Two Reconstitution Methods and Steam Flaking for Milo With Two Levels of Protein Supplementation

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Story in Brief

Three methods of processing milo were compared at two levels of protein supplementation.

Milo reconstituted in the whole form by soaking for three days before grinding and storage in a trench silo was similar to steam flaked milo in rate of gain, feed efficiency and carcass merit of steers. Grains processed by these two methods were utilized up to 19 percent more efficiently than milo which was ground before reconstitution and storage.

The higher level of protein supplementation improved feed efficiency of all three processed grains (an average of 12.3 percent), and also increased rate of gain with whole reconstituted-ground and steam flaked milo.

Introduction

New methods of grain preparation for finishing cattle are continually being explored to improve cattle performance and profit in the feeding operation. At this station and others a sizeable and consistent improvement in feed efficiency has been obtained with high-moisture-harvested and reconstituted milo compared to dry milo. Feeding the high moisture grain has usually resulted in less feed intake but no decrease in daily gain, indicating a greater utilization of nutrients in the high moisture milo compared to the dry milo. Conventional digestibility trials have shown an improved digestibility of the high moisture grain, and observations with the artificial rumen have also demonstrated increased dry matter disappearance. For best results with reconstituted milo, research at the Oklahoma Station has suggested that milo should be reconstituted whole, stored under oxygen-limited conditions, and then ground rather than being ground prior to reconstitution.

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Research at the Oklahoma Station, in agreement with results reported from other stations, has shown that stream flaking of milo has the potential for increasing feed intake, rate of gain and feed efficiency. As with the high moisture grain, conventional digestibility and *in vitro* dry matter disappearance are also improved.

In previous studies on methods of grain preparation, the rate of protein supplementation has been constant. With improved digestibility and utilization of nutrients in the high moisture and steam flaked grain, optimum performance may be realized at a lower level of protein supplementation than that needed for dry grain.

This experiment was designed to compare the effects of three different methods of milo grain preparation at two levels of protein supplementation on the performance of heavy yearling steers.

Materials and Methods

Eighty-four Hereford yearling steers were alloted to the ration treatments and started on test on June 13, 1969. The average initial weight was 740 pounds. The steers were divided into four weight groups of twenty-one head each and randomly alloted to the treatment groups. Two pens of seven steers each were assigned to each treatment.

The ration treatments were:

1. Ground-reconstituted milo plus 1.5 lb. "high protein" supplement.
2. Ground-reconstituted milo plus 1.5 lb. "low protein" supplement.
3. Whole-reconstituted-ground milo plus 1.5 lb. high protein supplement.
4. Whole-reconstituted-ground milo plus 1.5 lb. low protein supplement.
5. Steam flaked milo plus 1.5 lb. high protein supplement.
6. Steam flaked milo plus 1.5 lb. low protein supplement.

Corn silage was fed to all cattle at an approximate level of 15 percent of the total daily dry matter intake. Cattle were fed to appetite twice daily.

The ground-reconstituted milo was ground through a conventional hammer mill equipped with a ¼ inch screen; water was added as the ground milo was augered into a concrete lined trench silo for ensiling and storage. Whole-reconstituted-ground milo was placed in a large steel grain bin and flooded with water. The milo was allowed to soak for three days and then ground through the hammer mill and augered into a concrete-lined trench silo. Considerable sprouting occurred in the whole grain before grinding. The steam flaked milo was obtained from a local feed yard; and fresh daily supply of the steam flaked grain was

picked up each day, except that occasionally on Saturday a large enough quantity was obtained to last to the Monday evening feeding.

All steers were fed supplement at the rate of 1.5 pounds per steer daily. The ingredient makeup of the supplements is shown in Table 1. Both supplements were fortified with minerals, vitamins and an antibiotic; soybean meal and alfalfa meal in the "high protein" supplement were essentially replaced with milo in the "low protein" supplement. The low and high protein supplements analyzed 10.1 and 34.6 percent crude protein and furnished .15 and .52 lb. crude protein per steer daily, respectively.

The proximate analysis of the grains is shown in Table 2. Dry milo was not fed, but composition data of dry milo is shown for comparative purposes. The dry milo, ground-reconstituted milo, and whole-reconstituted-ground milo were from the same source, but the steam flaked milo was from a different source. The milo used for the reconstituted treatments was slightly higher in protein than the steam flaked milo.

Table 1. Ingredient Makeup of Supplements.

	Low Protein Supplement	High Protein Supplement
	Percent	Percent
Soybean meal (44%)	0	70.00
Alfalfa meal	0	15.00
Milo	83.00	0
Limestone	6.00	6.00
Dicalcium phosphate	4.00	2.00
Salt	5.00	5.00
Premix[1]	1.20	1.20
Aurofac 10	0.80	0.80
	100.00	100.00
Crude protein, by analysis	10.1	34.6

[1] Source of vitamin A, D and E and trace minerals.

Table 2. Proximate Composition of Grain[1]

Item	Protein	Fat	Fiber	Ash	NFE
	Percent	Percent	Percent	Percent	Percent
Ground-reconstituted milo	11.56	2.84	3.59	1.38	70.63
Whole-reconstituted-ground milo	12.51	2.45	5.57	1.60	67.87
Steam flaked milo	9.48	2.59	3.03	1.16	73.74
Dry milo	10.71	2.91	3.28	1.48	71.62

[1] All values expressed on a 90% dry matter basis.

All steers received two 15 mg. stilbestrol implants at the beginning of the test period.

Results and Discussion

Grain

The moisture content of the grains and silage as fed is shown in table 3. With the method used only 25.3 percent moisture was realized in the ground-reconstituted milo as fed out of the trench silo. The moisture content of the grain as it was augered into the silo was four to five percent higher than after ensiling, but it tended to dry rather quickly during packing in the trench silo. The whole-reconstituted-grain milo had a longer time to absorb water and a much higher moisture content was realized. In addition, it seemed less susceptible to evaporative loss.

There was a distinctive difference in the particle size, color, and aroma between the ground-reconstituted and whole-reconstituted-ground milo. Even though both grains were ground through the same hammermill screen, the whole-reconstituted-ground milo had a finer more homogenous consistency after ensiling; the ground-reconstituted milo retained a larger particle size. The ground-reconstituted grain had a light color and an alcohol-like aroma, while the whole-reconstituted-ground milo was much darker in color and had a distinctive lactic acid-like aroma. More spoilage was encountered with the ground-reconstituted milo, although it was not extensive.

Method of Processing

Rate of gain was not greatly influenced by processing (see Table 4 for performance and carcass data). Feed intake was very similar for the whole-reconstituted-ground and steam flaked treatments, but intake of the ground-reconstituted milo was considerably higher. This higher feed intake without an accompanying increase in rate of gain was reflected in a lowered feed efficiency for the ground-reconstituted milo. Whole-reconstituted ground and steam flaked milo were utilized 17.6 and 15.9 percent more efficiently, respectively, than the ground-reconstituted

Table 3. Percent Moisture of Grain and Silage.[1]

Date	Ground-reconstituted Milo	Whole-reconstituted-ground Milo	Steam Flaked Milo	Corn Silage
Moisture, %	25.3	38.2	14.4	70.7

[1] Each value is based on 10 samples taken at regular intervals during the feeding period.

Table 4. Feedlot Performance and Carcass Merit.

	Treatments					
	Ground-reconstituted		High protein	Low protein	High protein	Low protein
	High protein	Low protein	Whole-reconstituted-ground		Steam flaked	
No. steers	14	14	14	14	14	14
Initial wt., lb.	740	739	740	740	739	739
Final wt., lb.	1032	1036	1061	1020	1059	1038
Daily gain, lb.	2.55	2.57	2.79	2.43	2.77	2.53
Daily feed intake, lb.[1]						
Grain	17.9	20.4	15.6	15.5	15.6	15.2
Silage	3.7	3.9	3.5	3.4	3.4	3.4
Supplement	1.5	1.5	1.5	1.5	1.5	1.5
Total	23.1	25.8	20.6	20.4	20.5	20.1
Feed/lb. gain[1]	9.10	10.04	7.37	8.39	7.37	8.73
Quality grade	10.55	10.33	10.30	10.23	10.57	11.00
Yield grade	3.30	3.19	3.13	3.09	3.09	3.09

[1] All feed data expressed on a 90% dry matter basis.

grain. Considering only protein supplemented groups, both whole-reconstituted-ground and steam flaked grains were utilized 19 percent more efficiently than ground-reconstituted milo. Differences in carcass merit were small and apparently not greatly affected by processing method of the grain.

These results indicate little difference between whole-reconstituted-ground and steam flaked grain, in terms of feedlot performance and carcass merit of steers. A choice between the two processing methods should be influenced more by considerations other than rate of gain, feed efficiency, and carcass merit. In this trial steers on steam flaked grain "went off feed" more readily, and increases in feed levels had to be made more slowly, than was true with reconstituted grains.

This trial also supports earlier results from the Oklahoma Station which suggested that reconstituting of milo in the ground form is without appreciable benefit. Although there was a large difference in moisture content between the two reconstituted grains in this trial, large improvements in feed efficiency have been previously observed in whole-reconstituted-ground milo at moisture levels similar to that of the ground-reconstituted grain in this trial. Furthermore, the large advantage in efficiency of the whole-reconstituted-ground milo in this trial suggested that the ground-reconstituted grain was behaving essentially as dry milo.

The technique employed in reconstituting the whole grain in this trial is of interest. The grain was stored (while being soaked) only three days, in contrast to storage periods up to 20 days or more usually used in past experiments and in the feeding industry. In addition, the grain was not stored under oxygen-limiting conditions. **In vitro** digestibility studies have suggested that much improvement in efficiency might be attained in one to three days when the whole grain is reconstituted by soaking in water and allowed to stand under atmospheric conditions. This feeding trial supports the *in vitro* observations. This trial was conducted during the summer at warm temperatures; similar results might not be obtained during winter temperatures.

Level of Protein Supplementation

The higher level of protein supplementation improved rate of gain with both whole-reconstituted-ground and steam flaked milo, but not with the ground-reconstituted grain. The greater intake of the ground-reconstituted grain resulted in an increased daily protein intake (.55-.58 lb.) which was actually higher than the greater amount received supplementally by the high protein-supplemented cattle (.37 lb.); this may account for the lack of response in rate of gain from protein supplementation of ground-reconstituted milo.

Feed efficiency was markedly improved by protein supplementation within all processing methods. The improvement ranged from 9.3 (ground-reconstituted) to 15.6 (steam flaked) percent, and averaged 12.3 percent. These results show that the need for supplemental protein is not spared by processing methods such as reconstituting and steam flaking which greatly improved utilization of the grain. It is possible, of course, that alfalfa meal could have contributed to the superior performance of the high protein supplement.

Methods of Utilizing the Sorghum and Corn Plants for Finishing Cattle[1]

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Story in Brief

Shelled corn produced higher gains and was utilized 13.1 percent more efficiently than ear corn, considering both dry and high-moisture-harvested (HMH) grains.

Daily gains were very similar for dry vs. HMH shelled corn, and also for dry vs. HMH ear corn. HMH shelled corn was utilized 11.9 percent more efficiently than dry shelled corn, while HMH ear corn was utilized only 3.9 percent more efficiently than dry ear corn.

Corn and sorghum stovers were similar in feeding value to corn silage at a level of 20 percent of the dry matter of the ration. Sorghum stover was slightly superior to corn stover.

Introduction

Considerable research has indicated a large (10-20 percent) advantage in efficiency of feed conversion for high-moisture-harvested (HMH) milo over dry milo. The relative value of HMH shelled corn and ear corn compared to the respective dry products has been rather variable in previous research reported in the literature. In general, processing methods

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