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High-Moisture Grain for Beef Cattle

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Some Missouri farmers are harvesting and storing high-moisture corn or milo for cattle rations. This practice has a number of agronomic advantages that are appealing to farmer-feeders who produce their own grain. Also, high-moisture processing improves the feed value of the grain, especially milo.

Advantages

1. Early harvest releases land for fall plowing or stalk field use.
2. Field losses at harvest may be reduced by 5 to 10 percent. Losses average about 13 percent for 15 percent moisture grain vs. 2 percent for 26 percent moisture grain.
3. Storage losses are often 2 percent or less of the dry matter, which may be less than rodent and insect damage in crib storage.
4. Storage costs are usually cheaper than when high-moisture grain is dried for storage.
5. Less investment in equipment is needed for storage and feeding compared to steam flaking.
6. There may be as much as 10 percent improvement in the feed value of the grain for cattle.

Disadvantages

1. A large inventory of grain is needed, which increases capital requirements.
2. Less flexibility of use, since it must be fed to livestock.
3. May freeze in bunk in winter, and flies can be a problem in summer.
4. Optimum harvest conditions may exist only a short time.

Improved Feed Value

Milo. High-moisture storage improves the feed value of milo more than it does corn as feed for cattle. Hard seed coat and complex structure of the starch molecule in milo may be largely responsible for its greater response than corn to this and most other processing methods. High-moisture harvested milo has increased daily gains slightly (0 to 2 percent) and improved feed efficiency from 6 to 10 percent over dry milo for beef cattle.

Corn. There has been much variation in results of research to measure the feeding value of high-moisture corn for beef cattle. Improvement has been greater and more consistent with high-moisture ground ear corn than with shelled corn. The value of the cob appears to be improved.

A summary of 14 experiments showed high-moisture ground ear corn increased gains by 3 percent and feed efficiency by 10 percent over dry ground ear corn. High-moisture ear corn makes a palatable, complete finishing ration for beef cattle. It has 20 percent cob. Cattle are easy to start, keep on feed, and gain rapidly on high-moisture ear corn. Most modern harvesting machinery, however, is not equipped to pick the cob.

Earlier summaries showed no improvement in feed value for high-moisture shelled corn. Results have been

variable, but some recent studies have shown as much as 3 to 5 percent improvement in the value of the dry matter in high-moisture shelled corn for cattle.

Rate of gain has been similar for cattle fed dry or high-moisture shelled corn.

Wheat. High-moisture storage has not improved the feed value of wheat for cattle in a limited number of trials.

High-Moisture Grain For Hogs

High-moisture grains have the same or slightly greater value than dry grain for hogs on a dry matter basis. There is a problem of keeping it fresh in hot weather, and supplements may need to be fed separately from the grain. Unless cattle are being fed, the hog operation often does not use enough grain daily to keep high-moisture grain fresh in a conventional silo.

Moisture Levels

Harvest corn and milo when it has 22 to 30 percent moisture. At this moisture range these grains have their highest yield of dry matter per acre and preservation conditions are best. Studies with milo have shown that 30 percent moisture gives greater improvement in feed value than lower moisture levels.

Mold is a greater problem with drier grain, and there may be little fermentation. It is difficult to pack dry grain tightly enough to exclude air for proper preservation in trench silos. Grain as low as 20 percent moisture can be safely stored in sealed silos, but spoilage may be greater than higher moisture grain in unsealed silos during hot weather. If the grain is harvested too wet and immature, dry matter yield per acre will be less and a number of kernels will be left on the cob of corn.

Grinding at Silo

Grain should be ground or rolled before it is stored in horizontal or conventional upright silos in order for it to pack tightly and exclude air. Corn kernels should be broken into three or four pieces for proper packing. Use trial and error to determine the best screen size. A ½ to ⅝-inch screen is about right for corn. A 5/16-inch screen is often used for high-moisture milo. Drier material requires a smaller screen.

Grain is stored whole in gastight silos. It should be rolled or ground when removed for feeding. Research has shown some increase in feed value when high-moisture shelled corn is processed for beef cattle in rations that have over 15 percent roughage. Milo should never be fed whole to cattle.

The grain should be packed with a tractor in bunker or trench silos in a fashion similar to silage. The top should be covered with plastic and weighted down to seal it and prevent air flow beneath the cover in case of puncture. The plastic cover should be applied within one or two days after filling to prevent deterioration to the exposed grain. This may necessitate covering the silo as it is being filled. Rapid filling is important for best preservation in nonsealed silos.

Conventional upright silos must be strong and in good condition for storage of high-moisture grain. A silo that has been used for grass silage should be strong enough for high-moisture grain. Consult the manufacturer of your silo if you are in doubt about whether it needs extra bands for reinforcement.

Doors may need to be sealed with plastic strips. Seal the top of the silo with a plastic cap to prevent spoilage. Cut the plastic 1 to 2 feet larger than the circumference of the silo. Crown the center of the silo and make a ditch around the edge of the silo. This ditch can be filled with any material that will not blow away, to seal the plastic to the grain.

Storage for 21 Days

High-moisture grain should be left in the silo for 21 days to complete the fermentation period before it is fed. Feed 2 to 3 inches of the surface daily to prevent spoilage.

Reconstitution

This is a process whereby water is added to mature grain to raise the moisture content to 25 to 30 percent for storage in a silo. Studies at Texas and Oklahoma showed reconstituted milo stored whole in airtight storage for processing at feeding improved rate of gain slightly and feed efficiency by 12 to 15 percent. Both stations found, however, if the milo was ground before reconstituting, there was little improvement in feed value over dry milo for cattle. An average of five trials with reconstituted shelled corn at cornbelt stations showed no improvement in rate of gain and 4.5 percent improvement in feed efficiency by cattle. The corn was stored whole in airtight silos.

The gallons of water to add to raise the moisture level of grain is given in Table 1. Water can be added while it is on the wagon, or at the grinder, blower, or auger as it goes into the silo. Warming water to 100°F increases its absorption by whole grain. Adding water to ground grain is most satisfactory.

Table 1
Amount of Water to be Added in Ensiling High Moisture Grain

% Moisture In Grain	% Moisture Desired						
	30	29	28	27	26	25	24
	Gallons of water to be added per ton						
29	3.5	—	—	—	—	—	—
28	7.0	3.5	—	—	—	—	—
27	10.5	7.0	3.5	—	—	—	—
26	14.0	10.5	7.0	3.5	—	—	—
25	17.5	14.0	10.5	7.0	3.5	—	—
24	21.0	17.5	14.0	10.0	7.0	3.5	—
23	24.5	21.0	17.5	13.5	10.0	7.0	3.5
22	28.0	24.5	21.0	17.0	13.0	10.0	7.0
21	31.5	28.0	24.0	20.5	17.0	13.0	10.0
20	35.0	31.5	27.5	24.0	20.0	17.0	13.0
19	38.5	35.0	31.0	27.5	23.5	20.0	17.0
18	42.0	38.5	34.5	31.0	27.0	23.5	20.0
17	46.0	42.0	38.0	34.0	30.5	26.5	23.5
16	50.0	46.0	42.0	37.5	34.0	30.0	26.0

A good "thumb" rule to remember is: **to increase the moisture content of grain to 25 percent, add 3-⅓ gallons of water (26.7 pounds) to 1 ton of grain for each 1 percent moisture deficiency. If grain has 15 percent moisture (10 percent deficiency), adding 33 gallons (267 pounds) of water to a ton of grain raises the moisture to 25 percent. Add approximately 3.6 gallons for each 1 percent moisture deficiency to raise it to 30 percent moisture.**

Remember these simple figures, and when a table isn't handy, you can still figure out how much water to add to a ton of grain to raise the moisture content to these levels.

Type of Silo

Sealed storage is the most expensive structure. It has the least storage losses. Filling and feeding can be interrupted without feed spoilage. Storing the grain whole appears to have some advantage for the reconstitution of milo.

Conventional upright silos rank next to sealed silos in storage losses but have had 4 to 6% more dry matter loss in some studies. They cost much less than sealed units for the same storage capacity. Management is more critical for conventional silos but not as great as for bunkers and trenches. The top can be resealed if feeding stops before emptied.

Horizontal units have the least cost, but management is important for their success. A good job of filling, packing, and covering is needed to keep storage losses low. Storage losses can be held to a minimum in large capacity trench or bunker silos that are well managed. Losses need not be much higher under these conditions than those in upright silos. Using a stationary loader or a front end scoop on a tractor to remove grain from a horizontal silo makes a fast, efficient way to feed. These silos are used most exclusively in commercial feedlots of the high plains to store the large quantity of high-moisture grain needed by this size lot.

Size of Silo

Table 2 gives the number of cattle required to consume 2 inches of high-moisture corn daily from the surface of a 60-foot-tall tower silo at various levels of grain feeding. This is an average figure for the silo. A greater depth would be removed daily from the top than the bottom of the silo when the same poundage is fed. The numbers in Table 2 also give the number of cattle that can be fed for 360 days from a 60-foot-high silo when fed at this rate. This will aid in figuring the number of silos needed.

Table 2.
Number of cattle required to consume 2 inches/day from various sizes of tower silos

	Silo Diameter (Feet)			
	16	20	24	30
Lbs. fed/head daily[1]	Number of Cattle Required			
5	267	419	604	944
10	133	209	302	472
15	89	140	201	315
20	67	105	151	236
25	53	84	121	189

[1]28% moisture basis, and 40 lb/cubic ft

In a horizontal silo grain should be piled at least 12 feet high to minimize surface exposed, but not more than 18 feet high so as to make packing difficult and removal dangerous.

At least 4 inches per day should be removed from the surface of the grain to prevent spoilage in a horizontal silo. Table 3 gives estimates of the number of cattle needed to remove 4 inches a day from a 14-foot depth at various silo widths and rates of feeding.

Table 3.
Number of cattle required to consume 4 inches/day from various widths of horizontal silos

	Silo Width (Feet)					
	30	40	50	60	70	80
Lbs. fed/head daily[1]	Number of Cattle Required					
5	1400	1867	2333	2800	3267	3733
10	700	933	1167	1400	1633	1867
15	467	622	778	933	1089	1244
20	350	467	583	700	817	933
25	280	373	467	560	653	747

[1]28% moisture basis, and 50 lb/cubic foot

Also, these cattle numbers show many cattle can be fed to 360 days from a silo 120 feet long. These numbers are helpful in estimating the number and lengths of horizontal silos needed to store high-moisture grain for the number of cattle you feed.

Adding Urea and Minerals

Some cattle feeders correct the protein and mineral deficiencies of ground high-moisture shelled corn by adding at time of ensiling the mixture in Table 2. Adding 0.4 pounds of this mixture per ton of high-moisture corn for each percent of dry matter corrects the nutrient content on an air dry (90 percent dry matter) basis to approximately 11 percent crude protein, 0.27 percent calcium, 0.23 percent phosphorus, and 0.50 percent salt. Corn with 80 percent dry matter (20 percent moisture) or 70 percent dry matter (30 percent moisture) would require 32 pounds and 28 pounds of the mixture per ton, respectively. If urea is used alone, add per ton at the rate of 0.16 pound for each percent of dry matter in the corn. The additive should be mixed uniformly with the corn.

Table 4
The Composition of Additive Mixture

Additive	Percent
Urea (45 percent nitrogen)	40
Limestone, feed grade	33
Salt, trace-mineralized	27
	100

Remember when feeding high-moisture corn that it takes more pounds to supply the same amount of dry matter. Compared to corn with 15 percent moisture, it takes 6, 13, and 21 percent more of 20, 25, and 30 percent moisture corn for equal dry matter weights.

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