THE STORAGE AND UTILIZATION OF HIGH MOISTURE CORN FOR FEEDLOT CATTLE

by

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B. S., Kansas State University, 1974

A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Animal Science and Industry

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1977

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THIS BOOK CONTAINS NUMEROUS PAGES WITH DIAGRAMS THAT ARE CROOKED COMPARED TO THE REST OF THE INFORMATION ON THE PAGE.

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ACKNOWLEDGMENTS

I would like to take this opportunity to thank the members of my committee: Dr. Keith Bolsen, Dr. Jack Riley, and Dr. Gerry Posler, for their suggestions, guidance, and encouragement throughout my graduate program at Kansas State University.

I am especially grateful to Dr. Bolsen, my major professor, for his advice, counseling and patience in completing this report.

This manuscript is dedicated to my wife, Janice, for her love and encouragement throughout my graduate program. Also, a special sincere thanks to my parents, Mr. and Mrs. Dale Soderlund, for their support and understanding.

INTRODUCTION

In the past two decades there has been an increasing interest in the use of high moisture grains for feedlot cattle. Reduced field and harvesting losses, and earlier harvesting are factors which have contributed to this increase. Also, new developments in storage methods in the past 5 to 10 years have enabled cattle feeders to store high moisture grains with minimum spoilage.

Methods available for storing high moisture grain today include grinding and packing into upright and horizontal silos or storing the grain in the whole form in oxygen-limiting silos or with chemical treatment. The type and size of the feeding operation will influence which system should be used. Regardless, careful management is necessary to insure preservation of high moisture grain.

This report will review the recent research findings concerning the storage of high moisture corn and discuss factors which affect its storage and feeding value.

HIGH MOISTURE CORN (MAIZE)

Various names have been used to describe this feed. However, high moisture corn (HM Corn) seems to be the most frequently used term and will be used in this report. Other names such as cornage, corn-grain silage, and ensiled high moisture corn grain silage have been used and are considered synonomous to high moisture corn.

I shall refer to corn that has been harvested and stored at a moisture content varying from 20 to 40%, but most typically at about 30% as HM Corn. Research has shown that cereal grains are physiologically mature when the moisture content of the grain drops below 38 to 40% (Wagner, 1973). At this stage of growth, all the dry matter has been deposited in the kernel and no additional dry matter accumulates as the grain dries further. When corn is physiologically mature, a black layer develops in the base of the kernels where they attach to the cob (Stevenson, 1975). This is a more positive method of determining physiological maturity than grain moisture content and may be a helpful tool in determining harvest time.

The most generally recommended moisture level for harvesting, storing and feeding HM corn is 25 to 30% with lower and upper limits of 20 and 35%, respectively. These levels minimize field, harvesting, and storage losses and provide favorable conditions for fermentation.

Harvesting corn at recommended moisture levels will reduce total losses 5 to 10% compared to harvesting field dried corn

(Merrill, 1971). There is less lodging and ear drop and harvest can begin 2 to 3 weeks earlier which protects against losses due to poor weather later in the season.

Storage losses depend on moisture levels. Excessive fermentation occurs when the recommended moisture levels are exceeded, resulting in increased energy losses and increased protein breakdown (Fox, 1976). Corn dry matter intake by cattle may be low if the moisture content is excessive (Goodrich, 1976). If the moisture content is too low, very limited fermentation will occur and destructive organisms can flourish (Stevenson, 1975). Also, the exclusion of air is more difficult and mold growth and heating can result in energy losses and heat damaged protein.

METHODS OF STORAGE--ENSILING

Preservation of HM corn by ensiling is achieved by the formation of organic acids during fermentation by anaerobic bacteria. The pH of the ensiled grain drops to 4.5 to 5.5 as acid build-up occurs (Goodrich, 1975). This prevents the growth of undesirable organisms whose end products cause reduced palatability, nutrient loss or toxicity (Oldsfield, 1973).

It is essential to exclude air when ensiling HM corn. How this is done varies with the method of storage, but usually includes some combination of processing the grain, packing to exclude air internally and sealing the exposed surfaces.

The major advantages and disadvantages of the ensiling methods are discussed in the following section.

Oxygen Limiting Structures

Advantages

1. HM corn can be stored whole. This eliminates the need for processing prior to packing and thus requires less labor and equipment during harvest. Also, corn needs no processing when fed in high concentrate rations (Dexheimer, 1973).

2. HM corn can be stored in a wide range of moisture. This allows a longer harvest period and, in some cases, earlier harvesting.

3. Less storage losses with small quantities stored. Dry matter losses are expected to be 2 to 5% lower in oxygen limiting structures than in upright concrete silos and 5 to 10% lower than in horizontal silos (Fox, 1976).

4. More flexibility in the rate of feeding. This is especially true for farmer-feeder operations that have variations in the number of cattle on feed throughout the year. In structures that are not oxygen limiting, minimum amounts of grain must be removed from the surface daily to prevent spoilage.

Disadvantages

1. Cost. This type of storage has the greatest cost per bushel of corn stored.

2. Limited rate of removal. When large quantities of corn are needed in a relatively short time, such as in large feedlots, this system will not be applicable.

Upright, Concrete Silos

Advantages

1. Utilizes existing structures. Many cattle feeders have upright silos that were originally built for storing forage. These structures are usually adequate for storing HM corn.

2. Less storage losses than horizontal silos for small quantities. Fox (1976) reported that dry matter losses in concrete silos are usually 3 to 5% less than horizontal silos depending on the quantity stored and the management practices used.

Disadvantages

1. Must process the corn prior to storage. More equipment and labor will be required at harvest time.

2. Minimum rate of removal required. A minimum of 2 inches in cold weather and 3 to 4 inches in warm weather should be removed daily to prevent spoilage (Geasler, 1971). This means that a minimum number of cattle must be fed to assure that this amount will be removed daily.

3. More storage loss than the oxygen limiting structure.

4. Limited rate of removal. As with the oxygen limiting structure, there are limitations on the amount of corn that can be removed during a given period of time. This would definitely hinder large feedlot operations that require the removal of large quantities to maintain feeding schedules.

Horizontal Silos

Advantages

1. Cost. This type of storage has the lowest cost per bushel of corn stored.

2. Fast rate of removal. This is the best method for large operations based on the volume of corn stored and the volume that can be fed in a short time.

Disadvantages

1. Must process the corn prior to storage. It is essential to process the corn in order to insure proper packing and exclusion of internal air. Most grinding is done at the silo, using a hammer mill, burr mill, or blower with a recutter attachment.

2. Minimum rate of removal required. To prevent spoilage it is necessary to remove at least 4 inches per day from the surface of this type of silo (Geasler, 1971).

3. Highest storage losses for small operations. Small feedlots are not able to remove sufficient amounts from the surface to prevent spoilage. The size of silo should be determined by the number of cattle to be fed and the lbs. of corn fed daily.

METHODS OF STORAGE--CHEMICAL PRESERVATION

Chemical preservation of HM grain is a recent development in the United States. This method may prove to be the most efficient for storing HM grains since the treated grains can be transported without the risk of spoilage. Also, storage shrink is almost entirely eliminated because the grain does not ferment or respire (Driedger, 1976). Most commercial preservations are predominately propionic acid, however, various combinations of other volatile fatty acids and propionic acid have been effective. Formulin is another compound that is presently being used in combination with propionic acid. Application of organic acids is usually done by spraying the acid on the grain as it is being conveyed to the storage site. Proper application requires good mixing and the grain should be turned at least once after application. The rate of application depends on storage time and moisture content of the grain (Driedger, 1976). As the moisture content increases, it is necessary to proportionately increase the amount of acid. Likewise, the longer the grain must be stored, the more acid needed. Merrill (1971) reported that treating HM corn (31.5% moisture) with propionic acid at a level of 1.5% w/w was effective in preventing spoilage.

Advantages

1. Wide variety of storage structures can be used. Treated HM corn can be stored in upright and horizontal silos, flat storage grain bins, wooden bins or outside open piles. Piles should be on well drained concrete or asphalt slabs with access to the perimeter. The corn should be fed from around the pile, continually renewing the surface (Driedger, 1976). If galvanized or steel bins are used, they should be protected by an acid resistant coating to prevent corrosion.

2. Corn can be moved to different locations without spoilage. This may become an important factor if high moisture grains become commercial commodities.

3. Low storage loss. Dry matter loss is essentially eliminated since fermentation and respiration of the grain are inhibited by the chemicals.

4. Corn is stored whole.

Disadvantages

1. Chemically treated corn is classified as sample grade. It cannot enter normal channels of grain commerce and; therefore, it must be fed to livestock.

2. Cost. Estimates on chemical costs range from 13 to 20 cents per bushel of corn stored. (Duff, 1976).

3. Chemicals used are corrosive. Generally this problem has been exaggerated. Acids must be handled with care, but corrosion of equipment and storage facilities does not appear to be much different than with traditional silages (Riley, 1976).

FEEDING VALUE OF HM CORN FOR FEEDLOT CATTLE

The most important measures for the nutritional evaluation of feedlot performance of beef cattle are rate of gain and feed efficiency (Merrill, 1971). Feed intake is needed to determine these measures; but is less important and will not be discussed in this section. Feed efficiency is perhaps the most important measurement if the rate of gain is within acceptable levels. Wagner (1973) reported that a 10 percent improvement in feed efficiency has approximately four times as much impact on cost of gain as a 10 percent improvement in rate of gain. However, an increase in rate of gain or feed intake is usually reflected in an improvement in feed efficiency.

HM corn stored in oxygen-limiting structures

A considerable amount of research has been conducted to determine the feeding value of HM corn stored in an oxygen-limiting structure. Table 1 summarizes 10 trials conducted at various locations across the U.S. Dry rolled corn was the control in each trial.

Average daily gain was only slightly affected by corn treatment with an average difference of 1.9 percent in favor of HM corn. However, there was considerable variation between trials. HM corn stored in the oxygen-limiting structure consistently improved feed efficiency in the 10 trials with an average improvement of 5.6 percent.

HM corn stored ground and ensiled in upright concrete or horizontal silo

Table 2 summarizes 15 trials conducted to evaluate HM corn stored by grinding and ensiling in upright concrete or horizontal silos. Comparison in all trials was to dry rolled corn. Using this type of HM corn storage resulted in an average reduction of 5.6 percent in daily gain and an average decline in feed efficiency of .7 percent compared to dry rolled corn. It should be emphasized, however, that there was considerable variation from trial to trial. This would indicate more research is needed in this area to understand what factors cause such inconsistency.

Table 1. THE NUTRITIONAL VALUE OF HIGH MOISTURE CORN (HMC) STORED IN OXYGEN LIMITING STRUCTURES AS COMPARED TO DRY ROLLED CORN (DC)[1]

Reference	Days Fed	No. Cattle/ Treatment	% Moisture		Daily Gain (lbs.)		Feed/Gain		HMC as % of DC	
			HMC	DC	HMC	DC	HMC	DC	Gain	Feed/ Gain
Nebraska	90	22	25	14	2.10	1.87	9.0	9.0	+12.3	+ 9.0
Nebraska	105	44	25	14	3.15	3.14	6.5	6.3	+ .3	- 3.2
Nebraska	161	20	23	15	2.31	2.45	7.69	7.35	- 5.7	- 4.6
Nebraska	105	39	24	12.5	3.01	2.89	6.51	6.89	+ 4.2	+ 5.5
Michigan	104	32	32	--	3.33	3.54	7.19	7.97	- 5.9	+ 9.7
Iowa	165	46	27.2	10.7	2.33	2.35	7.64	7.95	- .8	+ 3.9
Iowa	140	34	26.6	13.8	2.38	2.20	5.82	6.62	+ 8.2	+12.1
Iowa	--	--	27.8	13.9	2.25	2.24	7.62	8.07	+ .4	+ 5.6
Colorado	--	--	--	--	2.34	2.50	8.49	8.84	- 6.4	+ 4.0
Florida	--	--	--	--	2.92	2.60	9.47	10.97	+12.3	+13.7
Summary of Ten Trials									+ 1.9	+ 5.6

[1]Adapted from Corah (1976).

Table 2. THE NUTRITIONAL VALUE OF HIGH MOISTURE CORN (HMC) THAT IS GROUND AND ENSILED IN A CONCRETE UPRIGHT OR HORIZONTAL SILO AS COMPARED TO DRY ROLLED CORN (DC)[1]

Reference	Days Fed	No. Cattle/ Treatment	% Moisture HMC	% Moisture DC	Daily Gain (lbs.) HMC	Daily Gain (lbs.) DC	Feed/Gain HMC	Feed/Gain DC	HMC as % of DC Gain	HMC as % of DC Feed/Gain
Guelph, Ont.	140	12	30	13	3.19	2.86	5.4	5.5	+11.5	+ 1.8
Nebraska	161	20	25	15	2.2	2.4	8.2	7.4	- .8	-10.8
Nebraska	90	22	25	14	1.68	1.87	10.7	9.9	-10.2	- 8.0
Nebraska	105	44	25	14	2.89	3.14	6.7	6.3	- 8.0	- 6.3
Purdue	--	--	26.4	--	2.52	2.47	6.8	7.4	+ 2.0	+ 8.1
Purdue	--	--	34.0	--	2.27	2.45	6.81	7.03	- 7.3	+ 3.1
Purdue	--	--	26.0	--	2.20	2.37	6.27	6.57	- 7.1	+ 4.6
Purdue	--	--	29.0	--	2.47	2.70	6.24	6.39	- 8.5	+ 2.3
Purdue	--	--	28.0	--	1.93	2.24	7.02	6.44	-13.8	- 9.0
Purdue	170	24	29.2	11.6	2.40	2.60	6.53	6.76	- 7.7	+ 3.4
Oklahoma	117	14	30	15	3.02	3.09	6.71	7.54	- 2.2	+11.0
Illinois	120	20	24	14.5	1.90	1.89	10.43	10.48	+ .5	+ .5
Illinois	120	20	29	14.5	1.91	1.89	10.40	10.48	+ 1.0	+ .8
Illinois	120	20	36	14.5	1.51	1.89	11.94	10.48	-25.4	-13.9
Colorado	134	20	Ap. 30	--	2.59	2.75	7.89	8.04	- 5.8	+ 1.9
Summary of 15 Trials									- 5.6	- .7

[1]Adapted from Corah (1976).

HM corn stored by chemical preservation

The nutritional value of chemical preserved HM corn is essentially equal to dry rolled corn. A summary of 19 trials is shown in Table 3. These data show slight average improvements in daily gain (1.1%) and feed efficiency (2.4%) for HM corn stored using chemical preservation compared to dry rolled corn.

FACTORS EFFECTING THE FEEDING VALUE OF HM CORN FOR FEEDLOT CATTLE

In reviewing the literature on HM corn, it appears the nutritional value is not greatly affected by the method of storage. Inconsistency in results among trials suggests that factors other than method of storage affect the feeding value of HM corn. It is beyond the scope of this report to try to discuss all possible factors; therefore, I will discuss only those which I consider most significant.

Dry matter analysis

Merrill (1971) reported considerable variation among dry matter (DM) values when different methods of determination were used. He compared five different methods for determination of silage dry matter: corrected toluene distillation (corrected for total acids, ammonia, and ethanol); uncorrected toluene distillation; 70°C forced air oven drying; freeze drying and 100°C forced air oven drying. Identical samples of HM corn gave average DM percentages of 74.69, 74.26, 73.58, 73.26, and

Table 3. THE NUTRITIONAL VALUE OF HIGH MOISTURE CORN (HMC) STORED BY CHEMICAL PRESERVATION AS COMPARED TO DRY ROLLED CORN (DC)[1]

Reference	Days Fed	No. Cattle/ Treatment	% Moisture		Daily Gain (lbs.)		Feed/Gain		HMC as % of DC	
			HMC	DC	HMC	DC	HMC	DC	Gain	Feed/ Gain
Guelph, Ont.	87	18	26	13	3.08	3.19	5.6	5.65	- 3.4	+ .9
Guelph, Ont.	120	24	24	13	3.34	3.34	5.30	5.30	0	0
Cornell	110	10	--	--	2.27	2.24	7.54	7.79	+ 1.3	+ 3.2
Cornell	118	10	--	--	1.87	1.78	9.84	10.32	+ 5.1	+ 4.7
Nebraska	90	22	26	14	1.90	1.87	10.1	9.9	+ 1.6	- 2.0
Nebraska	105	44	26	14	3.05	3.14	6.3	6.3	- 2.8	0
Purdue	83	50	--	--	2.66	2.53	5.97	6.20	+ 5.1	+ 3.9
Purdue	126	18	--	--	2.51	2.44	6.07	6.38	+ 2.9	+ 4.9
Purdue	111	18	--	--	2.11	2.24	6.53	6.44	- 5.8	- 1.4
Iowa	140	17	26	14	2.02	2.00	6.90	7.13	+ 1.0	+ 3.2
Iowa	103	6	26	14	2.60	2.42	N.A.	N.A.	+ 7.4	+ 4.6
Iowa	--	--	25	14	2.60	2.58	5.46	5.66	+ .8	+ 3.5

Table 3. (Contd.)

Reference	Days Fed	No. Cattle/ Treatment	% Moisture		Daily Gain (lbs.)		Feed/Gain		HMC as % of DC	
			HMC	DC	HMC	DC	HMC	DC	Gain	Feed/ Gain
South Dakota	158	29	22	14	2.60	2.54	8.06	7.57	+ 2.3	- 6.5
Iowa	151	147	25	14	2.56	2.54	5.77	5.83	- .8	+ 1.0
Iowa	150	156	25	14	2.58	2.54	5.33	5.70	+ 1.6	+ 6.5
Purdue	181	50	30	14	2.55	2.51	5.83	6.14	+ 1.6	+ 5.0
Purdue	181	18	27	11.6	2.42	2.38	6.55	6.87	+ 1.8	+ 4.7
Guelph, Ont.	140	12	30	13.0	3.08	2.86	5.00	5.50	+ 7.7	+ 9.1
Nebraska	93	22	25	--	1.89	1.89	10.1	10.1	0	0
Summary of 19 Trials									+ 1.1	+ 2.4

[1]Adapted from Corah (1976).

70.90, respectively, for the five methods. These data suggest that dry matter analysis may vary by as much as 4 percent depending on the method used. Discrepancies result from the loss of volatile compounds during drying. Inappropriate placement of these compounds in the water fraction under-estimates the dry matter and energy intake by an animal and results in an overrating of the feed efficiency. For example, if a steer is fed 25 lbs of HM corn daily that is determined to be 70% DM and has an ADG of 3 lbs. per day then the feed efficiency is 5.83 lbs. DM per lb. of gain. But if the actual DM is 74% (accounting for the volatile compounds), the actual feed efficiency would be 6.33 lbs. DM per lb. of gain, resulting in an 8.6% less efficient gain than the original calculation. The degree of this error with fermented feeds becomes greater with increasing moisture percentage because of its relationship with increased fermentation and production of greater amounts of volatile compounds. Many reports do not include details of the drying procedure; therefore, it is difficult to make reliable comparisons of feed efficiency between trials. In a 1976 Oklahoma State University Symposium on high moisture grain, it was agreed that greater uniformity in reporting data is needed to help scientists interpret research. It was recommended that the dry matter of HM corn be determined by the following methods listed in order of preference; (1) absolute water determination (Hood et al. 1971), (2) toluene distillation (AOAC, 1975), (3) lyophilization (freeze drying), (4) oven drying (AOAC, 1975).

Moisture content

Goodrich and Meiske (1976) summarized several trials to determine if the moisture content of HM corn influenced the performance of feedlot cattle. They reported that performance of cattle fed ensiled HM corn (less than 29 percent moisture) was superior (2.57 vs. 2.53 lbs. daily gain; 583 vs. 618 lbs. dry matter per 100 lbs. gain) to performance of cattle fed dry corn. Stating these results another way, cattle fed ensiled HM corn gained 1.6 percent faster and required 5.3 percent less dry matter per 100 lbs. of gain than cattle fed dry corn. These data were from 20 university trials in the U.S. and Canada. In a summarization of 10 trials where ensiled HM corn with more than 29 percent moisture was compared to dry corn, cattle fed the ensiled HM corn gained 6.1 percent slower (2.46 vs. 2.62 lbs. per day) but were 2.1 percent more efficient (797 vs. 814 lbs. dry matter per 100 lbs. gain) than cattle fed dry corn.

These comparisons indicate that moisture content does have an effect on the performance of cattle fed HM corn. This may be caused by reduced dry matter intake. Owens and Thornton (1976), reported that dry matter intake of HM corn was equal to the dry matter intake of dry corn when HM corn was 24 percent moisture. However, for every one percent increase in moisture; intake decreased by about 1 percent, regardless of the type of storage.

As moisture content increases the amount of fermentation also increases, resulting in a higher energy loss during storage.

Drier HM corn (less than 24 percent moisture) will result in lower grain yields due to greater field loss, and more oxidation and browning due to more difficult packing. These factors should be considered when harvesting HM corn.

Acid level

During fermentation, water-soluble carbohydrates are converted to short-chain organic acids and ethanol. When these fermentation products become excessive, dry matter intakes and daily gain of feedlot cattle may be lowered (Goodrich, 1976). Research data to support this concept are limited.

Wilkinson et al. (1976) added lactic and acetic acids to ensiled and unensiled (frozen) whole corn plant silage. They reported that dry matter intake and daily gain were reduced by the addition of these organic acids to the frozen forage and that cattle fed the ensiled corn plant silage had lower intakes and gains than cattle fed the frozen corn plants. Dry matter digestibilities were not influenced by treatments, but urinary nitrogen losses were greater for ensiled and acid treatments than for frozen forage. They concluded that the addition of acids may be detrimental to nitrogen balance via an effect on urinary ammonia excretion and acidification of the urine in response to the acid load. If this is a true biological response, it would follow that those techniques which minimize acidity during storage and feeding of HM corn would be desirable.

Cattle feeders have periodically reported that cattle fed ensiled rations consume less than expected and gain slower than expected. These reports may be at least partially explained by the concepts reported by Wilkinson (1976). Research supporting the idea that dry roughages are more beneficial than silage in rations containing ensiled HM corn is very limited. A study at the Garden City, Kansas Experiment Station supports this idea (Corah, 1976). Steers were fed ensiled HM corn with either alfalfa hay or corn silage as 10 percent of the ration on a dry matter basis. Steers fed the alfalfa hay ration were 7.5 percent more efficient than those fed corn silage. Perhaps HM corn does not produce an excessive acid load when fed with dry roughages, like alfalfa hay, that have an alkaline ash to neutralize some of the acids.

Soluble nitrogen

During fermentation of high moisture grain, protein changes from an insoluble to a soluble form and much of the protein is degraded to non-protein nitrogen (NPN) (McKnight *et al.*, 1973). This increase in soluble nitrogen may lower the feeding value of HM corn. Sprague and Breniman (1969) reported that depressed appetites and lower gains are frequently observed in feedlot cattle when the level of soluble nitrogen becomes excessive.

In whole plant silages, the nitrogen solubilization process is by the activity of endogenous plant proteases and occurs during the first few days of ensiling (Bergen *et al.*, 1974). Proteolytic enzymes in corn grain are also thought to cause solubilization of protein in HM corn (Prigge, 1976). Studies by Burger (1966) indicate that certain proteolytic enzymes of grain tend to have an optimal pH that is acidic. Therefore, bacterial fermentation may actually favor the solubilization of nitrogen due to its effect on pH.

Prigge (1976) reported that after 56 days of storage in laboratory silos, 38 percent of the total nitrogen was in the soluble form for ground ensiled HM corn compared to only 15 percent for whole HM corn from the same source. Other data show up to 70 percent of the nitrogen in ground HM corn in the soluble form. This indicates that particle size may have an effect on nitrogen solubility. Little increase in soluble nitrogen occurs after 56 days of storage.

Moisture content has a consistent relationship with nitrogen solubility (Thornton, 1976). As the moisture content increases the amount of soluble nitrogen increases. Apparently, acidity, particle size and moisture content all affect soluble nitrogen content. This suggests that the extent of fermentation is directly related to the degree of nitrogen solubility.

Soluble nitrogen isolated in bulk from corn silage is not readily degraded or converted to ammonia nitrogen in the rumen of sheep (Bergen, 1976). For an effective rumen fermentation of dietary carbohydrates, there must be an adequate ammonia-nitrogen source to promote microbial growth and activity. Bergen (1976) suggested that if a large fraction of the nitrogen in feeds cannot be degraded to ammonia-nitrogen, then there will be a depression in the amount of ruminal digestion and a decline in animal performance. However, Galyean <u>et al</u>. (1975) reported that both acid treated HM corn fed whole and ground HM corn produced a greater proportion of abomasal microbial nitrogen than dry corn, indicating that high moisture storage of corn increased microbial synthesis. A certain amount of soluble nitrogen is necessary for efficient utilization of energy and protein. Possibly one of the disadvantages of feeding HM corn is that nitrogen and energy are too readily available. At this time it is not known to what extent the solubilized nitrogen can be utilized by feedlot cattle.

SUMMARY

Feeding high moisture corn to beef cattle is rapidly increasing and this trend should continue in the future. Methods available for storing high moisture corn include grinding and packing into upright concrete and horizontal silos and storing the grain in the whole form in oxygen-limiting silos or with chemical treatment. The literature concerning high moisture corn indicates that the nutritional value for beef cattle is not greatly affected by the method of storage. High moisture corn stored in oxygen-limiting structures improved gain 1.9% and feed efficiency 5.6% when compared to dry rolled corn. High moisture corn stored by grinding and ensiling in upright concrete or horizontal silos resulted in an average reduction of 5.6% in gain and an average decline in feed efficiency of .7% compared to dry rolled corn. Chemically preserved high moisture corn improved gain 1.1% and feed efficiency 2.4% compared to dry rolled corn.

There was considerable variation in nutritive value from trial to trial. These inconsistencies indicate that factors other than storage methods affect the feeding value of high moisture corn. Dry matter analyses, moisture content, acid level and the amount of soluble nitrogen reportedly affect the performance of feedlot cattle fed high moisture corn. How these factors are interrelated and the extent they affect rate and efficiency of gain is not clear. It should be emphasized that these factors be included in future research on storage and utilization of high moisture corn.

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THE STORAGE AND UTILIZATION OF HIGH MOISTURE CORN FOR FEEDLOT CATTLE

by

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B. S., Kansas State University, 1974

AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Animal Science and Industry

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1977

ABSTRACT

The feeding of high moisture corn to beef cattle is a rapidly developing practice which should continue to grow in the future. Rising cost of propane and natural gas make artificial drying of corn an expensive method of storage. Storing and harvesting corn at a moisture content between 25 to 30% is an alternative which offers several advantages. Reduced field and harvesting losses, in addition to earlier harvesting contribute to the increased use of high moisture corn.

Methods available for storing high moisture corn include grinding and packing into upright concrete and horizontal silos and storing the grain in the whole form in oxygen-limiting silos or with chemical treatment. The type and size of the feeding operation will influence which method should be used. Regardless of the method, careful management is necessary to insure satisfactory preservation of high moisture corn.

In reviewing the literature on high moisture corn, it appears that the nutritional value for beef cattle is not greatly affected by the method of storage. High moisture corn stored in oxygen-limiting structures improved gain 1.9% and feed efficiency 5.6% when compared to dry rolled corn. High moisture corn stored by grinding and ensiling in upright concrete or horizontal silos resulted in an average reduction of 5.6% in gain and an average decline in feed efficiency of .7% compared to dry rolled corn. Chemically preserved high moisture corn improved gain 1.1% and feed efficiency 2.4% compared to dry rolled corn.

There was considerable variation in nutritive value from trial to trial. These inconsistencies indicate that factors other than storage methods affect the feeding value of high moisture corn. Dry matter analyses, moisture content, acid level and the amount of soluble nitrogen reportedly affect the performance of feedlot cattle fed high moisture corn. How these factors are interrelated and the extent they affect rate and efficiency of gain is not clear. It should be emphasized that these factors be included in future research on storage and utilization of high moisture corn.