Effects of Immature High-moisture Corn vs. Dry-rolled Corn in Feedlot Diets

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Introduction

Corn production in North Dakota is subject to cool temperatures, variation in rainfall, and other environmental effects like early frost. During the summer of 2004, unusually cool temperatures resulted in significant acreages of immature corn that was disked or rolled down, and in some cases burned. The most common use of immature corn is for silage but there were not enough choppers or cows in the affected corn-growing areas to consume all the possible silage. Combining immature wet corn is possible and there are a few feeders who can use significant amounts of this grain.

Mature high-moisture corn can be harvested earlier than dry corn, resulting in reduced dry matter losses and elimination of artificial drying costs. However, marketing flexibility is lost and corn will generally not keep for extended periods of time. Immature corn is useful only for feed and can be harvested with a combine at up to 50% moisture. Processing (rolling or grinding) and packing (elimination of oxygen) are required for optimum storage with minimal spoilage. Immature corn can be harvested as corn and cob meal with some modifications to the combine. Wet corn can be piled on the ground and packed with a tractor. Most feeders store wet corn in a bunker silo.

Little animal performance information is available on immature or low test weight, high-moisture corn. Mature high-moisture corn is generally perceived to have more energy than dry-rolled corn as it is digested more thoroughly in the ruminant animal. As the corn kernel dries down, the starch becomes more compact. This compaction and other physiological developments make the kernel less digestible (Pritchard, 2005). Dry rolling or grinding increases digestibility of dry corn, but optimum digestibility is not achieved. High-moisture corn ferments more rapidly in the rumen compared to dry-rolled corn, and most of the starch is removed in the rumen. Immature corn, however, with a higher proportion of fiber from the bran and germ, should not produce the same acidosis potential as mature corn.

This study was conducted to compare dry-rolled mature corn with immature high-moisture corn from the harvest of 2004 in finishing feedlot diets.

Ground and packed wet corn stored over winter.

Experimental Procedures

Ninety-eight crossbred steers (765.4 ± 22.4 lbs.) were allotted by source and weight to a dry-rolled or high-moisture corn-based diet (6 pens per treatment, 8 to 9 head per pen) to determine the effect of corn type on performance and carcass quality. Cattle were blocked into light and heavy groups. Steers were housed and fed at the Carrington Research Extension Center feedlot in open drylot pens. Each pen was equipped with automatic waterers, windbreaks, and fenceline bunks which allowed for two feet of bunk space per head. Feed was delivered as a totally-mixed ration once daily to appetite.

Diets were formulated to contain 12.3% CP and 64.7 MCal NEg/cwt (Table 1).

Table 1. Diet composition

	Dry-rolled corn	High-moisture corn
Corn	74.13	74.25
WDG	13.86	13.81
Straw	9.77	9.64
Supplement		
Barley	0.83	0.86
Dicalcium phosphate	0.04	0.04
Limestone	1.04	1.07
Potassium chloride	0.14	0.14
Rumensin 80	0.011	0.011
Salt	0.08	0.08
Urea	0.07	0.07
Vitamin A	0.01	0.01
Vitamin D	0.01	0.01
Vitamin E	0.01	0.01
Diet Specifications		
Crude protein, %	12.27	12.27
NEm, Mcal/cwt	98.6	98.6
NEg, Mcal/cwt	64.7	64.7
Ca, %	0.455	0.465
P, %	0.432	0.432

Feed samples were taken every week and composited for analysis of DM and CP. The high-moisture immature corn was sourced from a neighboring commercial feedyard with an estimated 150,000 bushels in its pile. At delivery, corn was tub-ground, piled and packed with a farm tractor and a box scraper. Bushel test weight varied with the many different loads of immature corn delivered to the feeder. The range was estimated at 37 to 48 pounds per bushel with an average of 42 to 44 pounds. Moisture content of the corn was taken as it was removed from the feedyard pile (two loads per week). The wet corn averaged 72% dry matter over the trial. Dry, mature corn averaged 54 pounds per bushel and was 14% moisture.

Cattle were vaccinated for protection against IBR, BVD, BRSV, PI3 (Bovishield-4; Pfizer, Exton, PA), and clostridia (7-way + somnus; Pfizer, Exton, PA). Health status of the cattle was monitored daily. Rectal temperatures were measured in animals that were visibly anorexic, or had severe nasal mucous drainage and rapid or labored breathing. Sick animals were treated with one of two antibiotics according to label instructions (Micotil, Elanco, Indianapolis, IN; A180, Pfizer, Exton, PA). Micotil was used on first and second pulls, followed by A180 if cattle were unresponsive. Antibiotic treatment continued until animals appeared healthy. Research protocols regarding animal care followed guidelines recommended in the Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching (FASS, 1998).

All steers were implanted with Component TE-S (120 mg trenbolone acetate, 24 mg estradiol; provided courtesy of VetLife, Overland Park, KS) at the initiation of the trial.

Ten out of 12 of the pens were slaughtered at Tyson Foods (Dakota City, NE) after 118 days on trial. The performance trial ended after 118 days on feed. Hot carcass weight, fat thickness, percentage kidney, pelvic and heart fat, longissimus muscle area, and USDA quality and yield grades were determined by qualified personnel 48 hours after slaughter. Two light pens (one high-moisture corn and one dry-rolled corn treatment) were not included in the carcass analysis.

Steers fed immature high-moisture corn.

Data were subjected to a one-way analysis of variance as a completely randomized design using the GLM procedures of SAS (Version 8.0; SAS Inst. Inc., Cary, NC). Pen was the experimental unit.

Results

Cattle fed mature dry-rolled or immature high-moisture corn gained similarly (3.79 vs. 3.91 lbs. /d, respectively; $P > 0.44$), and consumed a similar amount of dry matter (22.4 vs. 21.8 lbs. /d, respectively; $P > 0.24$) over the entire trial. Some period to period variation was observed but overall, cattle fed the immature wet corn exceeded the performance expectations. Owens et al. (1997) reported that cattle fed mature high-moisture grains tended to gain faster, consume less dry matter, and convert feed more efficiently. The immature wet corn in this study may not have contained the starch level to show an advantage over dry corn (Table 2.)

Table 2. Effect of corn type on performance and carcass characteristics of steers.

	Dry-rolled corn	High-moisture corn	St Error	P Value
Weight, lbs.				
December 1, 2004	765.7	765.0	22.4	0.98
December 29, 2004	871.7	887.4	18.3	0.56
January 26, 2005	960.2	966.1	18.5	0.83
February 23, 2005	1079.1	1083.8	19.9	0.87
March 28, 2005-Market	1203.0	1221.1	20.1	0.54
Average daily gain, lbs./d				
Period 1	3.79	4.37	0.34	0.26
Period 2	3.16	2.81	0.17	0.20
Period 3	4.47	4.28	0.07	0.10
Period 4	3.76	4.16	0.20	0.18
Overall	3.79	3.91	0.11	0.44
Dry matter intake, lbs.				
Period 1	21.0	20.3	0.60	0.47
Period 2	21.3	21.5	0.50	0.82
Period 3	22.6	21.4	0.30	0.02
Period 4	24.1	23.5	0.40	0.29
Overall	22.4	21.8	0.30	0.24
Feed efficiency				
Period 1	5.55	4.65	0.55	0.08
Period 2	6.72	7.67	0.46	0.07
Period 3	5.06	4.99	0.18	0.70
Period 4	6.43	5.67	0.34	0.04

No differences were observed for hot carcass weight, dressing percent, ribeye area, fat thickness, yield grade, marbling score, or percentage of carcasses grading choice ($P > 0.24$). Percent kidney, pelvic, and heart fat was greater for cattle fed dry-rolled corn (2.43 vs. 2.23%, $P < 0.04$) (Table 3).

Table 3. Effect of corn type on carcass traits of steers.

	Dry-rolled corn	High-moisture corn	St Error	P Value
Hot carcass weight, lbs.	718.4	725.4	5.8	0.42
Dressing percent	60.5	60.5	0.4	0.97
Marbling score	385.9	404.2	10.1	0.25
Yield grade	2.8	2.6	0.1	0.24
Fat thickness, in.	0.48	0.44	0.03	0.29
Ribeye area, sq. in.	12.8	13.1	0.2	0.39
Kidney, pelvic, heart fat, %	385.9	404.2	10.1	0.25
Choice, %	38.2	42.0	4.7	0.59

Discussion

Considering the similarity in animal performance in this study, feeders may have an economic advantage if they can purchase immature corn grain at a discount from corn farmers with no cattle. At a minimum, feeders can save corn growers the drying costs and negotiate an advantage in price. Corn growers, on the other hand, may want to consider feeding cattle to capture more value from their grain production. Insurance regulations may foster this tactic. Feeders who grow their own corn or partner with corn growers, may consider longer season varieties with increased yield potential and plan on harvesting immature grain for feed. The net result could be more pounds of beef per acre and increased profits to the feeding enterprise. The positive outcome of this study is another reason to consider the opportunities for cattle and feedlots in North Dakota.

References

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