6.53[b] | 6.67[b] | 0.16 | 0.01 |
| Day 56 to 70 | 12.30 | 9.79 | 11.40 | 1.89 | 0.19 |

[a,b,c]Means in a row without a common superscript are different, $P < 0.05$.