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MIN-AD

Effect of MIN-AD® in Combination with Steam Flaked Wheat and Steam Flaked Corn on Feedlot Performance

This bulletin is one of a series of technical bulletins that discusses the applications of MIN-AD to feedlot and dairy cattle nutrition and health.

It is well known that grain type and processing are factors that influence subacute acidosis in feedlot cattle. Wheat and barley, which have readily extracted starch, have the fastest rate of ruminal starch digestion. The starch granules of whole corn, which are embedded in protein and have less surface area exposed, have slower rates of fermentation.

Steam flaking can dramatically alter the rate and extent of ruminal starch digestion. Steam flaking corn increases starch digestion as compared to dry rolling because the protein matrix is disrupted and the starch is more accessible to digestion. On the other hand, steam flaking wheat reduces the rate of starch digestion as compared to dry rolling by decreasing the fines and thus the surface area.

A trial was conducted to examine three combinations of steam flaked wheat (SFW) and steam flaked corn (SFC) with and without MIN-AD. The objective was to determine whether feedlot performance could be improved by addition of a buffer or changing starch fermentation patterns by mixing grains.

With all three grain combinations, the cattle receiving MIN-AD had increased average daily gain (ADG) and in two cases had improved dry matter conversion (DMC). The cost of gain was lowered in all rations by the addition of MIN-AD. Rations without wheat tended to have the best feed efficiencies and energy recoveries, but the addition of MIN-AD to a combination 50% SFC:50%SFW diet brought feed and energy utilizations to levels comparable with the all corn diets.

Wheat (% of grain)	0		50		100	
MIN-AD	No	Yes	No	Yes	No	Yes
Days 0-128						
Start weight lbs	726	725	722	723	724	723
End weight lbs	1149	1163	1145	1164	1150	1152
ADG, lbs	3.30	3.43	3.30	3.45	3.33	3.35
DMI lbs/day	19.76	20.23	20.59	20.67	19.95	21.22
DMC	5.99	5.92	6.26	5.99	6.01	6.35
Cost of gain $/cwt	39.73	38.19	39.01	36.35	37.10	36.91
Hot carcass wt.,lbs	766	772	760	775	759	760
Dressing percent	65.09	65.28	65.07	65.17	64.62	64.59

Trial Procedure

From April to August 1991 378 Okie steers were fed three different ratios of SFW to SFC with or without MIN-AD. The yearling steers, averaging 724 lbs, were allocated to 42 pens of six treatments with seven weight blocks each. The ratios of wheat to corn in the diet were

(1) 0% of the grain as SFW, 100% as SFC,
(2) 50% as SFW, 50% as SFC, and
(3) 100% as SFW and 0% as SFC.

Each grain combination was fed with MIN-AD at 1% of the *as fed* ration and without MIN-AD. Calcium and magnesium from MIN-AD replaced portions of calcium carbonate and magnesium oxide in the appropriate diets. Finishing ration dry matter levels are given in Appendix A. The cattle were fed twice daily for 128 days. They were individually weighed at the start and end of the trial and three times during the trial.

Dry Matter Intake (DMI)

Feedlot performance by cattle weigh period is presented in Table 1. Without MIN-AD, DMI tended to increase when wheat was changed from 0% to 50% of the grain. As wheat was increased to 100% of the grain, the intake was the same as the 100% corn ration.

The addition of MIN-AD tended to improve or maintain intake of each grain combination averaged over the entire trial. By trial end, the increase in intake was 2.4% on the 100% SFC ration, 0.4% on the 50% SFC:50% SFW ration, and 6.3% with SFW as 100% of the grain.

MIN-AD was very efficient during the adaptation period on the 100% SFC and the combination SFC:SFW rations: it lowered intake and increased ADG. MIN-AD™ increased DMI of the 100% wheat diet during every weigh period.

Average Daily Gain (ADG)

ADG was the same for all three unbuffered rations after 128 days on feed. During the first 32 days on feed, ADG was increased by increasing the wheat or adding MIN-AD. The responses to increased wheat were variable during the other weigh periods and by trial end there were no numerical differences among the unbuffered rations.

The inclusion of MIN-AD increased the ADG of the 100% SFC ration during each weigh period. It was most pronounced in the first 32 days (+6%) and in days 104-128 (+14%). By trial end, the average increase in ADG was 4%. A similar response was observed with the 50% SFC:50% SFW ration, with the exception of

Table 1 Feedlot Performance for wheat-to-corn ratios and MIN-AD inclusion.

Wheat %	0		50		100		
MIN-AD	No	Yes	No	Yes	No	Yes	SE
Days 0-32							
Start weight lbs	726	725	722	723	724	723	16.95
ADG lbs	3.32	3.51	3.40	3.65	3.60	3.71	0.20
DMI lbs/day	18.79	18.56	18.96	18.60	18.08	19.44	0.59
DMC	5.75	5.34	5.87	5.12	5.15	5.33	0.37
Days 33-69							
Start weight lbs	832	837	831	840	839	841	17.34
ADG, lbs	4.44	4.46	4.25	4.47	4.33	4.19	0.12
DMI lbs/day	21.13	22.13	21.98	22.67	22.24	23.14	0.56
DMC	4.78	4.97	5.20	5.09	5.16	5.54	0.17
Days 70-103							
Start weight lbs	997	1002	988	1005	999	997	18.23
ADG, lbs	2.86	2.88	2.82	2.98	2.74	2.73	0.14
DMI lbs/day	19.91	20.08	20.90	20.96	19.92	20.96	0.61
DMC	7.08	7.00	7.54	7.12	7.30	7.73	0.29
Days 104-128							
Start weight lbs	1094	1100	1084	1106	1092	1089	19.53
ADG, lbs	2.25	2.56	2.43	2.32	2.30	2.49	0.17
DMI lbs/day	18.70	19.81	20.13	19.88	18.97	20.94	0.51
DMC	8.33	8.05	8.87	8.79	8.65	8.67	0.68
Days 0-128							
Start weight lbs	726	725	722	723	724	723	16.95
End weight lbs	1149	1163	1145	1164	1150	1152	19.40
ADG, lbs	3.30	3.43	3.30	3.45	3.33	3.35	0.08
DMI lbs/day	19.76	20.23	20.59	20.67	19.95	21.22	0.51
DMC	5.99	5.92	6.26	5.99	6.01	6.35	0.15
Cost of gain $/cwt[1]	39.73	38.19	39.01	36.35	37.10	36.91	1.03
Hot carcass wt.,lbs	766	772	760	775	759	760	13.04
Dressing percent	65.09	65.28	65.07	65.17	64.62	64.59	0.23

[1] Calculated with equal wheat and corn prices of $95/ton processed.

the fourth weigh period. Averaged over 128 days on feed, MIN-AD increased ADG of the 50% SFC:50% SFW ration by 4.5%.

The inclusion of MIN-AD to the 100% SFW ration did not influence ADG. Two possible explanations are that these cattle were already gaining at their maximum rate on these rations or that the optimum level of MIN-AD was not being fed.

Dry Matter Conversion (DMC)

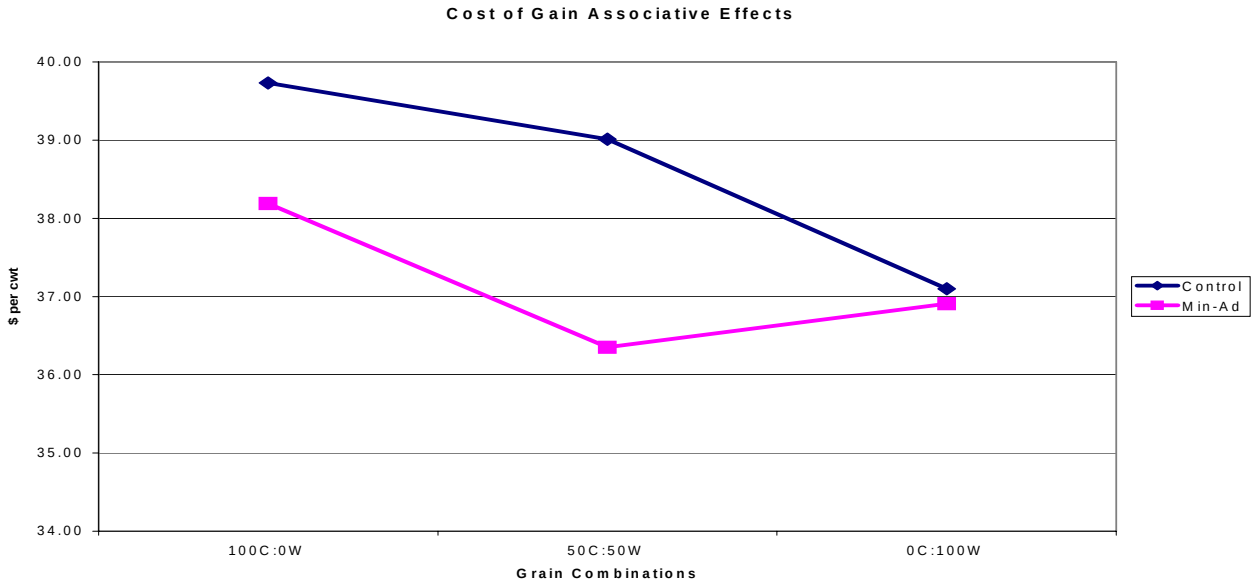
Increasing SFW from 0% to 50% in the unbuffered rations reduced feed efficiency during each weigh period. With the exception of the first weigh period, DMC of the unbuffered 100% SFW ration was intermediate between the corn and combination SFC:SFW rations.

The addition of MIN-AD to the 50%SFC:50% SFW diet improved each period's feed utilization and led to a 4% improvement over the duration of the trial. MIN-AD also improved the feed utilization during three of four weigh periods for the 100% SFC ration, in particular during Days 0-32. Because of the high intake of the cattle on the 100% SFW plus MIN-AD ration, they had the poorest feed utilization.

Rations without wheat tended to have the best feed efficiencies and energy recoveries, but the addition of MIN-AD to the 50% SFC:50% SFW diet brought feed and energy utilizations to levels comparable with the SFC diets.

Cost of Gain (COG)

When the same price for corn and wheat ($95/ton processed) were used to calculate cost of gain (ingredient costs only), increasing the amount of wheat to 50% tended to improve COG. Part of this improvement is likely due to the cost of supplemental soybean meal in the 100% SFC ration. MIN-AD significantly reduced COG for the 100% SFC (-4%) and 50% SFC:50% SFW (-7%) diets (P<0.001). There was a slight decrease in cost for the 100% SFW ration.



Bloat and Carcass Data

Although there were only three deaths in the trial, all three were digestive related and occurred on the 100% wheat rations; two without MIN-AD and one with MIN-AD.

As shown in Table 1, carcasses were heaviest with the MIN-AD SFC:SFW ration. MIN-AD tended to increase carcass weights for all rations. Dressing percents did not change until wheat was the only grain fed.

Associative Effects

Grain combinations are said to exhibit associative effects when performance measurements are different than the average of the two single grain rations. A positive value represents a performance or economic response better than the average; a negative value represents a poorer response. Table 2 shows the associative effects for the 50% SFC:50% SFW ration with and without MIN-AD.

For the unbuffered rations, there was no associative effect on ADG, a positive effect on DMI (+3.55%) and a subsequent negative effect on DMC (-4.33%). The inclusion of MIN-AD led to a positive effect on ADG (+1.78%), no effect on DMI, and a positive effect on DMC (+2.42%). The lack of effect on DMI was a result of improving intake on the 100% wheat ration.

Table 2 – Associative Effects

MIN-AD™	No	Yes
ADG	-0.45%	+1.78%
DMI (lbs/day)	+3.55%	-0.27%
DMC	-4.33%	+2.42%
Cost of gain	-1.53%	+3.30%

Summary Discussion

Grain processing, while improving starch utilization in the rumen, predisposes animals to acidosis. Buffering, or acid neutralization, can prevent a loss of intake and performance. This is illustrated by ADG and DMC improvements with the addition of MIN-AD to the SFC and SFC:SFW diets. Although DMI increased with the addition of MIN-AD to the 100% SFW ration, there was no improvement in ADG or DMC. This may have been because the optimal level of MIN-AD is different for different grain sources or that the all-wheat cattle were already gaining at their greatest attainable rate.

Over the duration of the trial, the 100% SFC ration had the best feed efficiency and energy recovery, but the addition of MIN-AD to the SFC:SFW diet brought feed and energy utilizations to levels comparable with the corn diets. MIN-AD was also very efficient during the adaptation period as it tended to lower intake and increase ADG.

The inclusion of MIN-AD resulted in positive associative effects. Indeed, it reversed negative DMC and COG associative effects that were observed with the unbuffered SFC:SFW ration.

Significant cost of gain savings were realized through the inclusion of MIN-AD in the 100% steam flaked corn and the combination steam flaked corn:steam flaked wheat rations.

Appendix A

The rations consisted of grain, corn silage, corn steep liquor, soybean meal, yellow grease, and a vitamin/mineral/additive supplement. They were formulated to provide the following dry matter levels in the finishing rations.

Roughage	6.5%
(75% of roughage from corn silage)	
NE_g	70.0 mcal/cwt
Crude protein	13.0%
Calcium	0.65%
Phosphorous	0.35%
Potassium	0.70%
Magnesium	0.25%
Vitamin A	3000 IU/lb
Vitamin E	15 IU/lb
Monensin	27 g/ton
Tylosin	7 g/ton
Salt	0.20%
Ammonium sulphate	0.15%

NPN crude protein equivalent was 3.25, 2.20, and 0.30% for 100% SFC, 50% SFC:50% SFW, and 100% SFW, respectively.