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R. J. Emerick
South Dakota State University

B. H. Dunn

L. B. Embry

South Dakota State University
Brookings, South Dakota
Department of Animal Science
Agricultural Experiment Station

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Annual grain supplies have been quite variable and shortages experienced in the past will undoubtedly be repeated at irregular intervals in the future. During periods of short feed grain supplies, emphasis is placed on longer backgrounding periods of high-roughage feeding followed by shorter finishing periods of high-concentrate feeding. Animals changed from high-roughage backgrounding diets to high-concentrate finishing diets often experience digestive disorders related to rumen acidosis and make unsatisfactory weight gains for a few weeks.

Sodium bentonite and sodium bicarbonate alter conditions in the rumen and may offer animals protection from some of the harmful effects of rumen acidosis. The potential benefits that may be derived from use of these materials have become increasingly important as backgrounding periods are extended and finishing periods are shortened. The experiments reported herein were designed to investigate the effectiveness of these materials, individually or in combination, in the adaptation of beef cattle to high-concentrate diets.

Experimental Procedure

Prior to beginning the experiment, steers of predominantly Hereford breeding averaging 894 lb. were fed alfalfa-brome hay free choice for 3 weeks. Subsequent high-concentrate feeding trials lasted an average of 93 days. At the start of high-concentrate feeding, all steers were implanted with 36 mg of Synovex-S. Four dietary treatments were used during the first 21 days (phase 1), control, 2% sodium bentonite, 2% sodium bicarbonate and 2% sodium bentonite plus 2% sodium bicarbonate. Each treatment was replicated three times with 5 to 6 steers per pen. In view of the potential danger of losses from acidosis, the replications were conducted at different time intervals. During phase 2 (days 22 to 93), the level of sodium bentonite or sodium bicarbonate supplementation for all dietary treatments was reduced one-half.

The control diet was basically a corn and soybean meal mix with 8% alfalfa-brome hay. The steers were fed 5 lb. per head of the treatment diets on day 1 of the experiment and were increased 5 lb. per head daily until reaching a full feed. Weights were obtained at 21-day intervals. When slaughtered at an average weight of 1195 lb., they were examined for liver abscesses and urinary calculi.

Results and Discussion

The steers fed 5 lb. per head of the high-concentrate diet the first day with subsequent increases of 5 lb. per head daily went off feed between the fifth and sixth day. Daily feed records indicate that the steers receiving

2% sodium bicarbonate or the combination of sodium bicarbonate and sodium bentonite did not go off feed to the same degree as those receiving the basal diet or sodium bentonite alone. Some of the steers became stiff and all animals exhibited varying degrees of diarrhea. All animals appeared to be consuming normal amounts of feed by the 12th day. There were no deaths due to rumen acidosis during the experiment.

Performance data are shown in table 1. By the end of the first 21-day period, there were only small differences in average daily ration (ADR), average daily gain (ADG) and feed/gain (F/G) for steers fed the control diet, 2% sodium bentonite or 2% sodium bicarbonate. Those fed the combination of these two materials showed a 16% increase in ADR and a 41% improvement in ADG during period 1. However, variation within treatments was large during this 3-week period and the differences proved to be nonsignificant.

Continued feeding of sodium bicarbonate with or without sodium bentonite tended to give lower ADG by the end of the average 93-day feeding periods. This negative effect of sodium bicarbonate on weight gains was evident during phase 2 (days 22 to 93). However, there were no significant differences in cumulative data over the full term of the average 93-day feeding periods.

Table 1. Means for Average Daily Ration, Average Daily Gain and Feed/Gain

Weigh periods	Basal	Sodium Bentonite	Sodium Bicarbonate	Sodium Combination
Phase 1[a]				
ADR, lb.	17.9	18.3	18.1	20.7
ADG, lb.	3.31	3.31	3.53	4.63
F/G	551	554	508	462
Phase 2[b]				
ADR, lb.	26.9	25.8	24.9	25.8
ADG, lb.	3.75	3.53	3.31	3.09*
F/G	705	753	762	845
End of experiment[c], filled weight				
ADR, lb.	24.7	24.0	23.4	24.5
ADG, lb.	3.75	3.53	3.31	3.53
F/G	673	703	690	721
End of experiment, shrunk weight				
ADR, lb.	24.9	24.0	23.4	24.7
ADG, lb.	3.53	3.53	3.31	3.31
F/G	698	699	703	743

[a] Twenty-one days, cumulative, 2% level of treatment materials.
[b] Days 22 to 93, 1% level of treatment materials.
[c] Ninety-three days, cumulative.
* Significantly lower than control ($P<.05$).

Feeding diets high in concentrates is often associated with a high degree of liver abscesses. In these studies, sodium bicarbonate appeared to offer some degree of protection. In each of the control and the sodium bentonite treatment groups, four of 17 to 18 animals (22%) had abscessed livers. In groups receiving sodium bicarbonate or the combination treatments, one to two animals of 18 (average 6%) had abscessed livers.

Alkali-forming salts including sodium bicarbonate have been previously shown to increase urinary calculi in susceptible animals. A 61% incidence of urinary mineral deposits was found in steers fed sodium bicarbonate compared to a 40% incidence in the other two treatments not containing this material.

The greatest potential for use of sodium bentonite or sodium bicarbonate appears to be in lowering the risk of rumen acidosis during adaptation to high-concentrate diets. Weight gain benefits obtained from these materials during adaptation to high-concentrate diets have not been sustained throughout the remainder of the feeding period.