HIGH-MOISTURE CORN STORAGE

Cooperative Extension Service
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Most farmers who store and feed high-moisture corn are happy with it. The suggestions for storing high-moisture shelled corn in this publication also apply to high-moisture grain sorghum.

—What farmers like best is the convenience. High-moisture corn can be harvested and loaded into storage as rapidly as possible.

—Harvesting corn during early fall at optimum moisture content for storage reduces hazards of late fall storms and minimizes field losses.

—Annual fixed costs for a high-moisture corn storage system are similar and often less than for a drying and storage system. Operating cost is less for high-moisture corn because very little fuel is required, thus also conserving energy.

—High-moisture corn is usually the best storage method for cattle feeders. It is convenient, and high-moisture corn will produce a pound of beef with fewer pounds of corn dry matter.

—High-moisture corn, normally stored in a sealed storage*, is a satisfactory feed for swine finishing rations. Although advantages usually outweigh disadvantages, there are a few to consider. The major decision is selecting a satisfactory feeding system. The corn must be fed daily during warm weather to prevent spoilage.

—Corn stored at high moisture is not marketable through regular channels. It usually is fed on the farm where stored. High-moisture corn is not for the feeder who is unsure of his future in the feeding business or for those who buy most of their corn.

Moisture Content for Storing

High-moisture corn is usually harvested when the air temperature is above 50°F. Under these conditions, few storage problems are encountered if the corn is harvested at the following moisture content:

Shelled corn 25-30%

Grain moisture of ground ear corn . .23-28%

Although many feeders believe their cattle prefer the lower end of the moisture range, harvesting should begin at a high enough moisture content so all of the crop can be harvested and stored before it gets too dry.

Some cattle feeders have had consistently successful experience in storing high-moisture grain at lower moisture contents than those recommended, but too many others have had problems.

If the corn is harvested late in the season when daily temperatures are quite low (below 50°F) and the grain moisture content is lower than the recommended minimum, chances of storage problems are very low.

Do not add water to corn to increase moisture content to the desired moisture level at harvest time. There are numerous examples where adding water may have caused storage problems, particularly darkened corn. The major problem appears to be poor mixing and lack of absorption of the water in the corn. Water should be added only with special water reconstituting equipment.

For most farmers who are unable to harvest corn at the recommended moisture contents, better alternatives than adding water are: (1) If the corn is not lower than 22-23 percent moisture content, harvest and store it as rapidly as possible; (2) if it is below 22-23 percent moisture content, treat it with an approved grain preservative; or (3) delay harvesting until the daily temperature is below 50°F.

In summary, the moisture content for storing high-moisture corn is important in minimizing storage problems so the grain removed from storage will be bright and free of mold. The appearance of the corn, however, does not necessarily describe its feeding value. Corn that looks very poor in appearance *may* have the same or nearly the same feed value as corn that looks good.

However, these comments about corn that looks bad do not mean that there should be no concern about moldy grain. There is a chance that it can be toxic. If it is moldy, consult a local veterinarian or livestock management specialist. Another possibility is to feed the moldy grain to one or a few head to observe the results.

Distribute the Corn

For best results, fill all high-moisture corn storage facilities as rapidly and uniformly as possible. Distribute the corn so it will pack uniformly and eliminate pockets of fine material, which tend to spoil or heat.

Spread and pack high-moisture corn in a horizontal silo with a track-type dual wheel, or a 4-wheel-drive tractor as the corn is loaded into the silo. This is particularly important for the top 3 to 4 feet of corn.

Mechanical grain or silage spreading equipment in the top of an upright structure will distribute the corn.

High-Moisture Shelled or Ground Ear Corn

Whether to store high-moisture shelled or ground ear corn depends primarily on two factors: ration and available harvesting equipment. Swine rations call for shelled corn. Most cattle feeders prefer high-moisture shelled corn if they feed a high silage ration. They can best use ground ear corn if they feed a limited amount of other roughage.

High-moisture shelled corn is most common when a farmer harvests most of his corn with a combine.

Grinding High-Moisture Ear Corn

Special equipment such as a forage harvester with a combine type snapping head is available to grind ear corn in the field, although it is not commonly used. This equipment appears to be the most convenient method to harvest ground ear corn. Com-

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*Sealed storage is the term used in this publication to describe high-moisture corn storage with bottom unloading.

bines can be used but, because of the extra power required for grinding ear corn and the problems with unloading finely ground ear corn from combine grain tanks, most farmers who use combines only partially process the corn in the field and further process it at the storage site.

Ear corn harvested with pickers can best be ground at the storage site with a burr mill or reel-type cutter attachment on an ensilage blower. Hammermills can be used, but care should be taken so they do not pulverize the corn too fine, particularly if the moisture content is close to 30 percent.

Processing High-Moisture Shelled Corn

High-moisture shelled corn should be cracked before it is fed to cattle if the corn is less than 70 percent of the ration. It is usually most convenient to grind the corn before it goes into an upright silo equipped with a top unloader.

Although grinding shelled corn will not improve performance of swine on a finishing ration, they grow faster on complete feeds and it is usually necessary to grind the corn if a complete ration is fed.

Corn stored in sealed storage with commonly used bottom unloading augers must be stored as whole grain so the grain will flow into the auger.

Corn to be stored in a horizontal silo should be ground. Ground corn seals better than whole corn in shallow storage depths.

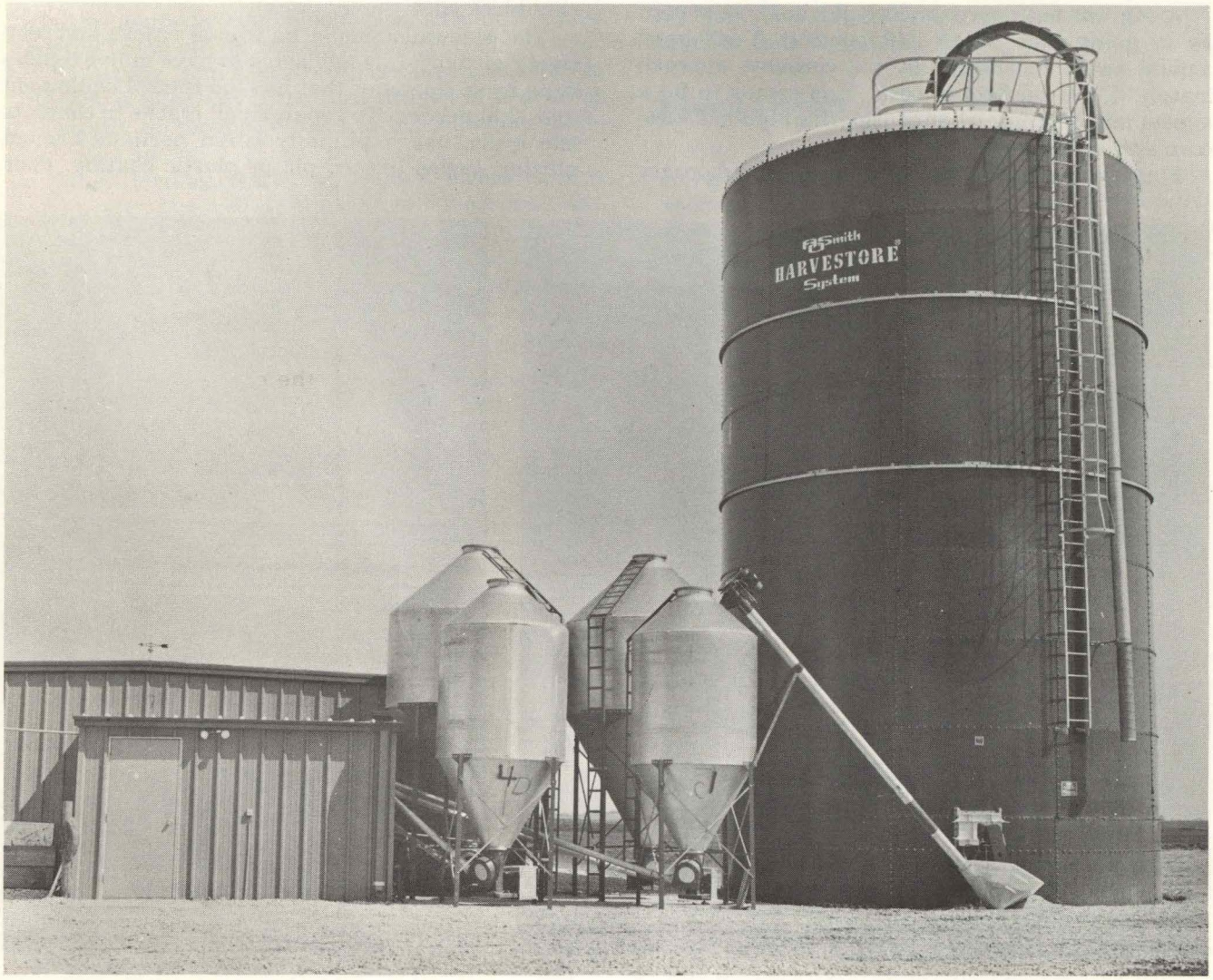
Storage Methods

Horizontal silos, sealed or conventional upright silos, and plastic-covered stacks are suitable for storing high-moisture grain.

Horizontal silos are most common for cattlemen feeding more than 1,000 head per year.

Upright storage units are usually selected by farmers who annually feed at least 100 to 1,000 head of cattle. Upright structures with mechanical unloading equipment are essential when used in a mechanized bunk feeding system.

Some type of sealed storage is usually best for storing high-moisture corn for swine because the



High moisture corn storage for swine.

corn can be removed at any rate. During warm weather, it is difficult to daily remove the desired 4 inches of corn from the surface of a conventional silo to stay ahead of spoilage. Four inches of 25 percent corn will be approximately 2,900 pounds in a 16-foot-diameter silo, 3,650 pounds in an 18-foot-diameter silo, and 4,500 pounds in a 20-foot-diameter silo. For estimating purposes, daily consumption of corn is shown in the following table.

Pig weight (lbs.)	Approximate daily consumption of corn (lbs.)
50	2¾
100	5
150	6¾
200	7½

As an example, it would require more than 1,000 50-pound pigs to remove 4 inches of corn from a 16-foot-diameter silo (2,900 ÷ 2¾ = 1,054). Most swine operations in Iowa are not this large.

A pig will eat approximately 11 bushels of corn as it gains from 50 to 240 pounds. A 400-head annual swine finishing unit will consume approximately 4,400 bushels of corn. This seems to be a logical minimum size when considering high-moisture corn storage for swine.

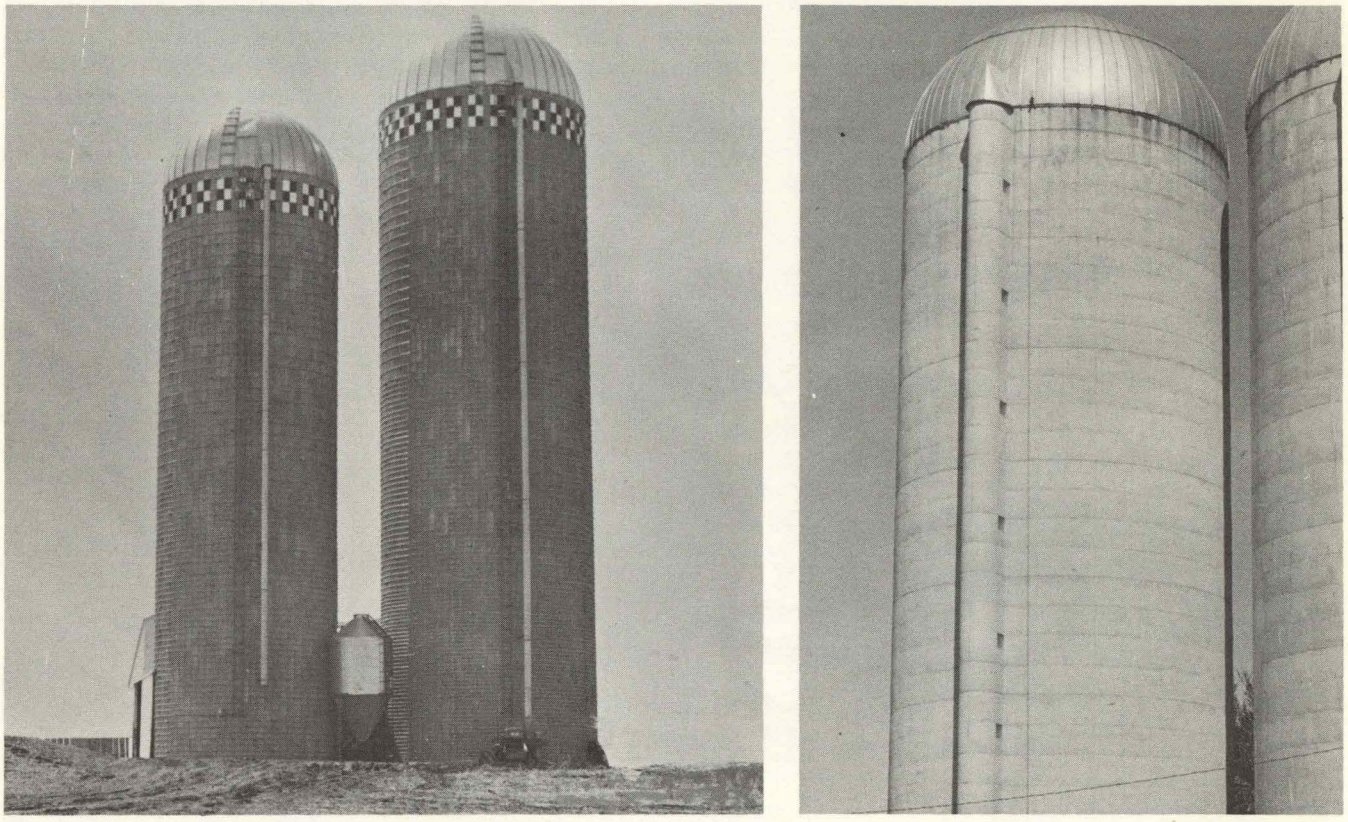
Plastic-covered stacks can be used for temporary storage or for storing corn to be later transferred into an upright unit.

High-moisture corn is being satisfactorily stored by treating with an approved grain preservative. At present, it is most appropriate for farmers storing a relatively small amount of corn for feeding (up to 2,000-3,000 bu.) to use a grain preservative. A grain preservative can also be used on high-moisture corn that has field-dried below the recommended moisture content for safe storage. Additional research may develop other satisfactory methods for using grain preservatives.

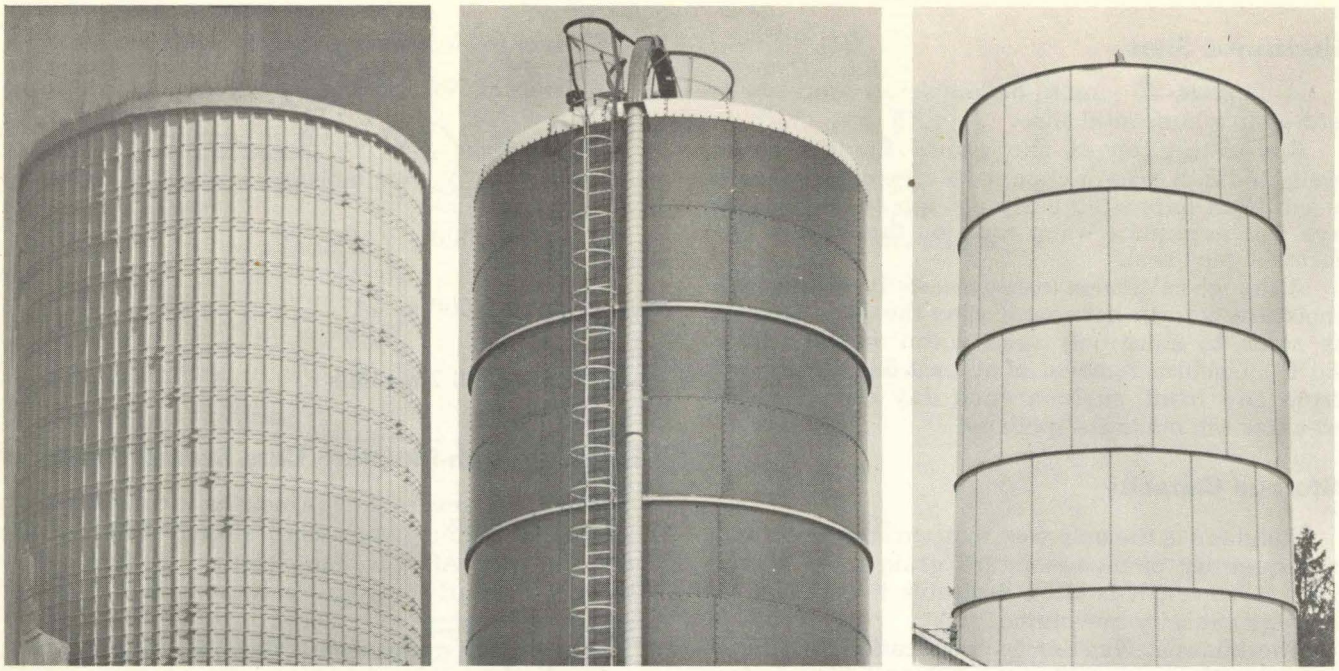
Conventional Upright Silos

Corn may be stored in clay block, concrete stave, or poured concrete silos if they are in good condition and adequately reinforced. Extra reinforcement is recommended if the silo was erected for only corn silage. Whenever possible, specific recommendations should be obtained from the company that erected the silo. If that is not possible, AE 1080 "How to Reinforce Silos" available at your local county extension office, has general reinforcing recommendations for concrete stave and clay block silos.

The sidewalls should be free of cracks and relatively airtight. It is advisable to have major repairs done by a company that has the special equipment and skill needed. To repair small cracks in concrete silo walls, use a properly cured portland cement plaster, boiled linseed oil, or plastic coating. Poor



Two types of conventional upright silos: concrete stave and poured concrete.



Three types of sealed storage structures for high moisture corn: concrete stave silo (left) and two types of steel silos.

mortar joints in clay block silos should be thoroughly raked out and remortared.

If feeding from the silo will not begin as soon as the silo is filled, cover the corn surface with a sheet of plastic or chopped forage to minimize top spoilage (see fig. 1).

When feeding starts, at least 2 inches of corn and preferably 3 to 4 must be removed each day in weather above 50 degrees to prevent spoilage. A top unloader does the best job of removing corn from the silo. It eliminates the labor of climbing the silo and throwing corn out, and it removes an even layer of corn each day.

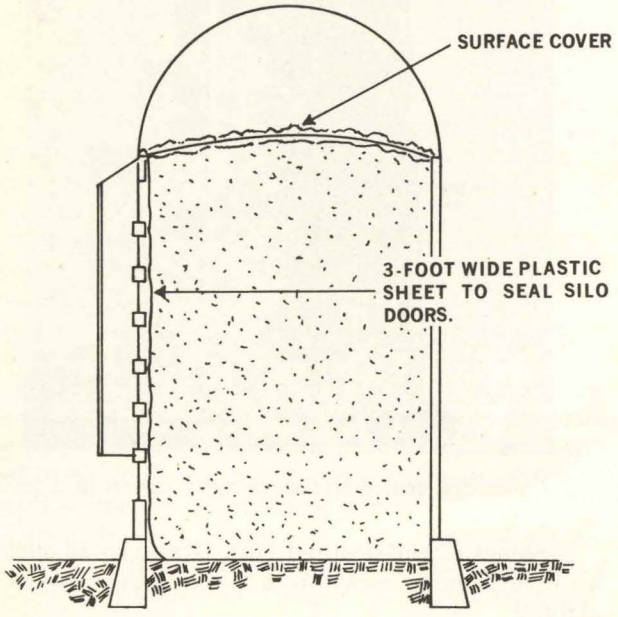
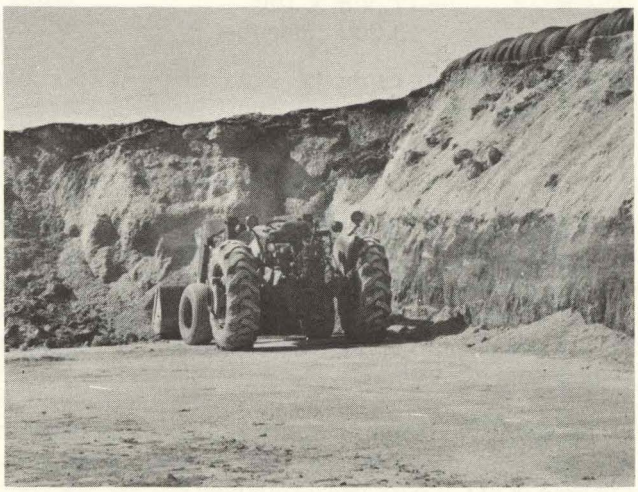


Fig. 1. Cross-section of a conventional silo with precautions shown for high-moisture corn storage. (Cover the surface if feeding will not start immediately.)

Sealed Storage

One advantage of sealed storage is that the corn can be removed at any rate with minimum risk of spoilage. This advantage is particularly important during warm weather. Unbroken and undamaged grain will flow into an unloading auger fairly well. If the grain is broken up as it is loaded into the storage unit, it can bridge and cause unloading difficulties.

Special unloaders such as forage unloaders must be used to unload ground ear corn from the bottom of a sealed silo.



Tractor with front-end loader is used to feed high moisture corn from this horizontal silo with concrete bottom.

Horizontal Silos

It is best to crack high-moisture corn to be stored in a horizontal silo.

Cover the top of the grain. Plastic sheets weighted with tires or chopped forage are frequently used. Corn harvested early enough so that oats or rye will germinate when sown on the surface also forms a good seal.

Although cattlemen are successfully storing high-moisture corn in horizontal silos the year round, it is safer to store only until warm weather (over 50°F). Uniform removal of at least 6 inches of corn from the front surface each day during warm weather will minimize spoilage.

Storage Capacity

Weighing is the only way to accurately determine the quantity of high-moisture grain in a storage unit. However, it is often desirable to estimate the storage capacity by volume.

The Midwest Plan Service publication *Beef Housing and Equipment Handbook,* available at your local county extension office, includes tables showing the approximate high-moisture corn storage capacity of different sizes of upright silos. These tables reflect the actual amount of corn when corrected to No. 2 grade (15 percent moisture content).

The tables also give a bulk density figure that can be used to estimate the storage of a horizontal silo. Following is the procedure for using the bulk density figure.

The figure given for 30 percent high-moisture ground ear corn is 1.76 cubic feet per bushel. Assume a horizontal silo has the following dimensions: 16-foot bottom width, 18-foot top width, 8 feet deep, 100 feet long.

Silo volume = average width x depth x length.

$$= \frac{16' + 18'}{2} \times 8' \times 100'$$

$$= 17' \times 8' \times 100'$$

$$= 13{,}600 \text{ cubic feet.}$$

Estimated silo capacity = volume ÷ 1.76 cubic feet per bushel.

$$= 13{,}600 \div 1.76$$

$$= 7{,}727 \text{ bushel of No. 2 corn}$$

If you need to accurately determine the quantity of grain, weigh the corn, divide the weight by 56 pounds per bushel for shelled corn or 70 pounds per bushel for ear corn. Determine the moisture content of the grain and correct the weight to 15½ percent (No. 2 corn).

EXAMPLE: Assume 56,000 pounds of 26 percent shelled corn is removed from a silo. How many bushels of No. 2 corn were removed?

$$\frac{56{,}000 \text{ lb.}}{56 \text{ lb/bu}} = 1{,}000 \text{ bu. of wet corn}$$

Correct to No. 2 corn with this formula:

Bushels of No. 2 corn (15½% moisture content) =

$$\text{bushels of wet corn} \times \left(\frac{100\% \text{ moisture content of wet corn}}{100\% \text{ moisture content of dry corn}}\right)$$

$$= 1{,}000 \times \left(\frac{100 - 26}{100 - 15\frac{1}{2}}\right)$$

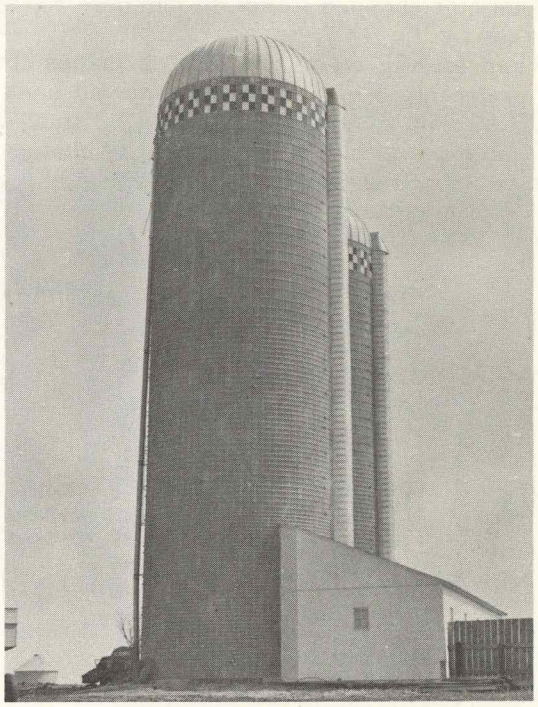
$$= 1{,}000 \times \frac{74}{84.5}$$

$$= 875.7 \text{ bushels}$$

Locating High-Moisture Corn Storage Facilities

There are several key principles to consider when locating a high-moisture corn storage facility. Plan the site well. After a high-moisture storage unit is built, it is nearly impossible to move it to a better site.

The following principles apply for locating both upright and horizontal high-moisture corn storage facilities. The principles are valid for locating high-moisture corn storage facilities for both beef and swine enterprises. The examples shown suggest specific ways to locate and organize upright storage structures in open-lot beef feeding systems.



These silos are located on the northwest corner of a feedlot.

—Select a well-drained site. Grade so all surface water will move away from the site such as shown in fig. 2.

—Develop good access roads to move grain to or away from the site.

—Plan to consolidate high-moisture corn and other feeds such as silage into one site. For ex-

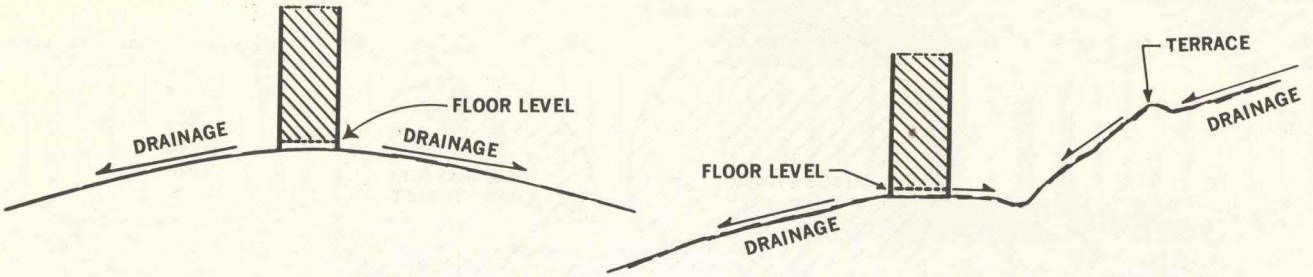


Fig. 2. Grading to move surface water away from silo.

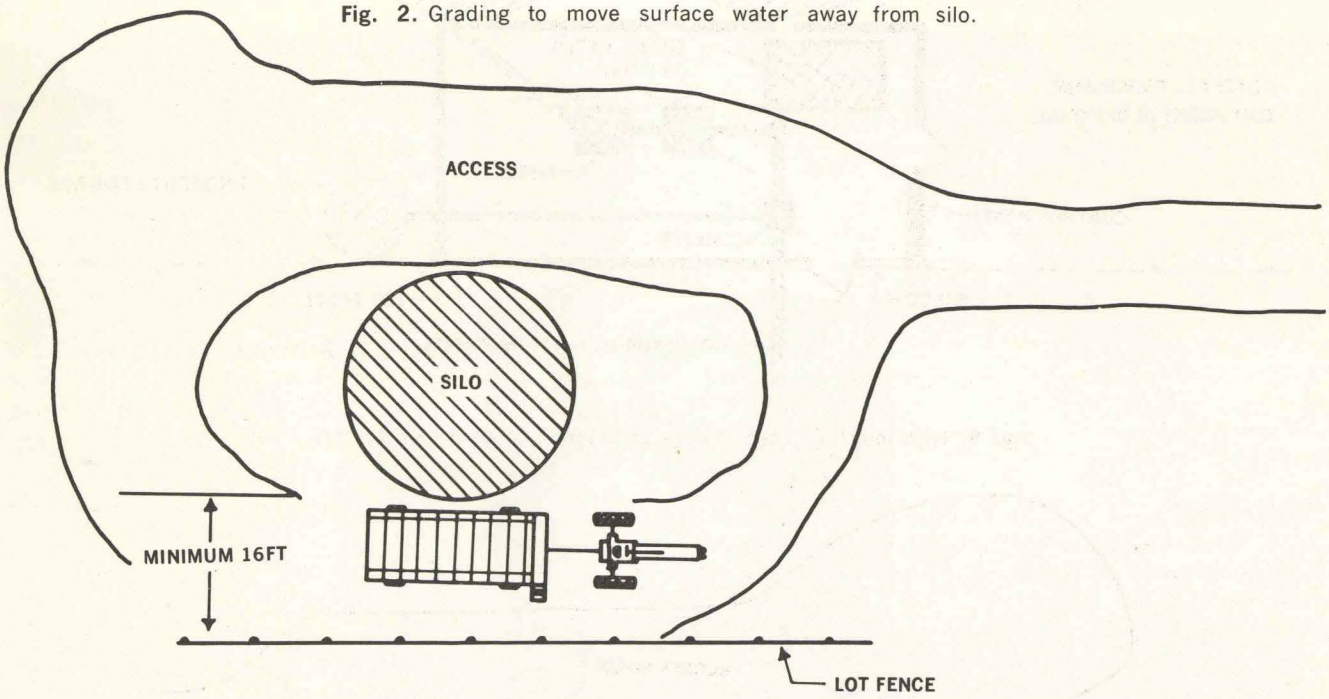


Fig. 3. Locate storage close to feeding lots.

ample, locate an upright storage facility close (within about 20 feet), but not in the cattle lots, as in fig. 3. This location permits hauling corn from the unit in a self-unloading wagon; or you can develop a mechanized bunk system, either immediately or in the future. Locate upright silos northwest, north, or northeast of the lot in the colder cattle feeding areas so they won't cast shadows in the lots and thus cause frozen manure. Figure 4 shows the preferred area for erecting upright structures close to a lot to minimize winter lot shading.

—Always provide space in your original plans for expansion of feed storage. Figure 5 suggests one way a high-moisture corn storage structure, located as shown in fig. 3, can be developed into a complete beef feed storage center.

Figure 6 is an example arrangement of a complete feed storage center and a mechanical feeding system for an open lot beef feeding system. It also emphasizes two important principles:

—Plan space in the original layout for additional storage.

—Plan convenient, all-weather access roads to the storage site.

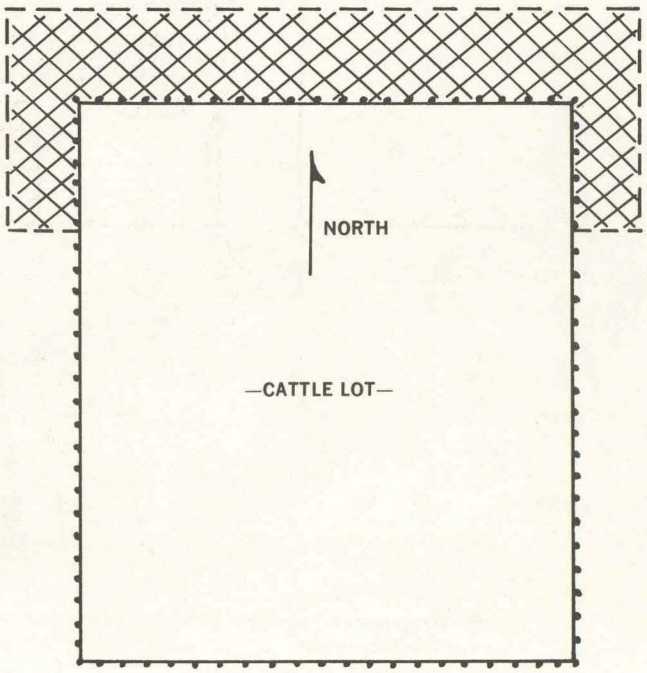


Fig. 4 Storage facilities located in the cross-hatched area will not cause sun shading problems during winter.

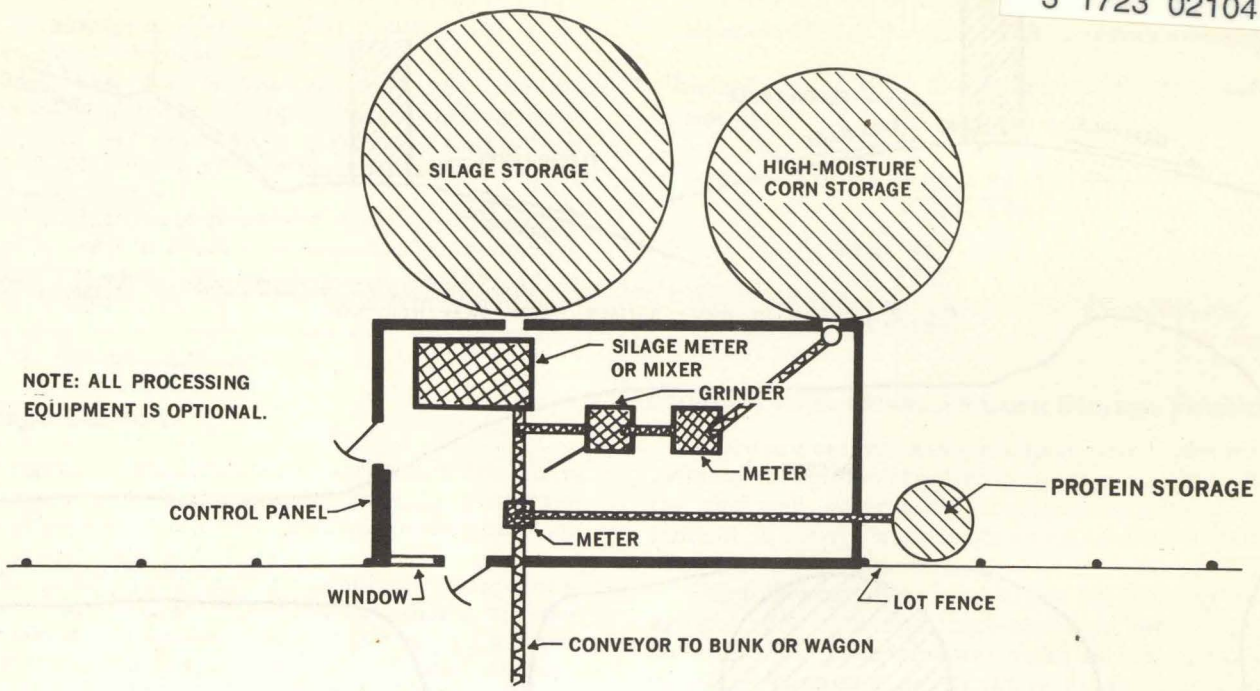


Fig. 5. High-moisture corn storage structure and beef feed center.

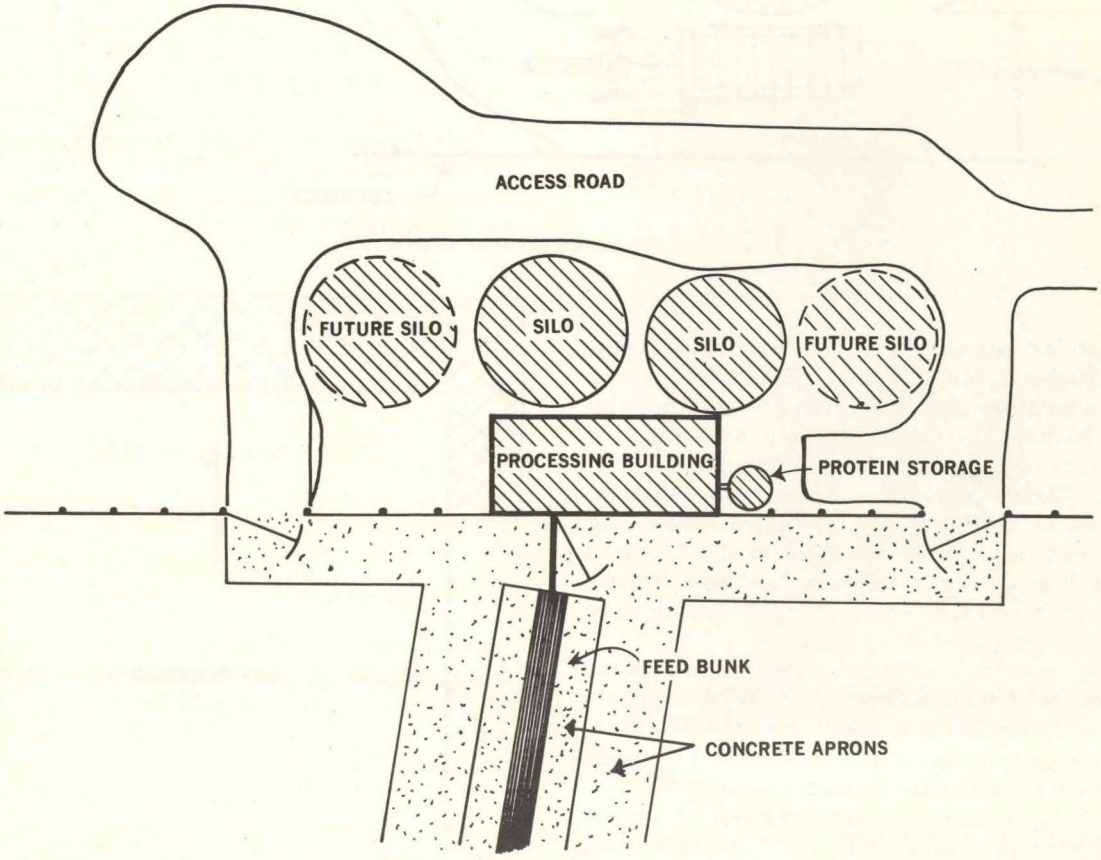


Fig. 6. Arrangement of feed storage center and mechanical feeding system. It is best to locate the silos north of the feed bunk.

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