these calculations had been based upon the methane reductions witnessed the first six hours following feeding, instead of over the 24-hour period, energy savings would boost feed efficiency approximately twice that stated above. Thus energy conservation from reduced methane production can explain much of the improvement in animal performance reported from feeding of rumensin.

Chemical Characterization of Ensiled Ground High Moisture Corn Grain

J. H. Thornton, F. N. Owens, D. E. Williams and M. Arnold

Story in Brief

Analysis of ensiled corn samples from 12 horizontal silos indicate large differences exist both within and between silos. In general, as dry matter content of ensiled ground corn increases, lactic acid levels decrease and pH increases, soluble nitrogen levels decrease and *in vitro* dry matter digestibility declines. Larger particle size was also associated with lower dry matter digestibility. Approximately 90 percent of the soluble nitrogen was in the form of non-protein nitrogen.

These results indicate that higher moisture grain may be better preserved and may also be more readily digested, possibly improving efficiency of feed utilization. However, ensiling drier corn will produce lower levels of soluble nitrogen, which should prevent depressed feed intake. Processing grain to smaller particle size before ensiling should insure better digestion and may also improve preservation quality.

Introduction

Preservation of high moisture corn by ensiling has become increasingly popular in recent years. This trend will likely continue as costs of alternative methods of grain preservation, such as drying with fossil fuels, continue to increase. Some producers are hesitant to adopt high moisture grain storage

because of variation in quality of the product and problems associated with feeding high moisture grain. Such worries could be reduced if factors affecting quality and subsequent animal performance were better described.

The purpose of this study was to characterize ensiled ground high moisture corn grain preserved in large horizontal silos.

Materials and Methods

Thirty-one samples of ensiled ground high moisture corn from the 1975 crop year, were obtained during early winter 1976 from 12 horizontal silos located on the High Plains region of Oklahoma and Kansas. Samples were analyzed for dry matter, total nitrogen, soluble nitrogen, soluble non-protein nitrogen, pH, lactic acid, acetic acid, particle size, and *in vitro* dry matter digestibility.

Results and Discussion

Ensiled corn in some of the individual silos sampled was quite uniform in appearance and analysis of samples from different areas in these silos revealed very similar characteristics. In contrast to this, some silos had layers of material differing in appearance, and samples from different layers revealed strikingly different chemical compositions. Differences within certain silos were as great as differences between silos.

Rather than present data by sample or silo, the relationship between variables measured are shown by graphing analyses against moisture content or particle size of the samples taken. Table 1 shows the relationships of all measurements.

Dry matter is related rather closely to several variables, as indicated by the asterisks. Dry matter is one of two factors which can be altered at ensiling time. For this reason, plots of these relationships are shown. Figures 1 and 2 show that as grain dry matter decreases, the pH of the sample declines and higher lactic acid values are present. Figure 3 indicates that soluble nitrogen levels decrease as grain dry matter increases. The relationship between soluble nitrogen and soluble non-protein nitrogen (Figure 4) is extremely close with approximately 91 percent of the soluble nitrogen being non-protein nitrogen. *In vitro* dry matter disappearance of unground samples (Figure 5) reveals that drier grain is less readily digested in the rumen.

The other variable which can be modified when grain is placed in silos is particle size. Figure 6 shows that ensiled grain with smaller particle size is more easily digested.

Since high levels of lactic acid and low pH are thought to be indicative of high quality silage, lower dry matter (higher moisture) grain and finer particle size would be expected to produce the best quality ensiled grain. However, such material would be expected to produce higher levels of soluble nitrogen,

Table 1. Relationships between characteristics of ensiled corn grain[1]

	D.M.	pH	Lactic Acid	Acetic Acid	Soluble		Pepsin Insol.	IVDMD	
					N	NPN	N	21 HR.	48 HR.
pH	.65**	------	------	------	------	------	------	------	------
Lactic Acid	-.69**	-.87**	------	------	------	------	------	------	------
Acetic Acid	-.42*	-.11	.32	------	------	------	------	------	------
Soluble N	-.81**	-.80**	.71**	.21	------	------	------	------	------
Soluble NPN	-.79**	-.74**	.67**	.29	.98**	------	------	------	------
Pepsin Insol N	.32	.36*	-.29	-.07	-.61**	-.57**	------	------	------
IVDMD, 21 HR.	-.62**	-.31	.34	.40*	.35	.36*	-.07	------	------
IVDMD, 48 HR.	-18	-.03	.18	.20	-.15	-.15	.18	.37*	------
Particle size	.44*	.52**	-.49**	-.09	-.38*	-.38*	-.01	-.51*	-.43*

[1]Higher values represent closer relationships.
*P<.05, **P<.01

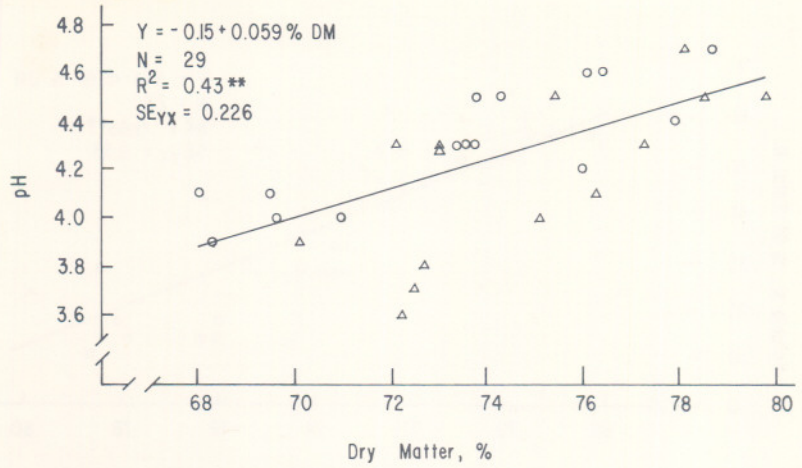

Figure 1. Relationship between percent dry matter and pH.

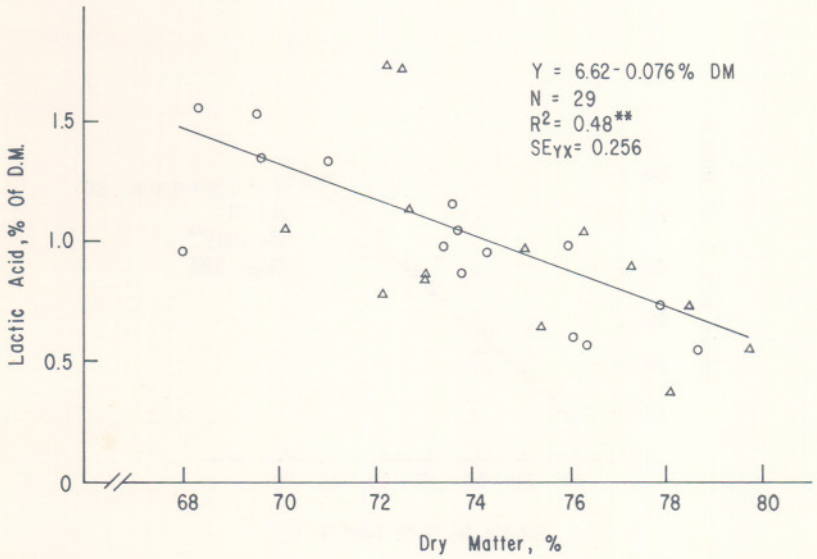

Figure 2. Relationship between dry matter and lactic acid.

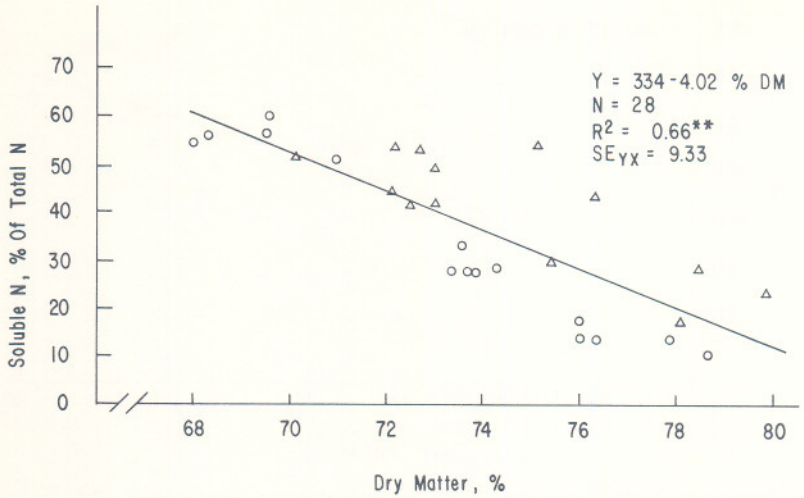

Figure 3. Relationship between dry matter and soluble nitrogen.

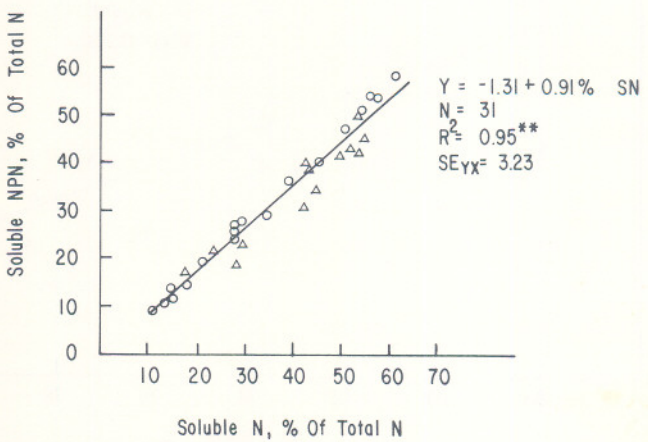

Figure 4. Relationship between soluble nitrogen and soluble NPN.

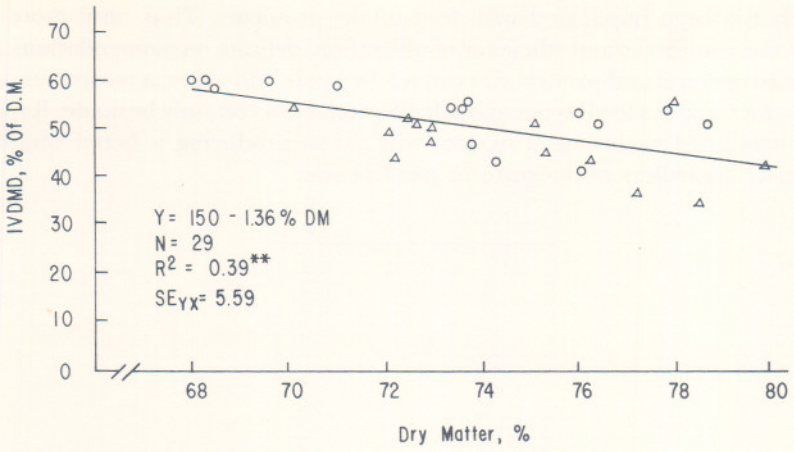

Figure 5. Relationship between dry matter and *in vitro* D.M. disappearance in 21 hrs. (unground).

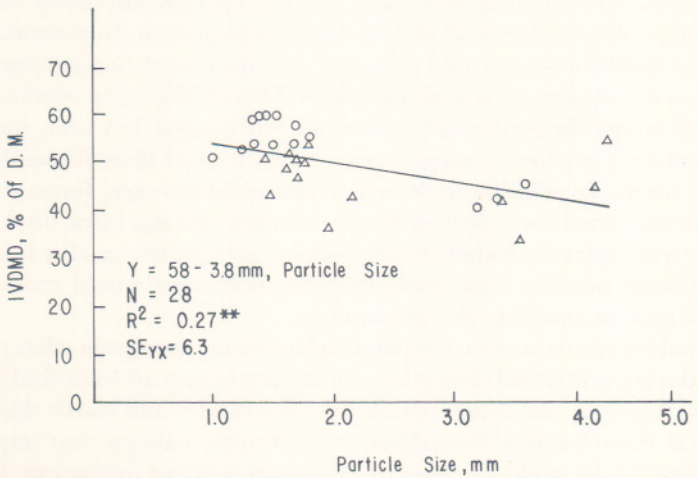

Figure 6. Relationship between geometric mean particle size and *in vitro* D.M. disappearance in 21 hrs. (unground).

which has been implicated with feed intake problems. Thus until more is known about intake and efficiency of utilization, definite recommendations as to moisture level and particle size can not be made. However, a recommendation which applies to all types of ensiled material can certainly be made. Rapid and continued exclusion of oxygen will aid in producing a better quality material regardless of moisture or particle size.

Fermentation and Digestion of Formaldehyde Treated Ensiled High Moisture Corn Grain

J. H. Thornton, F. N. Owens, D. E. Williams and E. C. Prigge

Story in Brief

Formaldehyde application of 0.2, 0.3, and 0.5 percent effectively reduced solubilization of ensiled ground high moisture corn protein. In general, these levels of formaldehyde increased intestinal, but decreased ruminal and total digestion of dry matter, starch, and nitrogen. Microbial protein synthesis per unit of dry matter digested in the rumen was unchanged, however, the total daily quantity of microbial nitrogen was reduced by all three formaldehyde treatment levels. In addition to decreased microbial nitrogen, formaldehyde treatments increased the supply of dietary nitrogen and increased total nitrogen to the true stomach or abomasum. Because corn protein quality is poorer than microbial protein, these formaldehyde treatments would reduce the quality of protein reaching the abomasum.

Formaldehyde treatment of ground high moisture corn grain offers potential for reducing protein solubilization, which may in turn alleviate feed intake problems. However, the depression in total dry matter and starch digestion observed at these levels of formaldehyde treatments indicate that improvement in feed intake could be offset by decreased nutrient utilization. Levels above 0.2 percent are useless. If lower levels of formaldehyde will prevent protein solubilization without decreasing total nutrient utilization, such