

Performance and Behavior of Weaned Beef Cattle that Were Fed Tall Fescue Dry Hay or Haylage

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Angela Smotherman, undergraduate student;
Jessica Morgan, undergraduate student;
Kayla Lannom, undergraduate student;
Jonathan Black, undergraduate student;
Jessica Gentry Carter, associate professor;
Warren Gill, Director, School of Agribusiness and
Agriscience, Middle Tennessee State University;
Anna K. Johnson, assistant professor,
Department of Animal Science, Iowa State University

Summary and Implications

Tennessee cattle producers may not understand the real benefits of feeding haylage because research on cattle performance and behavior has not been documented. Therefore, the objective of this experiment was to determine if there were differences in performance and behavior of feeder calves fed Tall Fescue dry hay (**hay**) or fescue haylage (**haylage**). The project began on October 20, 2008 and concluded on December 4, 2008. Total of 60 calves were weaned and preconditioned for 40 d prior to the study. Calves were 222 ± 45 d average age on trial and weighed 209.3 ± 13.3 kg. Breed type and sex were evenly distributed across treatments. Four pens of weaned calves including steers and heifers ($n = 15$ per pen) were used. Half of the calves (2 pens) were fed haylage and the other half (2 pens) were fed hay. Animals were housed in one of four adjacent paddocks with minimal forage available in each paddock. Each paddock included 1 cone-style hay ring and a water trough. Animal performance (weight and Average Daily Gain [ADG]) were monitored for a 45-d feeding period. Behavior was recorded on d 2, 22, and 41 using a live observation using a 5-min scan sampling methodology over four consecutive hours from 1300 to 1600. **Active** was defined as a summation of standing and walking. **Inactive** was defined as lying laterally or lying on their sternum. **Time eating** (eating) was defined as the summation of time an animal engaged in head inside the hay ring or grazing. **Time at drinker** (drinker) was defined as head down inside the water tank. **Time at licking mineral** was defined as head down inside the mineral feeder. Pen was the experimental unit for both the performance and behavior data. Data were analyzed using the PROC GLM of SAS. PDIF was used to separate differences at a P -value of $P < 0.05$. There were no ($P = 0.96$) differences between d-0 weights or during the first 21-d feeding period between treatments ($P = 0.96$). There were differences ($P = 0.0002$) in ADG for the two treatments between d 21 to 45. Overall ADG differed ($P = 0.03$) for calves fed hay (0.23 kg/d) compared to for calves

fed haylage (0.11 kg/d). There were no ($P > 0.05$) differences observed in the cattle behavioral repertoire for treatment or for the day by treatment interactions. In conclusion, reductions in performance were detected when calves were fed haylage compared to hay but their behavioral repertoire did not differ.

Introduction

Historically, Tennessee cattle producers have been harvesting hay for winter-feeding purposes. Recently, the use of hay wrapping machines has been widely discussed throughout the agriculture industry. Hay wrapping machines are used to produce haylage, which is hay that has been harvested green and wrapped in plastic to allow for the process of fermentation. Haylage generally has a higher nutritional value than traditional hay bales; although it has been hypothesized that fescue haylage can be deficient in energy (Smith et. al., 1987). Tennessee cattle producers may not understand the real benefits of feeding haylage because research on cattle performance and behavior has not been documented. Therefore, the objective of this experiment was to determine if there were differences in performance and behavior of feeder calves fed Tall Fescue dry hay or haylage.

Materials and Methods

The project began on October 20, 2008 and concluded on December 4, 2008. This project was approved by the Middle Tennessee State University animal care and use committee (protocol # 08-008) and all animals were housed in accordance with the *Guide for the Care and Use of Agriculture Animals in Agriculture Research and Teaching* (FASS, 1999).

Dry hay or haylage: A 40-acre field of *Festuca arundinacea* (Tall Fescue) was harvested on May 12 to 14, 2008. The hay was cut using a Vicon mower-conditioner. Bales were harvested after drying with a Vicon (RV 1901) baler (1.2 m high x 1.2 m wide bales). The haylage was wrapped using a Tube-Line bale wrapper. Sunfilm RT-100 white plastic silage wrap was used to wrap the bales. The haylage was wrapped at higher moisture content (50 %) and stored outside. The dry hay (13 % moisture) was stored under cover after harvesting. Both types of forage were harvested from the same field during the first cutting.

Animals and location: Calves were housed at the Middle Tennessee State University beef unit near Murfreesboro, TN. This location can be described as the central basin; with a temperate climate (average temperature is 15.3°C). A total of 60 calves were weaned and preconditioned for 40 d prior

to the study. Calf birth dates ranged from Feb. 13, 2008 through April 28, 2008 (222 ± 45 d average age on trial and weighed 209.3 ± 13.3 kg). All males were castrated either at birth or at weaning and four calves were dehorned at weaning. Breed type and sex were evenly distributed across treatments. Breeds included Angus, Hereford and Charolais. Calves were approximately 50 % British and 50 % Continental. At weaning, calves received vaccinations for protection against respiratory illness including bovine rhinotracheitis virus diarrhea, parainfluenza type 3, and respiratory syncytial virus (Express 5-HS, Boehringer Ingelheim, St. Joseph, MO), six strains of *Clostridial sp.* (Bar-Vac 7; Boehringer Ingelheim, St. Joseph, MO), and mannheimia haemolytic-pasteurella multocida (Pulmo-guard PHM-1; Boehringer Ingelheim, St. Joseph, MO). Calves were de-wormed with moxidectin (Cydectin; Ft. Dodge Animal Health, Fort Dodge, IA) with dosage according to weight. Calves were re-vaccinated 4-wks later (Express 5-HS and Bar-Vac 7) according to product recommendations.

Treatments and experimental design: Four pens of weaned calves including steers and heifers ($n = 15$ per pen) were used. Half of the calves (2 pens) were fed haylage (**haylage**) and the other half (2 pens) were fed dried hay (**hay**).

Diet, housing and husbandry: Animals were housed in one of four adjacent paddocks (205 long x 5 m wide, providing $68.3 \text{ m}^2/\text{hd}$) with minimal forage available in each paddock. Each group had access to shade in their paddock (tree line in the back of the pens). Each paddock included 1 cone-style hay ring (Figure 1, Coop Hay Saver item #156387, Tennessee Farmers Cooperative, Lavergne, TN) and a water trough with an automatic watering system (Little Giant plastic float valve, Buy and Large, Inc., Santa, Ana, CA). Dimensions of the water troughs were 46 cm wide x 91.5 cm high x 122 cm long). Round bales were placed in each pen every other day at approximately 1600 h. Calves always had access to hay or haylage. Calves were checked 2x/d and no animals were removed from the study due to illness.

Figure 1. Each pen included one cone-style hay feeder to feed hay or haylage.



Nutrient analysis of the forage: Forage samples were randomly collected ($n = 10$ bales / treatment). Samples were collected using a hay corer (40.6 cm long x 2.5 cm long) and mixed together for testing. Samples were stored in a plastic Ziploc freezer bag, frozen, and shipped to a commercial laboratory for a nutrient analysis (Table 1).

Table 1. Nutrient analysis of Tall Fescue hay and haylage.

| Nutrient | Hay | Haylage |
|-------------------------|------|---------|
| Moisture, % | 12.8 | 49.4 |
| Dry matter, % | 87.2 | 50.6 |
| Protein, % ¹ | 12.9 | 12.1 |
| TDN ¹ | 57 | 62 |
| Relative feed value | 76 | 95 |

¹Dry matter basis

Environmental measures: Recorded with one Hobo[®] (Hobo[®] H8 Pro Series, Onset Computer Corporation, Bourne, MA) that was placed in between pens 2 and 3 at the front of the pens on a post (1.72 m from the ground). Ambient temperature and relative humidity were recorded at 5-min intervals over the entire trial. Temperature and relative humidity averaged over the entire trial period were $28.0 \text{ }^\circ\text{C}$ and 54.4% . Average temperature during the behavioral observations was 23.6 , 16.0 and $7.2 \text{ }^\circ\text{C}$. Relative humidity on d 2 was 15.9% and d 41 was 44.3% (d22 the RH data was missing).

Performance: Animal performance (weight and Average Daily Gain [ADG]) were monitored for a 45-d feeding period. Calves were weighed on d 0, 21, and 45 using an Avery Weigh-Tronix (Model # 615, Avery Weigh-Tronix LLC., Fairmont, MN) electric scale that was placed on a Silencer squeeze chute (Moly Mfg. Inc., Lorraine, KS). ADG was calculated by taking the difference in weight for each weigh period divided by the number of days on feed.

Behavior: Recorded on d 2, 22, and 41. Behavior was recorded by live observation using a 5-min scan sampling methodology over four consecutive hours from 1300 to 1600. One observer was placed in or near each pen so that all calves were visible but so the observer would not disrupt the calves' behaviors. **Active** was defined as a summation of standing and walking. **Inactive** was defined as lying laterally or lying on their sternum. **Time eating** (eating) was defined as the summation of time an animal engaged in head inside the hay ring or grazing. **Time at drinker** (drinker) was defined as head down inside the water tank. **Time at licking mineral** was defined as head down inside the mineral feeder. Behavioral categories were mutually exclusive

Statistical Analysis: Pen was the experimental unit for both the performance and behavior data. Data were analyzed using the PROC GLM (performance measures) of SAS (2007; SAS[®] Inst. Inc., Cary, NC). The model included treatment (hay or haylage), sex (steer or heifers), and pen by treatment interactions. All behavioral data were expressed as percentages and were subjected to a square root arcsine transformation process to achieve a normal distribution to meet one of the basic assumptions of the analysis of variance (ANOVA). Transformed data were analyzed using the PROC MIXED procedure in SAS (SAS Inst. Inc., Cary, NC) software for parametric data. The model included treatment (hay or haylage), observation day (d 2, 22 and 41), and day by treatment interactions. PDIF was used to separate differences at a *P*-value of *P* < 0.05.

Results and Discussion

Performance: There were no (*P* = 0.96) differences between d-0 weights or during the first 21-d feeding period between treatments (*P* = 0.96; Table 2). There were differences (*P* = 0.0002) in ADG for the two treatments on d 21 to 45. The overall ADG for calves on hay was 0.23 kg/d and -0.11 kg/d for calves fed haylage (*P* = 0.03; Table 2).

Table 2. Performance least squares means (SEM) for calves fed hay or haylage for a 45-d period.

| Measure | Treatment | | SEM | P-value |
|---------------------------|-----------|---------|------|---------|
| | Hay | Haylage | | |
| 0-d wt., kg | 209.1 | 209.6 | 13.3 | 0.96 |
| 21-d wt., kg | 219.3 | 215.3 | 13.1 | 0.96 |
| 45-d wt., kg | 219.7 | 204.6 | 13.0 | 0.83 |
| ADG, d 0–21 ¹ | 0.49 | 0.27 | 0.12 | 0.56 |
| ADG, d 21–45 ¹ | 0.02 | -0.49 | 0.11 | 0.0002 |
| Overall ADG ¹ | 0.23 | -0.11 | 0.07 | 0.030 |

¹ ADG measurement reported in kg/d.

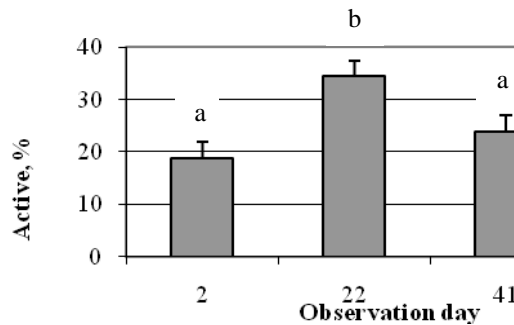
Behavior: There were no (*P* > 0.05) differences observed in the cattle behavioral repertoire for treatment (Table 3) or for the day by treatment interactions (Table 4).

Table 3. Summation of cattle behavior least squares means on three observation days fed either hay or haylage.

| Behavior, % | Treatment | | SEM | P-value |
|-----------------|-----------|---------|------|---------|
| | Hay | Haylage | | |
| Active | 23.2 | 28.3 | 3.08 | 0.189 |
| Inactive | 26.9 | 27.3 | 4.51 | 0.950 |
| Eating | 48.7 | 43.5 | 4.08 | 0.374 |
| Drinking | 1.0 | 0.7 | 0.21 | 0.707 |
| Licking mineral | 0.2 | 0.2 | 0.20 | 0.474 |

Regardless of treatment, calves become more (*P* = 0.030) active on d 22 (Figure 2). For all other behaviors and postures there were no (*P* > 0.05) day effects over the trial (*data not shown*). It should be noted that the calves from both treatments spent a considerable amount of time grazing on the first observation day, but all of the available forage was consumed by the end of the first week on trial. Afterwards, calves from both treatments were only provided either hay or haylage from the hay ring.

Figure 2. Percent of time spent in active behaviors on each observation day.



Reductions in animal performance were detected when calves were fed haylage compared to hay. It is speculated that the differences in animal performance may have been caused by increased ergovaline concentrations in the haylage. Ergovaline is the toxic alkaloid that is produced by the fescue fungus *Neotyphodium coenophialum*. The ergovaline alkaloid has been shown to cause decreases in forage consumption and weight gain in cattle. Research conducted by Roberts et al. (2002) showed that ergovaline concentrations were higher in ensiled hay than in dry hay. A concentrate supplement in addition to forage may be necessary to increase weight gains to a more acceptable level. There were no differences in eating patterns when calves were fed either hay or haylage. It may be helpful to conduct 24-h observation scans in order to more accurately compare and document behaviors between the two treatment groups. Observations were made in the afternoon and calves in this experiment tended to be most active early in the morning and late in the afternoon.

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Table 4. Summary of day by treatment interaction least squares means of cattle behaviors when fed hay or haylage.

| Behaviors, % | Day of Observation | | | | | | SEM | P-value |
|-----------------|--------------------|---------|------|---------|------|---------|-----|---------|
| | 2 | | 22 | | 41 | | | |
| | Hay | Haylage | Hay | Haylage | Hay | Haylage | | |
| Active | 12.5 | 25.3 | 36.6 | 32.1 | 20.4 | 27.4 | 4.3 | 0.21 |
| Inactive | 26.8 | 28.1 | 24.0 | 23.0 | 29.4 | 30.1 | 7.8 | 0.97 |
| Eating | 59.7 | 45.5 | 37.2 | 44.1 | 49.0 | 40.9 | 7.1 | 0.37 |
| Drinking | 0.8 | 0.9 | 1.3 | 0.4 | 1.0 | 0.8 | 0.4 | 0.41 |
| Licking mineral | 0.0 | 0.0 | 0.3 | 0.3 | 0.1 | 0.8 | 0.4 | 0.78 |