CORN PROCESSING FOR RANGE SUPPLEMENTS

G.E. Catlett[1] , C.A. Hibberd[2], R.R. Scott[1], W.W. Chan[1],
K.S. Swenson[3] and C. Worthington[4]

Story in Brief

The influence of supplemental grain processing on forage utilization and intake and beef cow/calf performance was evaluated in two trials. Trial 1 utilized a cottonseed meal control (41% CP, 3.4 lb/d), while both trials utilized four methods of grain processing. Treatments included: 1) whole corn intermixed with pelleted cottonseed meal, (22.6% CP, 6.1 lb/d); 2) coarsely cracked corn intermixed with pelleted and crumbled cottonseed meal (22.4% CP, 6.1 lb/d); 3) ground corn intermixed with unprocessed cottonseed meal (22.4% CP, 6.1 lb/d); 4) ground corn intermixed with cottonseed meal to make a complete pellet (22.3% CP, 6.1 lb/d). In Trial 1, five mature beef cows were utilized in a 5 x 5 Latin square to evaluate the effects of grain processing on digestion and intake of chopped low quality native grass hay (4.1% CP, 75.1% NDF). Hay OM intake tended to be higher for the control supplement. Total tract NDF digestibility was not affected by treatment. Total tract starch digestibility was reduced for the whole and cracked corn supplements compared to the ground or pelleted supplements. Although differences were not large, digestible OM intake tended to be greater for pelleted corn than for ground corn, while whole and cracked were intermediate. In trial 2, 76 lactating crossbred beef cows, blocked by calf age and calf sex were assigned to the four corn supplements for a 105-day trial. Cow weight change was not affected by corn processing. Calf weight gain tended to be less for the cracked corn compared to the others. In conclusion, although starch digestion was altered by supplemental corn processing method, digestible OM intake and cow performance were not dramatically affected implying that supplemental corn may not require processing prior to feeding.

(Key Words: Corn, Grain Processing, Beef Cattle, Supplements.)

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[1] Graduate Assistant [2]Associate Professor [3]Agricultural Technician [4]Herd Manager

Introduction

Fall-calving beef cows grazing dormant native grass pastures through the winter experience a forage base that is declining in nutritional quality. Therefore, protein and energy supplementation may be required to minimize cow weight loss and sustain sufficient milk production for calf growth. Energy supplements are frequently composed of a protein source combined with a cereal grain such as wheat, milo or corn. Cereal grains contain large quantities of starch which have been shown to decrease forage intake and digestion (Chase and Hibberd, 1987). Grain processing increases rate of starch fermentation but decreases ruminal pH and activity of cellulolytic bacteria. Whole corn supplementation may minimize these deleterious effects and also provide an economic advantage for producers. Although grain processing responses with high concentrate diets have been well documented, the effects of grain processing on forage utilization and cow/calf performance are unknown. The objectives of this research were: 1) to evaluate the effects of grain processing on forage digestion and intake, and 2) to examine the effect of supplemental corn processing on performance of lactating beef cows grazing dormant native grass.

Materials and Methods

Trial 1

Five mature non-pregnant Limousin x Hereford/Angus cows (average weight 1375 lb) were randomly assigned to five treatments in a 5 x 5 Latin square. Animals were housed indoors in concrete slatted pens (15 ft x 8 ft) with free access to fresh water. Supplements (Table 1) included: 1) a cottonseed meal control (41% CP, 3.4 lb/d, Trial 1 only); 2) whole corn intermixed with pelleted cottonseed meal (22.6% CP, 6.1 lb/d); 3) coarsely cracked corn intermixed with pelleted and crumbled cottonseed meal (22.4% CP, 6.1 lb/d); 4) ground corn intermixed with unpelleted cottonseed meal (22.4% CP, 6.1 lb/d); 5) ground corn intermixed with cottonseed meal to make a complete pellet (22.3% CP, 6.1 lb/d). Low quality native grass hay (4.1 % CP, 75.1 % NDF; Table 2), chopped through a 2 inch screen was available free choice.

Experimental periods consisted of 14 days of diet adaptation followed by 7 days of sampling. Hay intake and refusals were recorded and sampled on days 16 through 18. Fecal samples were collected six times during days 17 through 19 to represent every 4 h of a twenty four hour day. Hay , hay refusal and fecal samples were analyzed for dry matter, starch, crude protein and neutral detergent fiber. Acid insoluble ash was determined to calculate nutrient flow and digestibility.

Table 1. Supplement composition (DM basis) and nutrient supply.

	Supplements	
	Control	Processed corn
Feeds, %		
Cottonseed meal	93.44	41.60
Corn		54.94
Dicalcium phosphate	.23	
Cane molasses	3.47	2.00
Vitamin A-30	.08	.04
Sodium sulfate	1.08	.43
Trace mineralized salt[a]	1.70	.98
Intake, lb/day[b]		
Total DM	3.40	6.10
CP	1.39	1.36
Starch	.03	2.43
TDN, %[c]	73.3	83.0

[a]Trace mineralized salt contained 92% NaCl, .25% Mn, .2% Fe, .033% Cu, .03% S, .007% I, .005% Zn and .0025% Co.

[b]Seven-day basis.

[c]Estimated from NRC (1984).

Table 2. Chemical composition (DM basis) of native grass hay and supplements.

			Corn processing method			
	Hay[a]	Control	Whole	Cracked	Ground	Pelleted
CP	4.1	40.8	22.6	22.4	22.4	22.3
NDF	75.1	25.1	23.1	23.5	20.1	20.7
Starch	1.3	.9	41.2	40.2	39.3	39.0

[a]Native grass composed of big bluestem, little bluestem, indiangrass and switchgrass.

Intake and digestibility data were subjected to least squares analysis of variance with period, animal and treatment included in the model. A single contrast was conducted to evaluate the cottonseed meal control versus the average of the corn supplements. Within corn supplements, differences between least square means were detected by LSD.

Trial 2

Seventy-six lactating crossbred cows (average weight 1124 lb) were blocked by calf age and calf sex and allocated to one of the four corn processing treatments for a 105-d study. The trial was conducted at the Bluestem Research Range approximately 8 miles west of Stillwater, OK. Cows were wintered on dormant standing native grass (4% CP) with the predominant species being big bluestem, little bluestem, indiangrass and switchgrass. Supplements were identical to trial 1 with the exception that the cottonseed meal control was not used. Cows were individually fed their respective supplements at 8:00 am each morning. Supplement intake was adjusted so that the weekly allotment of supplement was fed in 5 days.

Initial and final cow weights and body condition scores were taken after a 24-h withdrawal from feed and water. Calf weights were taken after a 6-h removal from the cow. Three esophageally fistulated steers were used to obtain diet samples every 21 days. Dried masticate samples were analyzed for dry matter, crude protein, NDF and ash.

Cow and calf performance data were subjected to least squares analysis of variance with cow age, calf sex, treatment and sex x treatment included in the model. Calf age was included as a covariate. Differences between least squares treatment means were detected by LSD.

Results and Discussion

Trial 1

Total OM intake was not affected ($P=.12$) by treatment (Table 3). Hay OM intake, however, tended ($P<.10$) to be higher for the cottonseed meal control (20.7 lb/d) than the corn-based supplements (average 18.9 lb/d). Depressed hay intake with grain supplementation has been documented (Chase and Hibberd, 1987). Hay OM intake was not significantly altered by the method of corn processing.

Compared to the cottonseed meal control, total tract OM digestibility was not altered with supplemental corn (Table 3). Within corn processing methods, total tract OM digestibility was lower ($P<.05$) for cracked compared to pelleted corn (57.4% vs 61.1%) while whole and ground corn treatments were intermediate. Intake and digestion of OM should be improved with the addition of highly digestible supplements, however, negative associative

Table 3. Effect of supplemental corn processing on intake and digestibility of organic matter, NDF and starch in beef cows fed low quality native grass hay.

		Corn processing method				
Item	Control	Whole	Cracked	Ground	Pelleted	SE
Intake, lb/d						
Hay OM[a]	20.7	18.2	20.0	18.2	19.2	.90
Total OM	23.8	24.0	25.8	23.9	25.0	.90
Digestible OM[a]	13.5	14.5^{xy}	14.8^{xy}	13.9^{y}	15.2^{x}	.49
NDF	17.5	16.0	17.6	15.9	16.6	.74
Starch[a]	.33	2.76^{b}	2.73^{b}	2.64^{c}	2.64^{c}	.01
Total tract digestibility, % of intake						
OM	57.2	60.5^{xy}	57.4^{y}	58.0^{xy}	61.1^{x}	1.29
NDF	58.4	58.8	55.6	55.3	57.8	1.63
Starch	92.1	80.4^{c}	86.2^{c}	94.4^{b}	96.8^{b}	2.53

[a]Control vs average of corn supplements (P<.10).

[b,c,d,e]Means in a row with different superscripts differ (P<.05).

[x,y]Means in a row with different superscripts differ (P<.10).

Table 4. Effect of supplemental corn processing on cow and calf performance when grazing dormant native range.

	Corn processing method				
	Whole	Cracked	Ground	Pelleted	SE
Cow body weight, lb					
Day 0	1,064.2	1,085.7	1,072.0	1,068.7	24.5
Day 105	901.2	924.3	933.2	914.8	20.5
Change	-163.0	-161.4	-139.0	-153.9	9.5
Cow body condition, units					
Day 0	5.51	5.61	5.55	5.49	.09
Day 105	4.70[b]	5.00[a]	4.82[ab]	4.83[ab]	.12
Change	-0.81[b]	-0.61[a]	-0.73[ab]	-0.66[a]	.07
Calf weight, lb					
Day 0	193.4[d]	176.5[c]	185.5[cd]	189.9[d]	4.4
Day 105	336.6[d]	311.0[c]	329.3[d]	339.2[d]	6.9
Change	143.2[a]	134.5[b]	143.8[a]	149.3[a]	4.0

[a,b]Means within a row with different superscripts differ (P<.10).

[c,d]Means within a row with different superscripts differ (P<.05).

effects on hay digestion may have minimized the benefits of the grain-based supplements.

Compared to the cottonseed meal control, digestible OM intake was increased ($P<.10$) with corn supplementation (Table 3). This response is in contrast with previous studies (Chase and Hibberd, 1987). The level of corn intake in the current study was not excessive (3.4 lb/d), however, and protein intake was higher than in Chase and Hibberd (1987). Within corn processing methods, digestible OM intake was higher ($P<.10$) for pelleted corn than for ground corn while whole and cracked corn were intermediate. Although these differences tended to be statistically significant, the range in digestible OM intake for all corn processing methods was only 1.3 lb/d.

Total tract NDF digestibility was not altered by corn processing method (Table 3). This suggests that corn processing method had little effect on fiber fermentation in the rumen and large intestine. Total tract starch digestibility was reduced ($P<.05$) for the whole (80.4%) and cracked (86.2%) corn supplements compared to the pelleted (94.4%) and ground (96.8%) corn supplements.

Trial 2

The CP content (OM basis) of esophageal masticates decreased from 5% on December 20 to 4% by January 31. In contrast, the NDF content of esophageal masticates appeared to increase from 78 to 82%. Cow weight change during the 105-d trial was not affected ($P=.24$) by treatment (Table 4). Cows fed the cracked corn supplement tended to lose less body condition (-.61units) than cows fed the whole corn supplement (-.81 units). Calf weight gain tended to be lower ($P<.10$) for the cracked corn compared to the other supplements.

Although supplemental corn processing altered total tract starch digestion, digestible OM intake and cow performance were similar. Consequently, the use of whole corn in range supplements may be justified if significant feed processing savings can be realized.

Literature Cited

Chase, C.C. and C.A. Hibberd. 1987. Utilization of low-quality native grass hay by beef cows fed increasing quantities of corn grain. J. Anim. Sci. 65:557.