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Abstract

Many factors affect forage quality, including moisture level at baling, compaction, bulk density, and maturity at harvest. Losses of dry matter and nutrient value occur during field curing. Hay baled at or above 18% moisture should have less nutrient loss in the field. However, hay baled at these moisture levels has the potential to heat during storage, causing dry matter loss and nutrient degradation. Also, as particle length of forage decreases, packing ability of forage and bulk density of bales increase. Although particle length is reduced by grinding baled forage, this can result in nutrient losses. Also, when cattle are fed free choice in a ring feeder, precutting forage may help reduce waste because the smaller particles fall within the ring and are not pulled out by the animals and lost on the ground. Objectives of these experiments were to compare the effects of precutting alfalfa during round baling and conventional baling on heifer performance, forage wastage, and eating preference.

Keywords

Cattlemen's Day, 2010; Kansas Agricultural Experiment Station contribution; no. 10-170-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 1029; Beef Cattle Research, 2010 is known as Cattlemen's Day, 2010; Beef; Alfalfa; Heifer; Growth; Performance

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Round Bale Alfalfa Processing Method Affects Heifer Growth but Does Not Influence Wastage or Eating Preference[1]

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Introduction

Many factors affect forage quality, including moisture level at baling, compaction, bulk density, and maturity at harvest. Losses of dry matter and nutrient value occur during field curing. Hay baled at or above 18% moisture should have less nutrient loss in the field. However, hay baled at these moisture levels has the potential to heat during storage, causing dry matter loss and nutrient degradation. Also, as particle length of forage decreases, packing ability of forage and bulk density of bales increase. Although particle length is reduced by grinding baled forage, this can result in nutrient losses. Also, when cattle are fed free choice in a ring feeder, precutting forage may help reduce waste because the smaller particles fall within the ring and are not pulled out by the animals and lost on the ground. Objectives of these experiments were to compare the effects of precutting alfalfa during round baling and conventional baling on heifer performance, forage wastage, and eating preference.

Experimental Procedures

One field of alfalfa in northeast Kansas was swathed and raked in mid-July. In the conventional baling method, alfalfa was fed through the header of a round baler and carried by packer fingers into a baling chamber without further processing. In the precut method, alfalfa was fed through the header of a round baler equipped with serrated knives that cut the alfalfa stems into 3- to 8-in. sections as the packer fingers moved the stems from the header to the baling chamber. Because there were no knives on the outer 6 in. of each side, the perimeter of the bale was composed of alfalfa of full stem length, which maintained bale structure during hauling and handling. Experiments were conducted at the Kansas State University Purebred Beef Unit.

Experiment 1

A total of 46 heifers (595 lb initial body weight) were used to evaluate the effect of free choice feeding of precut and conventionally baled alfalfa hay on heifer performance in a 27-day study. Treatments were 5 × 4 ft conventional alfalfa bales and 5 × 4 ft precut alfalfa bales. There were four pens of beef heifers (two pens of 10 heifers, two pens of 13 heifers) with two pens per treatment. The treatments were offered free choice in 8-ft ring feeders. All heifers were fed 2.8 lb/day of wet corn gluten feed. Each individual bale of alfalfa was weighed before being placed into the ring feeders. Heifers were weighed on 2 consecutive days at the beginning and end of the 27-day trial to calculate gains. To calculate alfalfa dry matter intake, dry matter wastage by treatment (determined in experiment 2) plus remaining orts were subtracted from initial dry matter bale weights.

[1] Appreciation is expressed to John Deere (Ottumwa, IA) for funding of experiments and use of equipment.
[2] John Deere, Ottumwa, IA.

Core samples were taken from each bale and combined to make composite samples for each treatment, which were then chemically analyzed.

Experiment 2

Experiment 2 was conducted concurrently with experiment 1 to evaluate the effect of baling method on forage wastage from ring feeders. Three 5-day collection periods were used for a total of six replications per bale type. Prior to the start of each 5-day period, ring feeders and surrounding soil were scraped free of residual forage. Initial bale weights were recorded, and alfalfa wastage around the ring was collected every day at 7:00 a.m. for 5 days. Wastage was collected with a lawn rake from the feeder to a distance of 8 ft around the feeder. Collection of manure was minimized but could not be avoided in all circumstances. Wasted forage was collected and weighed every day. The entire amount of wastage collected by pen for the 5-day period was combined and subsampled for analysis. After the fifth day, feed remaining inside the ring feeders was collected and weighed. Individual bale core samples and alfalfa wastage combined by collection period were analyzed for dry matter, crude protein, and neutral detergent fiber.

Experiment 3

A total of 26 beef heifers (672 lb initial body weight) were used to evaluate the effect of free choice feeding of conventionally baled or precut alfalfa hay on heifer preference. Heifers were allotted by weight and breed to two pens. There were two ring feeders per pen (8-ft feeders); one contained the conventional treatment, and one contained the precut treatment. Unconsumed feed was collected and weighed every 2 days to calculate dry matter intake. Prior to the next 2-day period, feeders were moved within each pen so no carryover effect of feeder location would occur. Treatments were 4 × 4 ft conventional alfalfa bales and 4 × 4 ft precut alfalfa bales. During this study, all heifers were fed 13.3 lb of wet corn gluten feed daily. All bales were weighed individually prior to being placed in 8-ft ring feeders. Individual bale core samples were analyzed for dry matter, crude protein, neutral detergent fiber, and mold spore counts. At the end of the 2-day period, dry matter intake was calculated by subtracting orts from initial bale weight.

Data from all three experiments were analyzed with the MIXED procedures of SAS (SAS Institute, Inc., Cary, NC). Effects were declared significant at $P<0.05$ and regarded as tendencies at $P<0.10$.

Results and Discussion

In experiments 1 and 2, dry matter, crude protein, and neutral detergent fiber of bales differed between treatments (Table 1). The conventional treatment had greater dry matter (79.5% vs. 79.1%; $P<0.01$) and neutral detergent fiber (58.3% vs. 46.3%; $P<0.03$) than the precut treatment, but crude protein was greater (20.6% vs. 17.7%; $P<0.04$) in the precut treatment than in the conventional treatment. Initial body weights of heifers were similar (599 vs. 594 lb; $P=0.67$) for the conventional and precut alfalfa treatments (Table 2), as expected. Heifers consuming precut alfalfa had greater average daily gain than heifers consuming conventional alfalfa (3.02 vs. 2.49 lb/day; $P<0.01$). Calculated dry matter intake was not different between the precut and conventional treatments (12.3 vs. 11.5 lb/day; $P=0.70$). The reason for the greater gains of heifers in the precut alfalfa treatment is unknown, but the numerically greater intake

and better chemical composition (i.e., more protein and less fiber) of the precut treatment may have been contributing factors.

In experiment 2, there was no difference in alfalfa wastage (P>0.13) between treatments for day 1, 3, 4, and 5 (Table 3). Wastage for day 2 tended to be greater (P=0.10) for the precut treatment, but there was no overall difference (P>0.05). Previous research has demonstrated that up to 8.0% of dry matter can be wasted. Our data showed considerably less wastage (0.9% for conventional and 1.1% for precut), possibly because we evaluated different forage types. Dry matter and crude protein of orts were similar between treatments (P>0.90), but neutral detergent fiber was greater (P<0.02) in orts from conventional alfalfa bales (Table 4). In experiment 3, the precut treatment had greater dry matter (P<0.04) than the conventional treatment (Table 5) but less crude protein and neutral detergent fiber (P<0.04). These differences were surprising because bales were harvested from the same field only hours apart. Precut alfalfa bales in experiment 3 had greater mold counts, though it is unknown if these levels affected performance or eating preference.

In experiment 3, there was no difference in dry matter intake between the precut and conventional treatments (10.4 vs. 8.6 lb/day; P=0.48). Thus, type of alfalfa processing did not affect heifer consumption preference.

Implications

Feeding precut alfalfa bales increased heifer gains but did not affect forage wastage in ring feeders or eating preference compared with conventional alfalfa bales.

Table 1. Chemical analysis of alfalfa bales (experiments 1 and 2)

Item	Conventional	Precut
Dry matter, %	79.5	79.1
Crude protein, %	17.7	20.6
Neutral detergent fiber, %	58.3	46.3

Table 2. Effects of alfalfa bale type on heifer growth performance over 27 days (experiment 1)

	Alfalfa hay processing			
Item	Conventional	Precut	Probability, P<	SEM
Initial body weight, lb	599	594	0.67	30.2
Daily gain, lb	2.49	3.02	0.01	0.44
Forage dry matter intake[1], lb/day	11.5	12.3	0.70	4.0

[1] Estimated by subtracting orts and calculated wastage (determined in experiment 2) from initial bale weight.

Table 3. Effects of bale processing technique on hay wastage (experiment 2)

Item	Conventional	Precut	Probability, P<	SEM
Initial bale dry matter, lb	1106	1187	0.01	19.1
Hay dry matter wastage, lb				
Day 1	4.34	5.86	0.14	2.1
Day 2	2.56	5.22	0.10	3.6
Day 3	1.57	1.54	0.97	2.2
Day 4	0.99	0.52	0.16	0.7
Day 5	0.57	0.31	0.29	1.2
Total	10.03	13.47	0.30	6.3

Table 4. Chemical analysis of alfalfa orts remaining in the ring feeder (experiment 2)[1]

Item	Conventional	Precut	Probability, P<	SEM
Dry matter, %	78.1	78.6	0.90	3.9
Crude protein, %	20.0	20.1	0.96	1.0
Neutral detergent fiber, %	54.9	49.4	0.02	2.1

[1]Mean of six samples, each representing remaining alfalfa.

Table 5. Nutrient composition and intake of alfalfa hay by beef heifers (experiment 3)[1]

Item	Conventional	Precut	Probability, P<	SEM
Dry matter intake[2], lb/day	8.6	10.4	0.48	2.46
Nutrient analysis				
Dry matter, %	82.2	84.1	0.002	0.31
Crude protein, %	20.6	19.5	0.04	0.32
Neutral detergent fiber, %	54.5	50.8	0.01	1.21
Mold, spores/mg	10	64	0.04	16

[1] Five replicates per treatment.
[2] Calculated by subtracting weight of remaining orts from initial bale weight.