Effect of Organic Acids on the Preservation and Feeding Value of Reconstituted Milo[1]

K. K. Bolsen, O. J. Cox and C. L. Drake

The use of high moisture grain in beef cattle rations has increased during the past several years. It has improved feed efficiency of high energy rations five to 20 percent in previous research. Non-nutritional advantages of high moisture grain include: (1) earlier harvest to lengthen the harvest season and/or free land for other uses; (2) fewer field losses from shattering lodging, wind and early frost and (3) no artificial drying.

Structures suitable for storing high moisture grain are air-tight, concrete stave, trench and bunker silos. The storing and handling of high moisture grain in conventional grain storage facilities could add new dimensions to its use as a feed for livestock. Laboratory tests have shown that volatile fatty acids (formic, acetic, propionic and butyric) have fungicidal properties and prevent mold growth in high moisture feeds. The organic acids also have nutritional value to ruminants. They occur naturally during digestion and supply 40 to 70 percent of the energy used by beef cattle.

The objectives of this trial were to evaluate the effectiveness of an organic acid mixture[2] as a preservative for reconstituted milo and to determine the feeding value of the preserved grain.

Experimental

One hundred yearling steers of Angus, Hereford and Angus x Hereford breeding averaging 811 pounds were used in a feedlot trial beginning June 30, 1971. Three pens of five steers (group-fed) and five individually-fed steers were randomly assigned to each of five treatment groups.

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[1]Organic acids and financial support provided by Celanese Chemical Company, Corpus Christi, Texas.

[2]Organic acid mixture (trade name - ChemStor) contained 60% acetic and 40% propionic acids.

The following milo treatments were compared: (1) steam-flaked; (2) reconstituted whole, stored in an air-tight silo; (3) reconstituted whole, treated with the organic acid mixture, stored in a concrete stave silo; (4) the same as treatment 3 but stored in a metal grain bin and (5) reconstituted whole, then rolled and stored in a concrete stave silo. The same source of elevator-run, red milo was used for all milo treatments.

Steam-flaked milo was prepared once a week by subjecting the grain to steam in an over-sized steam chamber for 40 minutes at 210°F under atmospheric pressure and then rolling through a Ross mill with no tolerance on the rolls.

The reconstituted milo contained approximately 29 percent moisture; the organic acid mixture was applied at 30 pounds per ton of wet grain (2.11 percent on a dry grain basis). The acid, a clear, colorless liquid, was sprayed on the grain as it passed through an auger. Grain stored whole was rolled prior to feeding.

The initial rations contained 53 percent of the appropriate milo, 43 percent corn silage and four percent supplement (table 1) on a dry matter basis. Corn silage was gradually replaced with grain the first 17 days of the feeding period until final rations were 81 percent milo, 15 percent corn silage and four percent supplement on a dry matter basis. Dry matter content of the rations was 77.2, 70.4, 69.1, 70.8 and 70.3 percent for treatments 1-5, respectively. All rations were mixed and fed twice daily. Each steer was implanted with 30 mg of stilbestrol. The group-fed steers were confined to 15 x 30 foot non-sheltered, concrete pens; individually-fed steers were housed in 6 x 24 foot sheltered, concrete pens. Full weights were taken on two consecutive days at the beginning and end of the 112-day finishing trial. Final live weight was adjusted to a 60.9 percent dress and feedlot performance calculated on this basis.

Results and Discussion

Feedlot performance and carcass data for the group-fed steers are presented in table 2. Steers fed reconstituted milo stored in an air-tight silo (treatment 2) and reconstituted milo treated with organic acid (treatments 3 and 4) were similar in rate of gain, feed consumption and feed required per pound of gain. Steers fed steam-flaked and reconstituted, rolled milo (treatments 1 and 5, respectively) gained less ($P<.05$) than steers receiving the other rations. Daily feed consumption was lowest ($P<.05$) for steers fed steam-flaked grain. Steam-flaking on a weekly basis apparently reduced acceptability of the ration. In previous research at this station (1971 Cattlemen's Day - Bulletin 546), steers fed milo steam-flaked on a daily basis consumed nearly the same as steers fed reconstituted milo. In the trial reported herein, feed efficiency was significantly ($P<.05$) influenced by treatment. Steers receiving the reconstituted, rolled milo required an average of 0.63 pound more feed per pound of gain than those receiving the other four rations. No significant differences were obtained in carcass traits; however, dressing percentage tended to be higher for steers receiving the reconstituted milo treated with organic acid (treatments 3 and 4).

Individually-fed steers responded to the grain treatments (table 3) similar to group-fed steers. Steam-flaked and reconstituted, rolled milo resulted in lower gain ($P<.05$) and lower feed consumption than the other three rations.

Most of the reconstituted milo treated with the organic acid mixture was free of mold or spoilage. However, some heating and deterioration occurred in grain within three or four inches of the storage walls. This was probably from moisture migrating from the grain to the walls and a subsequent neutralization of the organic acids. Lining the storage facility with polyethylene should prevent this type of spoilage.

Table 1. Composition of the supplements.

Ingredient	% (dry matter basis)
Rolled milo	10.9
Soybean meal	45.5
Urea	10.7
Salt	12.5
Limestone	18.4
Trace minerals	0.5
Vitamin A[a]	0.7
Chlortetracycline[b]	0.8

[a]Formulated to supply 30,000 IU per steer per day.

[b]Formulated to supply 70 mg per steer per day.

Table 2. Performance and carcass data of the group-fed steers.

	Milo treatment				
	1	2	3	4	5
		Reconstituted			
Item	Steam-flaked	Air-tight silo	Organic acid treated, concrete silo	Organic acid treated, metal bin	Rolled, concrete silo
No. steers	15	15	15	15	15
Initial wt., lbs.	786	801	812	806	822
Final wt., lbs.	1120	1156	1165	1178	1153
Avg. daily gain, lbs.	$2.98^{a,b}$	3.18^{c}	$3.16^{b,c}$	3.32^{c}	2.94^{a}
Avg. daily feed, lbs.[d]	18.9^{a}	20.6^{b}	$21.5^{b,c}$	22.1^{c}	$21.2^{b,c}$
Feed/lb. gain, lbs.	6.34	$6.48^{a,b}$	6.80^{b}	$6.66^{a,b}$	7.21^{c}
Hot carcass wt., lbs.	682	704	709	718	702
Dressing percentage	60.2	60.7	60.8	61.3	60.4
Quality grade[e]	10.1	9.9	10.1	10.5	9.7
Yield grade	3.28	3.35	3.56	3.56	3.57
Fat, 12th rib, in.	0.64	0.61	0.56	0.64	0.59

[a,b,c] Means in the same row with different superscripts differ significantly (P .05).

[d] Dry matter basis.

[e] Quality grade assigned, 10 - low Choice, 11 - average Choice.

Table 3 . Performance and carcass data of the individually-fed steers.

Item	Milo treatment				
	1	2	3	4	5
		Reconstituted			
	Steam-flaked	Air-tight silo	Organic acid treated, concrete silo	Organic acid treated, metal bin	Rolled, concrete silo
No. steers	5	5	5	5	5
Initial wt., lbs.	858	841	853	807	785
Final wt., lbs.	1157	1209	1165	1150	1064
Avg. daily gain, lbs.	2.67^{a}	3.28^{b}	$2.78^{a,b}$	$3.07^{a,b}$	2.49^{a}
Avg. daily feed, lbs.[c]	17.2	21.4	20.0	20.7	18.3
Feed/lb. gain, lbs.	6.51	6.56	7.66	6.73	7.37
Hot carcass wt., lbs.	704	736	709	700	648
Dressing percentage	60.2	60.0	61.5	61.8	60.4
Quality grade[d]	9.4	9.4	9.2	9.8	9.6
Yield grade	3.21	3.67	3.71	4.01	3.57
Fat, 12th rib, inc.	0.57	0.68	0.67	0.71	0.66

[a,b] Means in the same row with different superscripts differ significantly (P .05).

[c] Dry matter basis.

[d] Quality grade assigned, 10 - low Choice, 11 - average choice.