indicates that the overall protein quality of the ration was higher for high moisture corn.

In vitro gas production data in this laboratory has previously indicated that the energy from ground high moisture corn might be more readily available than that of dry corn. Thus microbial protein synthesis could occur at a great rate using more rumen NH_3-N in the process. Studies with corn silage have indicated that the soluble NPN derived from plants is degraded by rumen microbes at a slower rate than urea; therefore the soluble NPN in high moisture corn could contribute ammonia at a more efficient rate for microbial protein synthesis. Since deamination of the soluble NPN fraction would continue over a longer time, ammonia losses by absorption into the blood would be limited.

Conclusion

This study indicates that nitrogen is utilied in high moisture corn rations efficiently and that urea can as effectively supplement high moisture corn rations as dry corn rations. In addition, the results suggest that supplemental protein levels necessary for optimum performance might be lower with high moisture corn rations if bacterial protein production is increased. Further studies will determine the extent to which urea can be utilized and levels of protein required with high moisture corn rations.

Influence of Processing on the Digestion of Corn Based Rations by Steers

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Story in Brief

Four mature Heredford steers were used to compare the digestion of dry rolled (DR), steam flaked (SF), propionic acid treated whole shelled high moisture (AHMC), and coarsely ground ensiled high moisture (GHMC) corn based rations.

In general, all four rations were similar in digestibility of dry matter, organic matter, crude protein, and acid detergent fiber. However, starch digestibility of SF and GHMC rations (99.14%) were higher than AHMC (95.81%) and DR (96.34%) rations. This might indicate an increased availability of energy from starch in SF and GHMC as compared with AHMC and DR rations.

Introduction

Knowledge concerning the effects of processing corn grain upon animal performance has been available for many years. Several workers have shown that feeding of heat processed (steam flaked) corn results in improvements of around 7% in feed efficiency for finishing cattle as compared to such conventional processing techniques as dry grinding and rolling. Recently, however, high moisture processing and storage of corn grain has come into extensive use, particuarly in the feedlot industry. Since little information is available concerning the digestibility of ration components of high moisture corn diets, study was undertaken to compare the digestibility of four corn rations: dry rolled (DR), steam flaked (SF), propionic acid treated whole shelled high moisture corn (AHMC), and coarsely ground ensiled high moisture corn (GHMC).

Materials and Methods

Four mature Hereford steers weighing an average of 944 pounds were housed in metabolism stalls. They were fed equal portions at two daily feedings and received the following amounts of ration dry matter (lbs) per day: DR (9.69), SF (9.87), AHMC (9.93) and GHMC (9.76). Composition of the rations is given in Table 1. Rations varied only by the method of processing.

AHMC was harvested at approximately 23 perecent moisture and treated in the whole shelled form with a commercial mixture of propionic acid (Sentry, Union Carbide Corp.) at a level of 19 lbs. preservative per ton of moist grain. The bushel weight of the final product was 49.2 lb.

Table 1. Composition of Rations

Ingredient	% in ration D.M. basis
Corn	78.0
Cottonseed hulls	15.0
Cottonseed meals	4.6
Urea	0.7
Dicalcium phosphate	0.5
Calcium carbonate	0.7
Trace mineralized salt	0.5
Vit A	150g/ton
Vit D	40g/ton
Aurofac-50	180/ton

SF was steamed at atmospheric pressure at 210-220° F for 20-23 minutes followed by rolling. The final product contained approximately 19 percent moisture with a bushel weight of 34.7 lb.

GHMC was coarsley ground through a hammermill and stored in a concrete pit silo at approximately 29 percent moisture. The moisture content of the DR grain was 88.3 percent. The particle sizes of GHMC and DR are given in Table 2.

The trial consisted of four feeding periods, each feeding period being 14 days. Each steer received a different ration in each feeding period so that by the end of the trial each ration had been fed to all four steers.

The first 10 days of each feeding period served as an adjustment period to the ration. During days 11-14 a total collection of feces was taken, weighed, and a sample was obtained for chemical analysis. The fecal samples were dried at 150° F for 48 hours and ground through a 1 mm screen in a Wiley mill. Samples of the rations also were taken each day during the fecal collection period and ground in the manner described above.

Fecal and ration samples were analyzed for dry matter, ash, organic matter, crude protein, acid detergent fiber, and starch.

Results and Discussion

Chemical composition of the rations is shown in Table 3. In general, most components were about the same for all four rations; how-

Table 2. Particle size (% retained on screen)

Grain	Screen Size (mm)							
	8	4	2	1	0.5	0.25	0.125	Pan
GHMC	0.70	13.8	39.6	30.8	12.7	1.5	0.9	----
DR	1.3	41.7	39.7	9.2	3.5	3.0	1.2	.40

Table 3. Chemical composition of rations (DM basis)

	Dry Matter	Ash	Crude Protein	Starch	Acid Detergent Fiber
	%	%	%	%	%
DR	88.19	3.56	11.66	68.92	14.94
AHMC	81.08	3.08	11.76	65.24	13.89
GHMC	74.73	3.12	11.96	75.69	13.04
SF	82.97	2.60	10.63	62.44	14.69

ever, it should be noted that the starch content of GHMC is somewhat higher than in the other rations.

Digestion coefficients for the various ration components are given in Table 4. Little difference was observed between the rations in digestibility of dry matter (DM), organic matter (OM), crude protein (CP) and acid detergent fiber (ADF). Ash digestibilities varied considerably between rations.

Perhaps the most interesting result in the difference in starch digestibilities between the four rations; starch digestibilities on SF and GHMC were higher (99.14 percent) than on AHMC and DR rations (95.81 percent and 96.34 percent respectively). This difference was judged statistically significant ($P<.05$); that is there are less than five chances in 100 that the observed difference is not real. This indicates that steam flaking and high moisture ensiling of corn grain results in increased digestion of the starch portion of the ration, possibly making more energy available to the animal. There is some evidence to indicate that this increased starch digestion observed in SF and GHMC may be due to more complete breakdown of starch in the rumen of the animal.

In brief, all four rations compare favorably in the digestion of most ration components. However, AHMC and SF corn rations may result in more available energy to the animal for productive purposes than AHMC and DR due to increased digestion of starch.

Table 4. Digestion Coefficients

	DM	OM	ASH	CP	ADF	Starch
	%	%	%	%	%	%
DR	79.90	80.89	53.94	68.38	45.61	96.34
AHMC	78.51	79.90	46.96	66.00	39.10	95.81
GHMC	80.35	81.58	42.26	66.72	36.45	99.14
SF	80.36	81.69	30.33	66.05	40.09	99.14