Ammonia, ChemStor and Formaldehyde Treated High Moisture Corn Grain for Feedlot Steers

J. H. Thornton, D. R. Gill,
J. J. Martin, F. N. Owens
and D. E. Williams

Story in Brief

Addition of 0.1 percent ammonia to high moisture corn at ensiling increased feed intake and rate of gain slightly with a low protein ration. Efficiency of feed use was unchanged by ammonia addition to high moisture corn or high moisture milo when an adequate protein level was fed. ChemStor III treated high moisture corn preserved well but had slightly lower feeding value than ensiled high moisture corn. Formaldehyde treatment of high moisture corn depressed gain and efficiency of feed use when fed in a low protein ration.

Introduction

Laboratory results with addition of aqueous ammonia added to high moisture corn (Thornton *et al.*, 1977) indicated that low level additions (below 0.3 percent) stimulate or extend fermentation; higher levels (above 0.5 percent) elevate the pH and inhibit fermentation. ChemStor III, a mixture of propionic acid and formaldehyde, is a commercial silage preservative produced by Celanese Corporation, New York, New York. Formaldehyde also has been used to treat protein and preserve forages. These trials were designed to determine the influence of these additives and several levels of ammonia addition on performance of feedlot steers.

Materials and Methods

Trial 1

Whole shelled corn containing 24 percent moisture from a common source was treated with chemicals; 1) 1 percent ChemStor III (67 percent propionic acid, 10 percent formaldehyde and 3 percent methanol), 2) .1 percent formaldehyde, 3) .3 percent ammonia (ammoniated water) with a calibrated applicator mounted on a 6 inch by 30 foot motor drive auger or, 4) left untreated. The corn was then ground with a tub grinder and transported to Panhandle State University, Goodwell, Oklahoma for storage. In excess of 25 tons of each treated corn plus an untreated control corn were stored in four silos and covered with plastic for three months prior to feeding. ChemStor and formaldehyde treated HMC were stored in upright cement silos while the others were packed in horizontal cement pits.

For the feedlot evaluation, 60 steers (535 lbs) were allotted to 12 pens at the Goodwell Station with the four corn treatments assigned to three pens each for the 84-day feeding trial. One supplement (Table 1) and corn silage were fed with the corn to provide the ration shown in Table 1. Rations were mixed and fed twice daily at levels to achieve maximum intake. The ration crude protein was designed to be suboptimal (10.2 percent of dry matter) to maximize response to supplemental protein. Animals were weighed a 28-day intervals during the trial. Initial shrunk and final weights adjusted to a constant carcass dressing percent were used to calculate daily gain and feed efficiency.

Trial 2

Experimental procedures duplicated those of the report on "Protein Sources and Levels" reported by Gill *et al.* elsewhere in this publication. High moisture corn was treated with 0.1 or 0.5 percent ammonia and fed to three pens of 8 steers each with the 11.5 percent protein urea supplement Gill *et al.* described. Additionally, three pens were fed the 0.5 percent ammonia-treated corn with the 10.5 percent protein supplement. High moisture milo was also treated with 0 or 0.1 percent ammonia and fed to three pens of eight steers each.

Results and Discussion

Trial 1

The effects of treatment on chemical composition are presented in Table 1. Dry matter was higher in the silages placed in upright silos, possibly attributable to more evaporative loss during filling and storage. Addition of 0.1 percent NH_3 should increased protein content by 0.5 percent, indicating a 73 percent loss in experiment 1 and a 14 percent loss in experiment 2. Soluble nitrogen content was lower with formaldehyde addition, indicative of binding of protein, while it was increased by ammonia addition. The ChemStor treated corn was fresh and bright while others tended to mold and heat when exposed to air. Ammonia-treated corn was quite dark in color.

Daily gain was greatest for steers fed the ammonia-treated and lowest for those fed formaldehyde-treated corn (Table 2). Feed efficiency was poorest for the steers fed

Table 1. Chemical composition of treated grains.

Item	Level	pH	Dry matter	Crude protein	Soluble protein[a]
Experiment 1			%	%	
Control	0	4.70	76.8	8.3	19.8
ChemStor	1.0	4.87	79.8	8.3	8.8
Formaldehyde	0.1	5.07	79.8	8.7	12.9
NH_3	0.3	6.48	77.3	8.7	22.4
Experiment 2					
HMC	0	4.72	74.6	8.82	----
HMC + NH_3	0.1	4.76	76.5	9.32	----
HMC + NH_3	0.5	8.14	76.2	11.03	----
HM Milo	0	4.17	72.5	10.55	----
HMM + NH_3	0.1	4.47	72.1	10.92	----

[a]Percent of total N.

Table 2. Steer performance.

Item	Control	ChemStor III	Formaldehyde	NH_3
Steers, No.	15	15	15	15
Daily gain, lb	3.13[ab]	3.13[ab]	2.88[a]	3.37[b]
Daily feed, lb	17.46	18.37	18.46	18.49
Feed/gain	5.58[a]	5.88[ab]	6.40[b]	5.50[a]
NE_g mcal/kg	1.21[a]	1.13[bc]	1.07[c]	1.22[a]

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

Table 3. Performance of steers fed ammoniated high moisture corn and high moisture milo.

Grain	Corn					Milo	
Protein level, %	11.5	11.5	11.5	10.5	10.5	11.5	11.5
Ammonia, %	0	0.1	0.5	0	0.5	0	0.1
Steers, no., lb	24	24	23	24	24	24	24
Pens, no.	3	3	3	3	3	3	3
Weight, initial, lb	701	703	711	710	703	710	707
Daily gain, lb							
0-66	3.91	3.57	3.76	3.84	3.58	3.57	3.42
66-134	2.73	3.11	2.78	2.94	2.92	3.03	2.75
0-134	3.30	3.33	3.26	3.38	3.24	3.29	3.07
Daily feed, lb							
0-66	19.43	18.76	20.52	19.63	19.51	20.14	19.60
66-134	19.46^{a}	20.41^{ab}	20.82^{b}	19.85^{ab}	19.94^{ab}	19.97^{ab}	19.39^{a}
0-134	19.44^{a}	19.60^{ab}	20.67^{b}	19.74^{ab}	19.73^{ab}	20.05^{ab}	19.49^{ab}
Feed/gain							
0-66	4.98^{a}	5.28^{abc}	5.48^{b}	5.12^{ab}	5.45^{abc}	5.66^{c}	5.75^{c}
66-134	7.15^{ab}	6.60^{a}	7.52^{b}	6.74^{ab}	6.84^{ab}	6.60^{a}	7.10^{ab}
0-134	5.89^{ab}	5.88^{ab}	6.37^{c}	5.84^{a}	6.09^{abc}	6.10^{abc}	6.34^{bc}
Fecal starch, %	16.3	16.6	20.5	18.3	16.7	21.9	15.0
Fecal pH	6.06	5.96	5.85	5.83	5.81	5.89	6.23
DMDDig.	71.1	66.3	66.8	70.1	73.2	68.3	72.3
Starch Dig., %	91.8	90.2	88.4	91.1	92.2	88.2	92.8
NE_g, meg/kg	1.43	1.42	1.34	1.44	1.35	1.40	1.35

^{abc}Means within a trial with different superscripts differ statistically ($P<.05$).

Table 4. Carcass characteristics of steers fed ammoniated high moisture corn and high moisture milo.

Grain	Corn					Milo	
Protein level, %	**11.5**	**11.5**	**11.5**	**10.5**	**10.5**	**11.5**	**11.5**
Ammonia, %	**0**	**0.1**	**0.5**	**0**	**0.5**	**0**	**0.1**
Carcass weight, lb.	708	711	710	719	704	712	692
Rib eye area, in^2	13.63[b]	13.47[b]	12.65[a]	13.17[ab]	13.24[ab]	13.01[ab]	12.87[ab]
Fat thickness, in^2	0.50	0.42	.49	.45	.46	.50	.52
KHP, %	2.83	2.94	2.82	2.92	2.88	2.93	2.81
Cutability, %	50.65	50.90	49.94	50.45	50.57	50.11	50.11
Abscesses	1.13	1.00	.79	1.00	1.00	1.38	1.25
Yield	3.52[b]	3.28[ab]	3.20[a]	3.23[a]	3.33[ab]	3.35[ab]	3.39[ab]
Marbling	14.29	14.67	14.56	15.16	13.58	14.36	14.04
Quality	13.21	12.83	13.21	13.00	12.42	12.91	12.92

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

formaldehyde-treated corn. Ammonia addition increased feed intake and rate of gain slightly, possibly because of the extra protein supplied since this was a low-protein ration.

Trial 2

With the high level of ammoniation, HMC had a strong ammonia odor. Rate of gain was not influenced by ammoniation of high moisture corn or milo (Table 3). Efficiency of feed use tended to decrease with ammoniation of the grain. Calculated net energy for gain was decreased a mean of 4 percent by the low level and 6 percent by the high level of ammonia addition. With the higher protein and higher ammonia level, rib eye area and yield grade were reduced (Table 4) although live and carcass weights were unchanged.

Results show no promise of enhancing the nutritive value of high moisture grains by ammonia addition. Odors made handling of 0.5 percent ammoniated corn distasteful, but did not reduce acceptability by steers.

Literature Cited

Thornton, J.H., F.N. Owens and M. Arnold 1977. Okla. Agr. Exp. Sta. Res. Rep. MP-101, p. 173.

Ronnel or Monensin for Feedlot Heifers

F. N. Owens, D. R. Gill and R. W. Fent

Story in Brief

Ronnel was fed with an 89 percent whole shelled corn ration to 140 growing heifers in a 137 day trial. Ronnel at 64 g per ton of feed tended to increase rate of gain (3.6 percent). No effects on carcass composition were apparent. Monensin at 30 g per ton of feed improved rate of gain (7.2 percent) and feed efficiency (11.1 percent).

Introduction

Ronnel[1] has been used for many years as a heel fly, horn fly and lice control agent for cattle. Trials from Kansas and Montana suggest that feeding of Ronnel at 64 to 96 g per ton may enhance rate of gain and feed efficiency of feedlot steers by 3 to 8 percent. This trial was designed to determine the influence of Ronnel on growth rate and feed efficiency of feedlot heifers. Three levels of Ronnel and one level of monensin were tested in the feeding study.

Experimental Procedures

One hundred-forty charolais by black badly heifers, mean initial weight of 679 lbs, were stratified by weight and randomly allotted, seven per pen, to 20 pens. Four pens

[1]Trade mark of Dow Chemical Co., Midland, MI.