A Comparison of Dry and High Moisture Methods of Processing Milo

Dennis White, Robert Renbarger, James Newsom, Vincent Neuhaus and Robert Totusek

Story in Brief

Seven kinds of processed milo — coarsely rolled, finely ground, very finely ground, high moisture harvested (HMH)-ground, high moisture harvested (HMH)-rolled, reconstituted-ground and reconstituted-rolled — were compared in a high concentrate ration for finishing cattle.

Calves fed HMH-rolled and reconstituted-rolled milo gained considerably faster than the other treatment groups. Differences in gain among the other treatments were small. Of the dry processing methods, very fine grinding resulted in the best feed efficiency, 6.7 percent better than fine grinding; the finely ground milo in turn was utilized 6.7 percent more efficiently than the coarsely ground grain. Grinding of HMH and reconstituted milo improved efficiency of utilization about the same as very fine grinding of the dry product, 9.1 and 7.3 percent better than fine grinding. The largest improvements in efficiency resulted when the wet grains were rolled. The HMH-rolled and reconstituted-rolled grains were utilized 18.8 and 16.9 percent more efficiently, respectively, than finely ground milo.

Introduction

Several trials have shown very little difference between dry rolled and finely ground milo. However, work at this station has indicated that if milo is ground, it should be ground rather finely for most efficient utilization (1/8 in. screen). A 1/8 in. hammermill screen has been the smallest used in previous research.

Milo which is dry rolled is often rolled very coarsely, with many kernels passing through the roller unbroken. Whole milo is not well utilized by cattle.

Previous research has shown that both reconstituted milo and high-moisture-harvested milo are more efficiently utilized than dry milo. Reports of a 10 percent or greater increase in feed efficiency due to high moisture processing are not uncommon.

Results of another trial at this station indicate that at a moisture level of 30 percent, reconstituted milo must be stored in the whole form to benefit from the reconstituting process.

In cooperation with USDA Agri. Research Service, Animal Husbandry Research Division.

The objective of this experiment was to compare three dry and four high moisture types of processed milo — coarsely rolled, finely ground, very finely ground, high moisture harvested-ground (HMH-ground), high moisture harvested-rolled (HMH-rolled), reconstituted-ground and reconstituted-rolled.

Methods and Procedures

Eighty-four Hereford and crossbred (Angus x Hereford) steers with an average weight of 511 lb. and an average age of 9 months were used in a feeding trial. The calves were divided into two blocks on the basis of shrunk weight, condition score and breed, and then were randomly assigned to the seven treatments within each block. Four pens of three steers each were assigned to each treatment.

The calves were started on feed 6 days before the trial began. The initial ration consisted of 8 lb. of test ration and 4 lb. of cottonseed hulls per head per day. The test ration was gradually increased until the steers were receiving 13 lb. of the test ration on the sixth day following initial feeding, at which time the feeding trial started.

The composition of the ration is shown in Table 1. All ingredients other than milo were combined into a premix, which was mixed with the processed milo in the ratio of 83.4 percent milo and 16.6 percent premix. Stilbestrol was not used in this trial. Proximate analyses of the processed milo grains and premix are shown in Table 2.

Processing Method

Coarsely rolled milo was produced by setting the rollers to allow approximately 25 percent of the milo grains to be unbroken. Finely and very finely ground milo were produced with a hammer mill, using ⅛ in. and 1/16 in. screens, respectively. The HMH milo was combined when it had matured to a moisture level of 30-31 percent, then stored in the

Table 1. Ration Composition.

Ingredient	Amount Percent
Milo	83.4
Alfalfa hay, chopped	6.0
Cottonseed hulls	4.0
Cottonseed meal	4.0
Urea (42% nitrogen)	1.0
Salt	1.0
Bonemeal	.6
	100.0
Added per lb. of ration	
Vitamin A	1500 I.U.
Aureomycin	5 mg.

Table 2. Proximate Analyses.

Feed	Dry[1] Matter	Ash[2]	Crude[2] Protein	Ether[2] Extract	Crude[2] Fiber	NFE[3]
	Percent					
Milo						
Coarsely rolled	85.3	1.37	8.86	3.85	1.95	83.97
Finely ground	85.5	1.16	9.35	3.0	2.1	84.39
Very finely ground	85.5	1.31	10.28	3.65	1.95	82.81
HMH-ground	70.1	.94	8.36	2.3	1.1	87.3
HMH-rolled	68.9	.91	8.06	1.8	.85	88.38
Recon.-ground	74.3	1.27	8.77	3.4	1.45	85.11
Recon.-rolled	73.4	1.03	9.05	2.9	1.40	85.62
Premix	90.9	10.82	36.7	6.05	25.29	21.14

[1] Average of determinations of 24 samples.
[2] Average of 2 determinations.
[3] 100 — (Sum of figures reported for ash, crude protein, ether extract, and crude fiber).

whole form in a 14 x 27 ft. Harvestore structure. Reconstituted milo was produced in a 14 x 27 ft. Harvestore structure by adding water to the air-dry grain as it was augered into the structure, raising the moisture level to approximately 26 percent. Both reconstituted and HMH milos were either ground (1/8 in. screen) or rolled (.003 in. tolerance between rollers) just prior to feeding.

All milo used in this trial was of the variety Northrup King 222 and was produced in the same field on the Fort Reno Station. In order to minimize variation in the milo due to location in the field, the milo was strip combined so that all areas of the field were represented in all treatments. All rolling was done with a heavy duty Ross 18 x 24 in. roller mill.

Feeding

The coarsely rolled, finely ground, and very-finely ground grains were processed, combined with the premix, and stored in one-ton quantities. The four "wet" grains (HMH-ground, HMH-rolled, reconstituted-ground and reconstituted-rolled) were processed daily, wth the exception that enough was processed on Friday to feed over the weekend.

The steers were fed once daily in sufficient quantities to assure availability of feed until the next feeding. Unconsumed feed was removed and weighed back as necessary to assure that only fresh feed was available at all times. The steers had access to open-sided sheds and outside lots, with water (warmed in winter) available at all times.

Data Obtained

Feed samples were taken at regular intervals during each 28-day period for proximate analysis and dry matter determination. Dry matter percentages were used to adjust all rations to a 90 percent dry matter basis. The grains were sieved and test weights were taken to determine particle size and density, respectively, as shown in Table 3.

Initial and final weights were taken after a 16-hr. shrink off feed and water. Intermediate weights were taken at 28-day intervals, after a 16-hr. shrink with no water (feed was available). The steers were slaughtered on two different days after an average of 174 days on trial. Carcass data was obtained after a 36-hr. cooler chill. Bladders were collected at slaughter, and the amount of calculi in each bladder was determined.

Results and Discussion

HMH-rolled and reconstituted-rolled milo was 37.8 and 32.7 percent bulkier, respectively, than finely ground milo (see Table 3). The very-finely ground and the HMH-ground milos were very similar in particle size; however, the fluffy nature of the high moisture grain was very evident as shown by the test weight per bushel (density) of the two processed grains (40.8 and 31.3 lb. per bushel, respectively, for very finely ground milo and HMH-ground milo).

Performance information is summarized in Table 4. Statistically, rate of gain was not siginificantly affected by method of milo processing; how-

Table 3. Particle Size[1] and Density[2] of Processed Milo.

Process	Screen Size, in. 12/64	8/64	1/12	1/18	1/25	40 Mesh	40 Mesh	Wt.[2] Per Bu.
	% Retained on Screen						% Thru	lb.
Coarsely rolled	0	33.4	59.8	5.8	.62	.17	.18	53.3
Finely ground	0	.14	.90	9.64	18.1	32.6	38.6	44.7
Very finely ground	0	.12	.12	.39	4.17	28.6	66.6	40.8
HMH-ground	0	.56	1.9	5.9	9.0	18.3	64.3	31.3
HMH-rolled	6.2	26.6	19.8	7.8	3.3	9.0	27.2	27.8
Recon.-ground	0	.19	1.0	11.6	14.7	22.8	49.7	37.6
Recon.-rolled	4.6	27.2	24.3	10.9	3.8	7.2	22.0	30.1

[1] Particle size: Four 100 gm. samples of each grain were sieved.
[2] Test weights reported are an average of four determinations, and are on a 90% dry matter basis.

Table 4. Feedlot Performance (174 days).

	Coarsely Rolled	Finely Ground	Very Finely Ground	HMH Ground	HMH Rolled	Recon. Ground	Recon. Rolled
No. steers	12	12	11	11	12	12	11
Initial wt., lb.	513	514	518	495	513	506	516
Final wt., lb.	902	930	908	886	972	908	981
Daily gain, lb.	2.23	2.34	2.18	2.18	2.58	2.25	2.62
% change[1]	—4.7		—6.8	—6.8	10.3	3.8	12.0
Daily feed, lb.[2]	16.9[c]	16.8[c]	14.7[a]	13.4[e]	15.2[b]	15.0[c,b]	15.7[d]
Feed/lb. gain, lb.[2]	7.60[a]	7.12[a]	6.64[b]	6.47[b,c]	5.78[d]	6.60[b]	5.92[c,d]
% change[1]	—6.7		6.7	9.1	18.8	7.3	16.9

[1] Compared to finely ground milo.
[2] Any 2 averages without a common letter differ significantly ($P < .05$).

ever, it is interesting to note that the calves fed HMH-rolled and reconstituted-rolled milo gained faster than those fed dry milo or the ground "wet" milos.

The feed intake of the calves fed very finely ground milo, HMH-ground milo, HMH-rolled milo, reconstituted-ground milo and reconstituted-rolled milo was significantly lower than that of calves fed coarsely rolled milo and finely ground milo. This is simply a reflection of improved feed utilization; note that the feed efficiency figures for these treatments followed the same pattern, and these differences were also significant.

Rolling of HMH milo and reconstituted milo markedly improved feed efficiency over the other processing methods in this trial. Apparently the rolling process imparts a beneficial effect to "wet" grains, similar to that which has been observed with both dry and streamed milo.

The results of this trial indicate that if milo is dry rolled, no grain should pass through the roller unbroken. It was also apparent that very finely ground milo was utilized more efficiently (6.7 percent) than was the finely ground milo, and a marked decrease in feed intake and gain due to a very floury texture did not occur.

Carcass merit and dressing percentage were not significantly affected by processing method, as shown in Table 5. Quantities of calculi in the bladder were very small and unrelated to the processing method.

Table 5. Slaughter and Carcass Information.

	Method of Processing Milo						
	Coarsely Rolled	Finely Ground	Very Finely Ground	HMH Ground	HMH Rolled	Recon. Ground	Recon. Rolled
Dressing %[1]	59.6	60.6	59.4	61.4	60.2	59.2	60.0
Carcass grade[2]	9.2	9.7	9.0	9.5	9.8	9.3	9.9
Ribeye area, sq. in.[3]	10.8	10.7	11.0	10.6	11.5	10.5	11.0
Fat thickness, in.[4]	0.66	0.75	0.68	0.65	0.71	0.68	0.76
Marbling score[5]	11.9	12.9	11.7	12.4	13.3	12	14.3
Cutability, %[6]	49.5	48.7	49.6	49.5	49.3	49.3	49.9

[1] Calculated on basis of Ft. Reno live shrunk weight and chilled carcass weight.
[2] U.S.D.A. carcass grade converted to following numerical designations: av. choice-11, low choice-10, high good-9, av. good-8, low good-7.
[3] Determined from tracing at the 12th rib.
[4] Average of three measurements determined on tracing at the 12th rib.
[5] Marbling scores. 1 to 30, 11=slight, 12=slight plus, 13=small minus 14=small, 15=small plus.
[6] Percent of boneless trimmed retail cuts on carcass basis=51.34 − 5.78 (fat thickness) − .462 (% kidney fat) + .740 (ribeye area) − .0093 (chilled carcass wt.).