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Cornstalk Round Bale Processing Method Does Not Influence Feeding Characteristics or Feed Refusals[1]

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Introduction

Nutritionists and producers often assume that ingredients in a total mixed ration are uniformly mixed. However, many factors can affect ration homogeneity, including particle size, particle shape, differences in density of feed ingredients, and relative point at which the mixture is discharged from a mixer batch. Forages often are ground prior to mixing in a total mixed ration to reduce variation in forage particle length. Preprocessing forages during baling may facilitate particle length reduction, eliminating the need to grind forages prior to mixing. The objectives of this study were to determine the effects of forage processing on (1) uniformity of the ration discharged from the mixer at different points, (2) particle length throughout the mixing process by bale type, and (3) difference in feed refusals of mixed rations based on forages processed by different methods.

Experimental Procedures

A total of 60 heifers (730 lb initial body weight) were used to evaluate the effects of cornstalk processing methods on forage particle size length and heifer growth performance. In mid-October 2009, a portion of a cornstalk field in northeast Kansas was cut with a flail shredder (John Deere 27) and raked (Darf 17 wheel v-hay rake) on a single day. Cornstalks were either conventionally baled or precut and baled. Precut stalks were baled using a round baler equipped with serrated knives that cut the forage into 3- to 8-in. sections as the packer fingers moved the forage from the header to the baling chamber. No knives were present on the outer 6 in.; thus, the full-stem-length forage on the ends and perimeter maintained the structural integrity of the bale. The treatments were: (1) 5 × 4 ft conventionally baled cornstalks, (2) 5 × 4 ft precut cornstalks, and (3) 5 × 4 ft conventionally baled cornstalks that were later tub ground. Before the start of the experiment, conventional bales were unrolled on a concrete slab. Precut bales were broken apart by being raised approximately 16 ft with a tractor grapple fork and dropped onto concrete. Tub-ground bales were ground with a Haybuster H-1000 (DuraTech Industries International, Inc., Jamestown, ND) using a 2-in. screen. Rations (Table 1) were prepared with a horizontal mixer (Forage Express, Roto-Mix, Dodge City, KS) and fed at an average of 2.45% of body weight (dry basis) over the 15-day period.

Plastic containers (12 in. × 9 in. × 6 in.) were placed at the first, middle, and last third of the bunk line for collection of discharge location samples. Unconsumed feed remain-

[1] Appreciation is expressed to John Deere (Ottumwa, IA) for funding and use of tractors and baler and to Mark Cooksey of Roto-Mix (Scott City, KS) for technical support and donation of the mixer used in this study.

[2] John Deere, Ottumwa, IA.

ing in the bunk was collected and weighed before the next feeding period for determination feed refusals. Bale cores, discharge samples, and feed refusals were analyzed to compare concentrations of dry matter, crude protein, acid detergent fiber, and neutral detergent fiber. To calculate average dry matter intake, feed refusals were subtracted from initial dry matter of the total mixed ration that was fed and divided by total number of animals. Animals were weighed on 2 consecutive days at the beginning and end of the study for determination of weight change during the 15-day experimental period. Diet particle length was determined by measuring the percentage of forage remaining on the top two screens (>12.7 mm), the overall particle length, and standard deviation of particle size.

Results and Discussion

Average dry matter intake for the 15-day feeding period was 17.9 lb per animal each day. Final average body weight for the heifers was 785 lb, and average daily gain for the entire 15-day feeding period was 3.52 lb/day. Chemical analysis revealed no ($P>0.32$) mixer discharge site × bale type interactions. Different discharge locations for batches of feed representing the different cornstalk treatments had similar ($P>0.11$) dry matter, crude protein, acid detergent fiber, and neutral detergent fiber. Total mixed ration samples taken from the beginning of the mixer discharge had lower ($P=0.02$) dry matter and higher ($P=0.04$) crude protein levels than samples taken at the end of the mixer discharge (Tables 2 and 3). Samples taken during the middle of the mixer discharge had lower ($P=0.01$) acid detergent fiber and neutral detergent fiber percentages, higher ($P=0.01$) protein levels, and a tendency for greater ($P=0.09$) dry matter content compared with samples taken at the end of the mixer discharge. Feed refusals were similar ($P>0.25$) among all three treatments (Table 4). Chemical analysis of the refusals revealed similar ($P>0.12$) levels of dry matter, crude protein, acid detergent fiber, and neutral detergent fiber for mixed rations made from forages processed by different methods.

There were no differences in the amount of feed refusals between the different cornstalk processing methods. The lack of a difference in chemical analysis of the feed refusals indicates there was limited sorting of ingredients due to initial cornstalk bale processing method.

Implications

Precutting forages during baling resulted in responses similar to those for conventionally baled and processed forages at the levels fed in this experiment.

Table 1. Diet composition

Ingredient, % dry matter basis	
Cornstalks	45.00
Wet corn gluten feed	44.95
Steam flaked corn	6.14
Premix[1]	3.91
Calculated composition	
Dry matter, %	70.85
NE_m, Mcal/lb	0.70
NE_g, Mcal/lb	0.43
Crude protein, %	14.00
Calcium, %	0.76
Phosphorus, %	0.55

[1]Total mixed diet contained 1,500 IU/lb of vitamin A; 10 IU/lb vitamin E; 0.3% salt; 0.1 ppm cobalt; 10 ppm copper; 0.6 ppm iodine; 60 ppm manganese; 0.3 ppm selenium; 60 ppm zinc; 30 g/ton Rumensin; and 9 g/ton Tylan.

Table 2. Effects of cornstalk bale type and mixer discharge location on ration composition[1]

	Bale type									
	Conventional			Precut			Tub ground			
Item %	First third	Middle third	Last third	First third	Middle third	Last third	First third	Middle third	Last third	SEM
Dry matter	67.6	69.5	73.7	70.0	68.8	71.8	68.6	70.6	69.9	1.16
Crude protein	12.6	13.1	11.8	12.2	12.5	11.1	12.6	12.7	12.2	0.45
Acid detergent fiber	28.2	27.0	28.3	28.6	26.1	31.8	28.2	27.6	29.9	1.45
Neutral detergent fiber	51.6	50.0	53.7	54.6	49.8	56.7	53.3	53.3	54.7	1.78

[1]15 days of feeding different cornstalk bale types on discharge location in a total mixed ration chemical analysis.

Table 3. Probabilities of effects of cornstalk bale type and discharge site on ration composition[1]

	Probabilities, P<						
Item, %	First third vs. Middle third	First third vs. Last third	Middle third vs. Last third	Conventional vs. Precut	Conventional vs. Tub ground	Precut vs. Tub ground	Site × Type
Dry matter	0.49	0.02	0.09	0.98	0.65	0.67	0.32
Crude protein	0.41	0.04	0.01	0.12	0.92	0.14	0.86
Acid detergent fiber	0.23	0.17	0.01	0.41	0.55	0.83	0.60
Neutral detergent fiber	0.15	0.21	0.01	0.19	0.18	0.97	0.56

[1]Probabilities of 15 days of feeding different cornstalk bale types on discharge location in a total mixed ration chemical analysis.

Table 4. Refusal amount and composition according to cornstalk bale type and discharge site[1]

					Probability, P<		
	Bale type				Conventional	Conventional	Precut vs.
Item	Conventional	Precut	Tub ground	SEM	vs. Precut	vs. Tub ground	Tub ground
Dry matter refusals, lb/day	51.9	55.0	40.0	31.77	0.81	0.33	0.25
Crude protein, %	5.1	5.1	4.9	0.32	0.97	0.55	0.58
Acid detergent fiber, %	50.6	51.2	49.4	1.05	0.71	0.42	0.24
Neutral detergent fiber, %	76.7	77.7	79.2	1.07	0.53	0.13	0.35

[1]Refusal dry matter and chemical analysis of 15 days of feeding cornstalk bales in a total mixed ration.