1974

G74-100 Feeding High Moisture Corn

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G74-100-A
(Revised December 1983)

Feeding High Moisture Corn

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In recent years the use of high moisture grain has become more popular due to the increased costs of handling and dry feed grains. For cattle feeders in particular, storing grains as high moisture is one practice that can improve their competitive position and reduce costs. Using high moisture grains allows greater opportunity to design a system that will minimize harvest, storage and feed processing costs.

Grains such as sorghum and wheat have been stored as high moisture, but corn is the principal high moisture grain stored. High moisture corn can be processed and stored as whole shelled corn, ground shelled corn or ground ear corn. When deciding whether to dry or store high moisture corn, consider the following advantages and disadvantages.

Advantages of High Moisture Corn

1. Costs incurred during artificial drying are eliminated.
2. High moisture corn can be harvested two to three weeks earlier than corn harvested for dry storage.
3. Dry matter losses from field and harvesting can be decreased by 3 to 8 percent for corn harvested at 25 to 30 percent moisture compared to corn harvested for dry storage.
4. Greater potential exists for the use of higher quality residues.

Disadvantages of High Moisture Corn

1. Loss of some marketing flexibility compared to dry corn.
2. Additional processing equipment may be needed.
3. Additional storage facilities may be needed.
4. Spoilage can be a problem and storage losses may be higher than for dry corn if high moisture corn is not properly ensiled and fed at adequate rates.
5. High moisture, fermented corn may require better bunk and feeding management than dry corn.

Optimum Maturity and Harvest Moisture

Corn is considered physiologically mature when it will yield the maximum quantity of dry matter. Most corn kernels accumulate dry matter until moisture decreases to 30 to 35 percent; although, some hybrids may be mature at 40 percent moisture. Postponing harvest to decrease corn moisture does not increase yield or energy per acre and often increases field losses. Corn kernels that have started to dent have about 50 percent moisture and are in a medium soft stage, but are not mature. Twelve to 16 days are usually needed to reduce kernel moisture from 50 to 40 percent. During this time, yield can increase at a rate of 0.5 to 0.75 bushel per acre per day.

Table I. Approximate moisture content of kernel, cob and the whole ear.

Kernel Moisture	***Cob Moisture***	***Whole Ear Moisture***
percent	percent	percent
24	44	29
26	46	31
28	48	33
30	50	35
32	53	37
34	55	39
36	57	41
38	59	43
40	60	45

Optimum moisture in corn should allow for easy harvesting, lower field losses, excellent packing, proper fermentation and more desirable animal performance. Moisture content that best satisfies these requirements occurs shortly after physiological maturity is reached. An acceptable range for corn moisture content is 22 to 28 percent. At this stage corn loses about 1/2 to 1 percent moisture per day in the field. For producers who use ear corn, *Table I* shows the approximate moisture relationship between kernel, cob and the whole ear.

Field losses at harvest can be significantly affected by corn moisture content. Harvesting and handling becomes easier as moisture content falls, but ear droppage and downed stalks increase due to wind, stalk rot, and insect damage. These losses can be minimized with proper machinery adjustment, and beginning harvest when corn is around 30 percent moisture and finishing before corn is less than 24 percent moisture.

High Moisture Corn Storage

Storage methods commonly used for high moisture corn consist of two main types. Ground high moisture corn is normally stored in bunker or trench silos, whereas whole high moisture corn is stored in upright oxygen limiting structures. Ground or coarse rolled corn can also be stored in upright structures. The large bagging systems that have been primarily for storing silage can also be used for high moisture corn storage.

Ground High Moisture Corn

Corn stored in bunker silos should be harvested at moistures above 22 percent. The preferred harvesting moisture is around 24 to 26 percent. Corn stored by this method should be ground or rolled and well

packed into the silo. Since proper packing depends on the moisture and particle size, corn that is to be stored in a bunker silo can be coarsely ground (as much as 40 to 50 percent whole corn passing through).

However, as moisture of the corn decreases below 25 percent, finer grinding may be necessary to achieve proper packing. Finer grinds also permit a slower feeding rate once the silo is opened. If the feeding rate is fast enough to prevent deterioration as the grain is fed, a coarser grind is recommended. As the silo is being filled, only enough corn kernels need to be ground or broken up to permit a firm pack.

Compared to dry corn, the feeding value of ground high moisture corn tends to vary with roughage level fed and storage method. In a high concentrate ration, 10 to 15 percent roughage, corn stored in a bunker silo will, on the average, produce daily gains 5 percent lower than dry corn. Feed efficiencies are similar for both corn types, however.

The lower gains experienced with high moisture corn may be due to a more rapid ruminal digestion of the corn starch, resulting in a greater chance of digestive disturbances, such as acute or subclinical acidosis, occurring. Past research results from Oklahoma show that cattle fed processed grains are more predisposed to acidosis conditions. Recent research results from the University of Nebraska Northeast Station have shown that the decreased performance observed with ground high moisture corn occurred primarily during the step-up or adjustment period -- the period in which cattle normally have the greatest chance of developing acidotic problems. Once cattle were on the high concentrate (10 percent roughage) ration performance was similar regardless of corn type fed.

The more rapid ruminal starch digestion is primarily due to the increased solubilization of the corn starch as a result of the fermentation process. As starch becomes more soluble it is digested more rapidly and possibly to a greater extent than less soluble starch. Grinding or rolling corn also increases the rate of starch digestion. Too rapid starch digestion will lower ruminal pH and increase lactic acid production, which ultimately can cause acidosis.

Adding dry corn to the ground high moisture corn ration may lower the incidence of acidosis and improve steer gains and feed efficiencies. When compared to steers fed only ground high moisture corn or dry corn, results of studies conducted in Nebraska and Oklahoma have shown that mixtures of these corn types improve steer weight gains and feed efficiencies 5 to 10 percent.

Whole High Moisture Corn

Shelled corn can be stored whole in oxygen limiting silos and bins. Research at the Northeast Station has shown that steers fed high moisture corn stored whole and fed whole gain approximately 5 percent faster and are 5 percent more efficient than steers fed dry rolled corn in high concentrate finishing rations. Rolling whole high moisture corn prior to feeding resulted in only a 1 to 2 percent improvement in gain and feed efficiency over steers fed dry rolled corn. With higher roughage rations (> 20 percent dry matter basis) coarse rolling or grinding is generally recommended.

With oxygen limiting structures corn can easily be stored at a much lower moisture than is needed for bunker stored corn. Optimum moisture for corn stored under this type of structure is between 22 and 26 percent moisture, however, corn can be stored at moistures outside this range.

High moisture corn can also be stored whole in other types of structures by treating it with organic acids. Such organic acids can be used to treat high moisture corn stored outside, particularly in low rainfall

areas. Steer gains and feed efficiencies may be improved 1 to 3 percent over dry rolled corn when fed organic acid treated corn; however, the extra cost of the acid and its application must be considered before using this method of preserving and storing high moisture corn.

Reconstitution

A summary of research conducted at South Dakota, Indiana and Nebraska has shown that reconstituting corn results in little, if any improvement in gain and feed efficiency when the corn is fed in high concentrate rations. With the costs incurred in drying the corn and then reconstituting it, harvesting high moisture corn from the field and storing it in that form appears to be more economical. Adding enough moisture for adequate fermentation is also a problem, since moisture content of 25 percent or more is desirable for proper reconstitution. Reconstitution of milo has been shown to be much more beneficial, however, and should not be discarded as a processing method for it.

Ground Ear Corn or Ground Snapped Corn

Ground ear corn (corn and cob only) appears to have 6 to 10 percent greater feed value when stored as high moisture feed than when fed dry. This improvement may be largely due to increased palatability of the feed.

Approximately 16 to 20 percent of the dry matter of high moisture ground ear corn is found in the cob (*Table II*). This is more roughage than necessary for maximum rate and efficiency of gain in finishing rations. Thus, additional grain should be added to a ground ear corn ration once the cattle are started on the finishing ration.

Ground snapped corn (cob and shuck, included) will have 6 to 8 percent more roughage equivalent than ground ear corn and thus would be fed at a lower level than ground ear corn in a finishing ration. In finishing rations, 10 to 12 percent roughage is generally recommended. At 10 percent roughage equivalent, ground ear corn would be included at about 50 percent of the total ration if no other roughage is included since it is about 20 percent cobs. Ground snapped corn is about 25 percent cob and shuck and would be included at approximately 40 percent of the ration dry matter.

Table II. Approximate dry matter composition of corn harvested in different forms.

	Snapped Corn	***Ear Corn***	***Shelled Corn***
Corn, %	72-78	80-84	100
Cob, %	16-19	16-20	_
Husk, %	6-8	_	_
Crude Protein, %	8.8	9.2	10.0
Crude Fiber, %	11.5	8.5	2.3
NEm, Mcal/lb	.92	.98	1.04
NEg, Mcal/lb	.54	.58	.67

Before ensiling, high moisture ear corn needs to be properly processed. For best results, reduce cob pieces to 1/2 inch in diameter to assure good packing and adequate consumption when fed. A 3/4 to 1 inch screen appears acceptable for ear corn at 28 percent or higher moisture. Drier material may need to be ground through slightly smaller screens (1/2 to 5/8 inch) for better packing. Harvesting the cob

requires about 50 percent more storage capacity compared to storing the grain only. Where storage capacity is limited or more expensive structures are used, the improvement in feed utilization and the feed value of the cob may not always offset the additional cost of harvest and storage.

Feeding Value of Immature or Early Harvested Corn

When corn has been planted late or growth halted because of an early frost, the harvested grain may be immature and the nutritional value considerably different than that of corn reaching maturity. The composition of corn harvested at various maturities is shown in *Table III*. In general, immature corn is higher in protein than mature corn, but similar in energy. Test weight is lowered considerably depending on degree of immaturity.

Immature corn that is incapable of being shelled can be harvested as ear or snapped corn, but will have a lower energy value than mature snapped corn. As corn progresses from the milk stage to full maturity, the percentage of corn in a corncob mix increases from approximately 60 percent to 80 percent of the total dry matter. Snapped corn harvested in the dough to early-dent stage of maturity will have 90 to 95 percent the energy value of mature snapped corn. After mid-dent, the energy value is similar to mature snapped corn. In the typical beef cattle ration, the digestibility of immature corn is expected to be similar to the digestibility of mature corn.

Table III. Dry matter composition of corn at different stages of maturity (Minnesota).

Nutrient	*Early Milk*	*Early Dough*	*Mid-Dent*	*Mature*
Crude Protein, %	16.6	12.5	10.7	10.9
Crude Fiber, %	5.4	3.3	2.5	2.1
Starch, %	47.4	55.0	58.7	63.7
Gross Energy, Kcal/lb.	2073	2064	2086	2081
Test Weight, lbs/bu	35	47	55	58

File G100 under: BEEF
A-5, Feeding & Nutrition
Revised December 1983; 12,000 printed.

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Elbert C. Dickey, Director of Cooperative Extension, University of Nebraska, Institute of Agriculture and Natural Resources.