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Micronized Sorghum Grain in Rations For Lactating Dairy Cows

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Story in Brief

Since sorghum grain is often the most economical energy source in dairy rations, research work to evaluate different methods of processing is justified. The purpose of the trial reported here was to compare sorghum grain micronized to different degrees with finely ground grain in terms of feeding value for lactating dairy cows.

Grain for the experiment was ground using a 1/16 inch screen, or micronized to give test weights of either 30 or 18 lb. per bushel. These treatments did not affect average milk yield of the cows to a significant extent, with persistency of production being very similar for the groups throughout the trial. Data on milk composition were not conclusive. Digestibility of ration components was not related to method by which the grain was processed. Ruminal VFA values in cows fed micronized grain were marginal in terms of expected effect on milk fat percentage.

Introduction

Micronizing of sorghum grain has been shown to result in greater breakdown (gelatinization) of starch in the grain than is obtained by grinding or by rolling. Moreover, the degree of gelatinization increases as the extent of micronizing, measured in terms of density of product pro-

duced, is increased. Rate of *in vitro* digestion of grain dry matter has been shown to follow a similar pattern (Hinman, 1973; Croka, 1974).

In one trial, Hinman and Johnson (1973) observed ruminal digestion of starch in ground, micronized and steam flaked grain to be 86 and 84, and 81 percent, respectively, which was comparable to values reported by Bush et al. (1973) for starch in ground sorghum grain. Thus, results at this station do not agree with a report by McNeill et al. (1971), indicating considerably lower ruminal digestion of starch in micronized or ground sorghum grain than in grain processed by other methods.

Hinman and Johnson (1973) noted higher starch digestion when sorghum grain was micronized, steam flaked or ground than when it was dry rolled. Relatively large particle size of dry rolled grain compared to ground grain (geometric mean diameter, 1023 vs. 398 microns) may account for the difference between these two, since the degree of gelatinization was nearly the same. Except for the dry rolled grain, total starch digestion was relatively high i.e., 97.8 to 99.6 percent. Similarly, Bush et al. (1972) observed total digestion of starch in ground sorghum grain by dairy cows to range from 96.4 to 98.1 percent, with a slightly higher value with more finely ground grain. Based on these results and other reports (Holmes et al., 1970; McNeill et al. 1971), it appears that any advantage in utilization due to method of processing might be associated with a difference in rate of starch digestion rather than the extent of either ruminal or total digestion.

In work reported last year (Bush et al., 1973), very little difference was found in milk yield of cows fed rations containing sorghum grain processed by fine grinding, steam rolling, or micronizing. However, the fat content of milk produced by cows fed micronized grain was lower than that of cows fed grain processed by other methods.

The objective of this trial was to compare sorghum grain micronized to different degrees with finely ground grain in terms of its feeding value for lactating dairy cows.

Materials and Methods

Thirty lactating cows (12 Ayrshires and 18 Holsteins) were used to compare rations containing sorghum grain processed by (a) fine grinding (1/16 inch screen), (b) micronizing (30 lb. test wt.) or (c) micronizing (18 lb. test wt.). Particle size of the ground grain was about 300 microns (geometric mean diameter), as determined by the method of Ensor et al. (1970). The extent of starch gelatinization measured in terms of amount of maltose released after incubation with beta amylase, was found by Croka (1974) to be 40 and 105 mg/g grain for the 30 and 18

lb/bu products, respectively, as compared to a value of 7.5 mg/g for ground sorghum grain with 398 microns geometric mean diameter (Hinman, 1973).

Sorghum grain comprised 70 percent of the concentrate mixture (Table 1) which was fed in a 50:50 ratio with excellent quality alfalfa hay. The cows were started on the experimental rations approximately 3 months after calving, following a preliminary feeding period of 4 weeks. Ration allowances based on size, age, milk production and fat test were calculated to meet 1971 NRC requirements and maintained at a constant level throughout the 12-week trial.

Milk production was recorded twice daily, with samples from four consecutive milkings each week composited for analysis of total solids and fat percentage. Body weights were recorded on three consecutive days prior to the start and at the end of the trial. Digestibility of ration components was determined during the 7th week of the trial by use of chromic oxide as an indicator. Rumen samples for VFA analysis were taken by stomach tube before the trial and at the end of the 4th and 8th weeks of the trial.

Results and Discussion

Method of processing sorghum grain used in the concentrate mixture did not have a significant effect on average milk yield of cows (Table 2). Persistency of production was very similar for the different groups throughout the trial. Thus, it appears that cows fed rations containing micronized sorghum grain cannot be expected to produce any more than cows fed finely ground grain.

The fat test of milk from cows fed micronized grain was not significantly lower than that of cows fed ground grain; however, the fat tests tended to be erratic due to sampling procedure used in this trial. Since

Table 1. Composition of Concentrate Mixture

Item	Percent
Ingredient	
Sorghum grain	70
Soybean meal (44%)	10
Wheat, ground	10
Dried molasses	7.5
Urea (45% N)	1
Dicalcium phosphate	1
Trace mineral salt	0.5
Protein equivalent content, air dry basis	15.4

Table 2. Ration Characteristics and Responses of Dairy Cows

Item	Method of Processing		
	Ground	Micronized 30 lb./bu.	Micronized 18 lb./bu.
Degree of gelatinization, mg. maltose/g. grain	7.5 ¹	40 ²	105 ²
Feed intake (dry basis)			
Concentrate mix, lb./day	18.3	18.5	18.7
Alfalfa hay, lb./day	18.4	18.2	17.9
Digestibility of ration			
Dry matter, %	67.0	66.2	67.5
Protein, %	71.4	68.9	70.6
Organic matter, %	69.1	68.6	69.6
Milk production			
Milk yield, lb./day ³	46.8	47.1	46.3
Fat %	3.73	3.43	3.60
Non-fat solids, %	8.86	8.96	9.18
Body weight change			
Av. gain for 12 wk., lb.	39.5	54.0	62.2

¹ Data from Hinman (1973).

² Data from Croka (1974).

³ Average values adjusted by covariance analysis on the basis of production during the last 2 weeks of a pre-trial period.

some depression in fat test of cows fed micronized grain was observed in a previous trial (Bush et al., 1973), additional data are needed concerning this point.

Overall digestibility of ration components was similar regardless of the method by which the sorghum grain was processed. This finding confirmed previous work at this station on feeding micronized grain to dairy cows, and lends further support to the suggestion that any improvement due to micronizing would be due to rate of ruminal starch digestion rather than extent of total digestion of the grain.

There was a decrease in molar percentage of ruminal acetic acid with a corresponding increase in propionic acid in cows fed the rations containing micronized grain. Moreover, the observed values were within the range that might be considered marginal in terms of effect on milk fat percentage. As noted above, further work to elucidate this point is needed.

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