Corn Moisture and Processing

D. R. Gill, F. N. Owens, J. J. Martin
R. A. Zinn, D. E. Williams
and R. J. Hillier

Story in Brief

Corn harvested at 24 and 31 percent moisture was stored at these moisture levels and compared with corn harvested at 24 percent moisture and reconstituted with water to 31 percent moisture. Each moisture level of corn was ensiled in the ground form or as a blend consisting of 60 percent whole kernel corn plus 40 percent ground corn. These six types of corn were fed to 150 steers (673 lb) for 112 days. Higher moisture content, whether present at harvest or from water added prior to ensiling, improved feed efficiency (8.5 percent) over corn at 24 percent moisture. Except for a slight sacrifice in rate of gain, adding water to high-moisture corn improved its feeding value. Corn processing prior to ensiling had little effect on performance. Feed efficiency was improved 1.5 percent by grinding. Source of supplemental protein also had little effect on animal performance. Results confirm previous studies which indicate that efficiency of feed use of high-moisture corn is greater when it contains about 30 percent moisture than when it contains only 24 percent moisture.

Introduction

Moisture level of high-moisture corn alters efficiency of feed use according to previous trails from Oklahoma (Teeter et al., 1979) and Kansas (Davis, 1981). High-moisture corn containing 20 to 24 percent moisture is not as well utilized as either dry corn or corn containing more than 27 percent moisture. To obtain higher moisture levels, corn can be harvested earlier, or water can be added at ensiling time. Method of processing high-moisture corn at ensiling time also is debated. Fine grinding assures packing and may improve digestibility of starch but requires additional energy and time. Nebraska trials with high-moisture corn stored and fed in the whole form seem promising, but packing of the grain to avoid air penetration and molding in trench silos is simplified when fine particles are present. The objectives of this trial were to determine the influence of moisture content (harvested or reconstituted high-moisture corn) and grain processing on value of high-moisture corn for feedlot steers. Because the ideal protein supplement for high-moisture corn is uncertain, soybean meal, urea and a mixture were tested as supplements.

Materials and Methods

Corn from western Kansas was harvested at 31 percent moisture or at 24 percent moisture and transported to Goodwell, Oklahoma. A portion of each batch of corn was ground with a tub grinder for storage in the ground form. A blend of high-moisture corn in the whole form (60 percent) with ground corn (40 percent) also was prepared for storage. These two processing methods will be termed "blend" and "ground" in this report. The corn was stored at harvest

moisture levels, and half of the 24 percent moisture corn was reconsituted to 31 percent moisture by adding water to corn mixing in feed trucks. Each of the three grains was stored in plastic bags (Ag-Bag) from November until the following April.

One hundred fifty steers of mixed breeding weighing 673 lb were divided into 30 pens of 5 head each and fed the rations (Table 1) for 112 days. Steers had been on feed at Hitch Feedlot for over a month prior to initiation of this feeding trial.

Table 1. Ration composition (% of dry matter)[a]

	Supplemental protein		
Ingredient	Soybean meal	Urea	Mixture
Corn, high moisture	82.1	87.7	83.9
Corn silage	6.4	6.4	6.4
Alfalfa, chopped	3.6	3.6	3.6
Soybean meal	5.84	0	3.55
Limestone	.86	.82	.84
Urea	0	.87	.34
Ammonium sulfate	.15	.15	.15
KCl	.23	.43	.31
Salt	.38	.38	.38

[a]Crude protein of negative control was 9.4% and of other rations was 11.8% of dry feed. All rations contained .7% K, .5% Ca and .34% P plus rumensin (30 g/ton), Tylan (90 mg/head daily) and vitamin A (30,000 IU/head daily).

Results and Discussion

No interactions of moisture level, processing and protein source were apparent. A discussion of three factors follows.

Moisture level

Dry matter intakes were greater for the drier (24 percent moisture) corn than for corn with water added or corn higher in moisture at harvest. This has been observed in previous trials. Gains differed little with moisture content. Wetter and

Table 2. Influence of grain moisture on steer performance

	Moisture		
Item	Dry	Wet	Recon
Daily gain, lb			
0-55	2.83	2.84	2.58
56-112	3.08	3.21	3.15
0-112	2.96	3.03	2.87
Daily feed, lb			
0-55	16.4	15.4	14.3
56-112	17.3[a]	16.4[ab]	15.4[b]
0-112	16.8[a]	15.9[b]	14.8[b]
Feed/gain			
0-55	5.81	5.43	5.60
56-112	5.65[a]	5.13[ab]	4.89[b]
0-112	5.70[a]	5.25[b]	5.18[b]
ME, mcal/kg	3.15[b]	3.33[a]	3.36[a]

[ab]Means in a row with different superscripts differ statistically ($P<.05$).

reconstituted grain improved feed efficiency by 8.5 percent, and calculated energy content was 6.2 percent greater for grain containing more moisture than the 24 percent moisture corn. One could conclude that adding water to drier high-moisture corn decreases feed intake (5.3 percent) and increases efficiency of feed use (9.1 percent) with a slight sacrifice (3.0 percent) in daily gain. Higher moisture harvested grain does not appear to depress gains to the extent reconstitution may.

Grain processing

Effects of grain processing on steer performance are presented in Table 3. Performance of steers fed high-moisture corn stored and fed ground was little different than that of steers fed high-moisture corn in which 60 percent of the grain was stored and fed in the whole form. The advantage in feed efficiency attributable to grinding (1.5 percent) may not justify the additional cost of grinding. However, when corn is stored in a pit silo instead of being encased in plastic as it was in this study, packing and spoilage will be more of a problem with a product that has whole kernels than with a ground product.

Table 3. Influence of processing on steer performance

	Processing	
Item	Blend	Ground
Daily gain, lb		
0-55	2.73	2.73
56-112	3.08	3.19
0-112	2.91	2.96
Daily feed, lb		
0-55	15.4	15.3
56-112	16.2	16.5
0-112	15.8	15.9
Feed/gain		
0-55	5.65	5.64
56-112	5.29	5.20
0-112	5.44	5.36
ME, mcal/kg	3.25	3.29

Protein source

Effect of protein source on animal performance is presented in Table 4. Rate of gain and feed intakes were slightly lower for steers fed the soybean meal supplement. Differences in feed efficiency were very small. Previously, soybean meal supplements have usually proven superior to urea supplements with high moisture corn. Compared with other years, the urea supplements this year were balanced with the soybean supplement not only for nitrogen, calcium, phosphorus and potassium but also for sulfur from sodium sulfate. Also, monensin was included in the supplement. Sulfur and monensin additions to urea supplements for moisture corn diets need further research.

Gains and feed efficiencies for all treatments are presented in Table 5 for those who have interests in certain specific combinations.

Table 4. Influence of protein source on performance of feedlot steers

Item	Protein source		
	SBM	Urea	Mixture
Daily gain, lb			
0-55	2.68	2.72	2.79
56-112	3.11	3.18	3.11
0-112	2.90	2.95	2.95
Daily feed, lb			
0-55	14.9	15.7	15.5
56-112	16.6	16.4	16.1
0-112	15.7	16.0	15.8
Feed/gain			
0-55	5.59	5.79	5.55
56-112	5.36	5.18	5.20
0-112	5.42	5.43	5.35
ME, mcal/kg	3.27	3.27	3.27

Table 5. Gains and feed efficiency with high moisture corn diets

Moisture	Process	Daily gain, lb			Feed/gain		
		Protein source			Protein source		
		Urea	Mix	SBM	Urea	Mix	SBM
24H[a]	Blend	2.83	2.83	2.99	5.70	5.53	5.88
	Ground	2.88	3.21	2.99	5.90	5.66	5.53
31R[b]	Blend	2.84	2.90	2.84	5.37	5.19	5.10
	Ground	2.99	2.90	2.74	5.05	5.11	5.25
31H[a]	Blend	3.25	3.03	2.88	5.22	5.12	5.71
	Ground	3.20	2.79	3.02	5.08	5.38	4.98

[a]Harvested at this moisture level.
[b]Harvested at 24% moisture and reconstituted to 31% moisture.

Literature Cited

Davis, G. V. 1981. Cattle Feeders' Day, Garden City, KS. p. 14.
Teeter, R. G. et al. 1979. Okla. Agr. Exp. Sta. Res. Rep. MP-104:62.