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The Effects on Milk Composition of Treatment of Ear Corn Silage by Zinc Bacitracin and Limestone

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INTRODUCTION AND REVIEW OF LITERATURE

The causes of abnormally low milk fat are complicated (1). Tyznik and Allen (7) found that cows fed low levels of forage (3 lb. daily) produced milk abnormally low in milk fat content and that feeding sodium acetate increased the milk fat percentage.

Klosterman et al (3) demonstrated that feeding of limestone-treated corn silage high in lactic acid content resulted in significantly greater gains of body weight than untreated corn silage.

Byers et al (2) treated corn with 1 percent limestone at silo filling time. The resulting silage contained 104 percent more acetic acid and 80 percent more lactic acid than untreated corn silage. They found no significant differences in response to treated and untreated silage of dry matter intake, milk yield, milk fat percentage, or change in body weight of dairy cows.

Simpkins et al (5) fed calcium carbonate-treated and untreated corn silage to milking dairy cows in a reversal experiment. There was no significant difference in response to the two rations in milk flow, 4 percent F.C.M. (fat-corrected milk), or percentage of solids-not-fat. The milk fat percentage was lower ($P < .10$) when treated corn silage was fed. This limited response was regardless of an increase from 6.52 percent of organic acids in the untreated to 11.24 percent in the limestone-treated silage.

Pratt and Conrad (4) found that treatment of alfalfa-grass mixtures with Silotracin (containing bacitracin) resulted in a silage higher in acetic acid content but variable in lactic acid. No information existed regarding the effect of bacitracin on corn silage.

Becker et al (1) reviewed the literature thoroughly regarding the factors which influence milk fat percentage. The reader who wants a review is referred to their bulletin.

The use of corn silage treated with either bacitracin or limestone suggested an approach to the problem of the effects on milk composition of variations in intake of acetic and lactic acids of normal rations.

EXPERIMENTAL PROCEDURE

Ear Corn Silage

Three types of ear corn silage were prepared for this experiment. Ear corn was picked when it contained about 55 percent dry matter. The ears were chopped through a picker-grinder used as a stationary unit at the silo. The cobs were cut by revolving blades and the material was passed through a screen and between rollers which crushed it thoroughly. Some portion of each kernel was crushed, thus favoring high digestibility. The material was ensiled in 8 by 40-foot stave silos. Some silage was ensiled without treatment, some was treated with 5 lb. Silotracin (containing 5 g. zinc bacitracin) per ton, and some was treated with 1 percent ground limestone.

Experimental Animals

Cows which were already on a continuous feeding experiment were used and this experiment was superimposed upon the other. One group of eight animals was fed alfalfa-grass silage of 35.5 percent dry matter from a glass-lined silo. Another group of four animals was fed silage of 52.3 percent dry matter from a 12 by 40-foot tile silo. Both groups were fed ear corn silage from the same sources simultaneously.

Plan of Experiment

The plan of the experiment is presented in Table 1. Milk samples were taken at each milking and composited daily from February 15 to 21 inclusive. During that period, both groups remained on their respective silages and were fed bacitracin-treated silage as they had been for 13 weeks (or more in most cases) before this experiment began. They continued on this same feeding regime through March 6. On March 7, both groups were changed to untreated ear corn silage and daily sampling was resumed on the morning of March 7. For both the third and fourth periods, sampling was resumed at the same feeding when the change in ear corn silage feeding was made.

TABLE 1.—Plan of the Experiment.

	Experimental Periods			
	1	2	3	4
Treatment of Ear Corn Silage	Bacitracin	Untreated	Limestone	Bacitracin
Date	2/15-2/21	3/7-3/11	3/14-3/18	3/21-3/24
No. of Cows Fed				
Silage, 52.3% Dry Matter	4	4	4	4
Silage, 35.5% Dry Matter	8	8	8	7

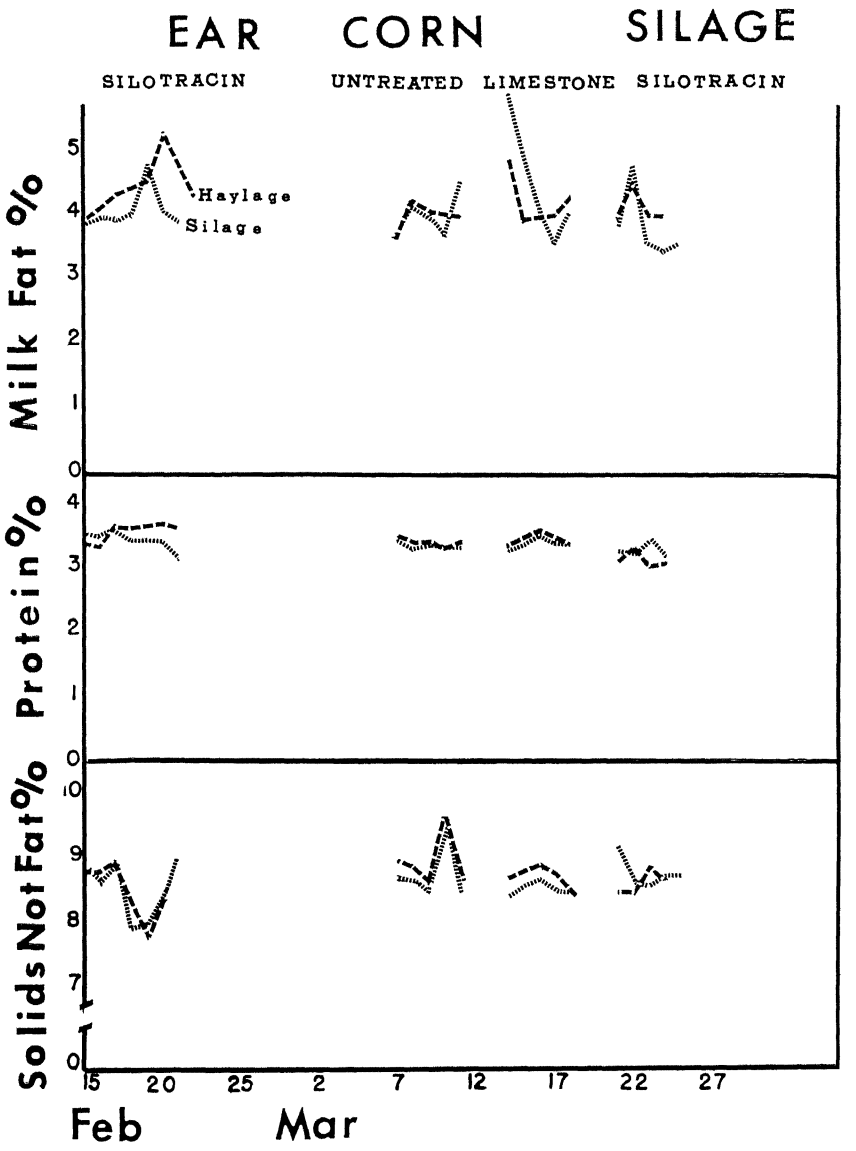

Fig. 1.—The relationships of treatment of ear corn silage to solids-not-fat, protein, and milk fat.

TABLE 2.—Group Means for Protein, Milk Fat Percentage, Solids-not-fat, and Actual Milk Production.

	Protein		Milk Fat		Solids-not-fat		Milk Produced	
	(%)	(%)	(%)	(%)	(%)	(%)	(lb.)	(lb.)
Dry Matter of Silage (%)	52.3	35.5	52.3	35.5	52.3	35.5	52.3	35.5
Bacitracin-treated	3.62	3.60	4.64	4.81*	8.90*	8.82*	35.27**	32.33**
Untreated	3.52	3.57	4.53	4.35	9.12	9.27	33.40	30.97
Limestone-treated	3.54	3.59	5.05*	4.74*	8.88*	9.07*	32.51	30.23

*Significantly different from the untreated at the 5% level.
**Significantly different from the untreated at the 1% level.

Milk Analyses

The composite samples of the two milkings were analyzed daily for protein, milk fat, and solids-not-fat. Protein was determined by the orange G dye method (6). The Tesa test was used in determining milk fat. Solids-not-fat were determined by substracting milk fat percentage from the value for total solids.

RESULTS AND DISCUSSION

The group means for each analysis appear in Table 2 and are presented in graphic form in Figure 1. The effects of treatment of ear corn silage on milk composition are not so obvious that they can be detected without statistical analysis. The variations during the first period are relatively great.

Attention is called to the practice of maintaining a constant ratio of forage to grain dry matter. This would obviate the variations in milk composition known to occur due to changes in grain content of the ration.

The treatment of the ear corn silage would have no effect on the protein content of the ear corn silage and only slight effect upon its energy content. Treatment of the ear corn silage with bacitracin reduced the total organic acids of the moist silage by 5 percent and limestone treatment increased the acid content by 25 percent.

The treatment of ear corn silage had a significant effect ($P < 0.05$) on milk fat percentage, with both bacitracin and limestone increasing milk fat percentage. Treatment also had a significant effect ($P < 0.05$) on the level of solids-not-fat in the milk, with both treatments lowering its level significantly. The level of dry matter in the alfalfa-grass had a highly significant effect ($P < 0.01$) on the amount of milk produced. The cows fed silage of 52.3 percent dry matter averaged 33.73 lb. per cow daily as compared to 31.18 lb. for those fed silage of 35.5 percent dry matter. The regression of stage of lactation on milk production was highly significant ($P < 0.01$), as one would expect if the data were valid.

From the data presented above, it is impossible to tell whether the increases in milk fat percentage are caused by acetic or lactic acid, since limestone treatment increased both acids. The organic acid content of the three ear corn silages appears in Table 3. The effect of treatment of ear corn silage by limestone was to increase lactic acid by 10 percent and to increase acetic acid by 100 percent. Bacitracin treatment decreased the amount of lactic acid by one-fourth and practically doubled the amount of acetic acid.

TABLE 3.—Organic Acid Content of Ear Corn Silage.

	Dry Matter Content	Organic Acids		
		Acetic	Butyric*	Lactic
	(%)	Percent Dry Basis		
Untreated	50.5	0.65	0.08	5.64
Bacitracin-treated	54.6	1.23	0.12	4.27
Limestone-treated	51.5	1.40	0.16	6.21

*The amount of propionic acid was not sufficient to be separated from the butyric by partition chromatography.

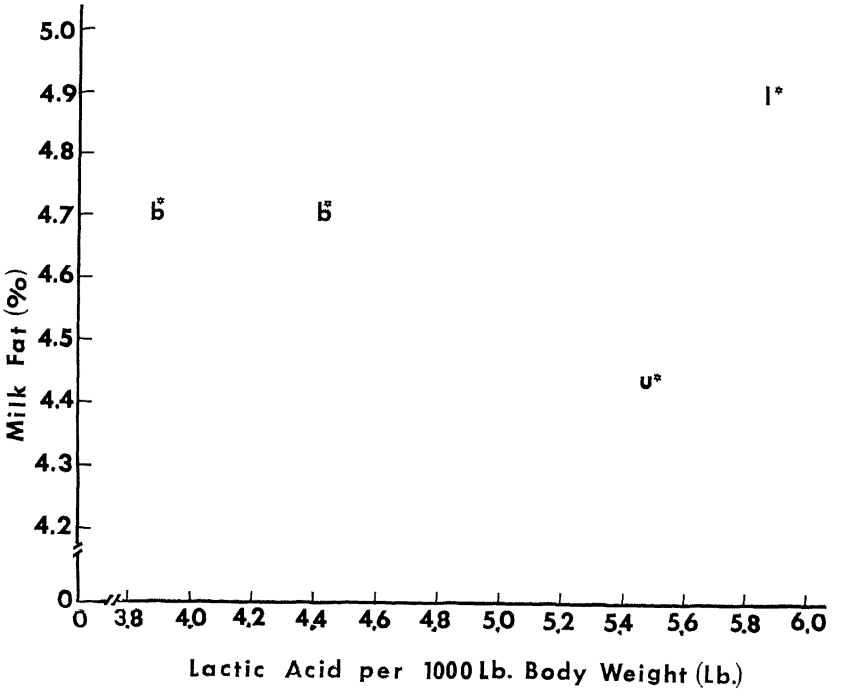

Fig. 2.—There was a linear relationship of daily intake of acetic acid of ear corn silage to milk fat percentage. Legend: u, untreated; b, bacitracin-treated; l, limestone-treated ear corn silage.

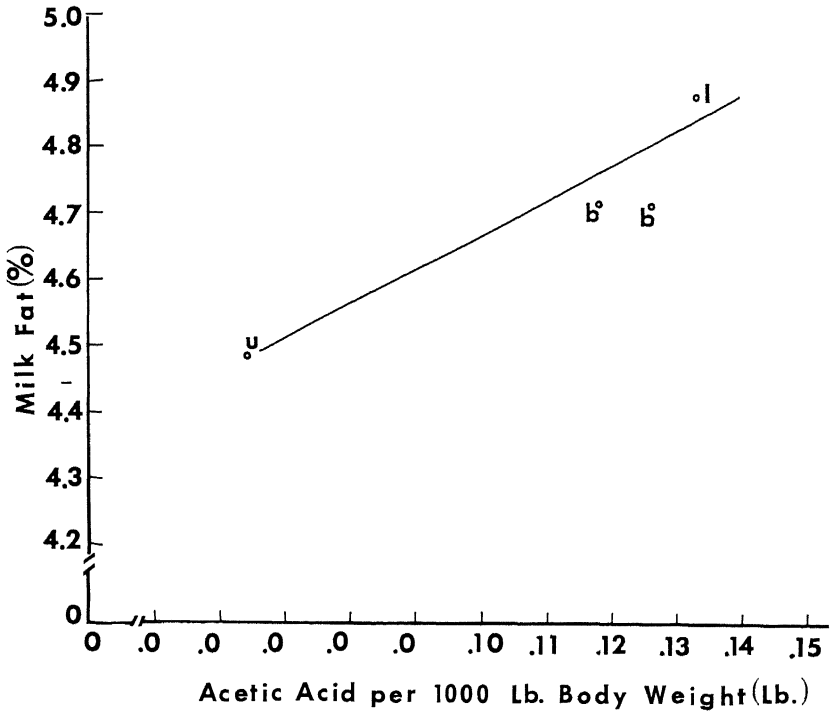

Fig. 3.—There was no correlation between intake of lactic acid of ear corn silage and milk fat percentage. Legend: u, untreated; b, bacitracin-treated; l, limestone-treated ear corn silage.

The regression of the daily intake of acetic acid from ear corn silage per 1000 lb. live weight on milk fat percentage (Figure 2) shows a definite straight line relationship. Both bacitracin and limestone treatment had a similar effect.

When the daily intake of lactic acid per 1000 lb. live weight is regressed on milk fat percentage (Figure 3), no clear relationship is apparent. There is no evidence that lactic acid affects milk fat percentage.

SUMMARY

Twelve cows were fed: (1) bacitracin-treated ear corn silage as grain; (2) untreated ear corn silage; (3) limestone-treated ear corn silage; and (4) bacitracin-treated ear corn silage.

The cows were milked twice daily and the milk samples composited on a daily basis. The daily composites were analyzed for protein, solids-not-fat, and milk fat.

The short-time effect of treatment of ear corn silage by bacitracin and by limestone caused a significant ($P< 0.05$) increase in milk fat percentage and a significant decrease ($P< 0.05$) in solids-not-fat.

The cows averaged 33.73 lb. of milk daily when fed silage of 52.3 percent dry matter and 31.18 lb. when fed silage of 35.5 percent dry matter. This was a highly significant difference ($P< 0.01$).

Regression of daily intake of acetic acid per 1000 lb. live weight on milk fat percentage shows that the acetic acid content of both bacitracin and limestone treatments was highly correlated with increased milk fat percentage. Lactic acid did not have this effect.

LITERATURE CITED

1. Becker, R. B., P. T. Dix Arnold, C. J. Wilcox, W. A. Krienke, L. E. Mull, and E. L. Fouts. 1965. Subnormal milk—cause and correction. Fla. Agri. Exp. Sta. Bull. 692.
2. Byers, J. H., C. L. Davis, and C. E. Baylor. 1964. Feeding value of limestone treated corn silage for lactating dairy cows. J. Dairy Sci. 47: 1062.
3. Klosterman, Earle W., Ronald R. Johnson, A. L. Moxon, and Harold W. Scott. 1963. Feeding value of limestone treated corn silages for fattening cattle. Ohio Agri. Exp. Sta. Res. Bull. 934.
4. Pratt, A. D. and H. R. Conrad. 1961. Bacitracin as a preservative for legume-grass silage. Ohio Agri. Exp. Sta. Res. Bull. 893.
5. Simpkins, K. L., Jr., B. R. Baumgardt, and R. P. Niedermeier. 1965. Feeding value of calcium-carbonate-treated corn silage for dairy cows. J. Dairy Sci. 48: 1315.
6. Treece, J. M., L. O. Gilmore, and N. S. Fechheimer. 1959. A comparison of the orange G dye and Kjeldahl methods for determining milk protein. J. Dairy Sci. 42: 367.
7. Tyznik, W. and N. N. Allen. 1951. The relation of roughage intake to the fat content of milk and the level of fatty acids in the rumen. J. Dairy Sci. 34: 493.

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