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4-5-2002

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Recommended Citation

Durland, G.R. and Pohl, Steve, "Harvesting and Ensiling High-Moisture Crops" (2002). *Extension Extra*. Paper 15.
http://openprairie.sdstate.edu/extension_extra/15

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Extension Extra

ExEx 1015
Updated April 2002
Agriculture and
Biosystems
Engineering

COLLEGE OF AGRICULTURE & BIOLOGICAL SCIENCES / SOUTH DAKOTA STATE UNIVERSITY / USDA

Harvesting and Ensiling High-Moisture Crops

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An early fall and/or a short growing season can mean some hard decisions regarding the harvest, storage, and use of corn, sorghum, and soybean crops. The first damaging frost date will be the key to the harvest and storage method. It will be much easier if you plan for alternate methods prior to the frost date so that the crop can be harvested with the most efficient method for the respective operation.

One of these options will be to harvest the crop as silage. Preparations must be arranged for chopping, hauling and storage. Many farms do not have a silage chopper; in that case, make prior arrangements with a custom operator or a dealer for use of a machine. Since silage needs to be put up rapidly when it reaches the proper moisture content, enough wagons and trucks will be needed so that the hauling does not create a slowdown of the operation. Storage structures can be conventional upright or bunker silos, or, emergency storage methods may need to be provided. Some common emergency methods are to bag the silage, place it in piles, improvise bunker silo walls with large round bales lined with plastic on the inside, moveable/portable bunker systems, or place it in trenches. Corn and sorghum also can be combined and stored as high-moisture grain.

An option that must be considered, if the owner has no way to feed the silage or high-moisture grain, is to sell it in the field to someone who can use it as feed. A rule of thumb is that you will get about 1 ton of silage per acre for each foot of plant height not counting the tassel and stalk left standing. Or, if you can get an estimate on the potential bushel yields, silage tonnage will be about 20% of the corn bushel yield. These estimates might help negotiate a field price for the silage.

Inspect fall, frost-damaged crops the morning after the frost as soon as the plant has begun to thaw out. Options for handling the fall, frost-damaged crop depend on the plant stage when the frost occurred.

Corn

Corn will be in the milk, dough, or dent stage. If the corn was frozen in the milk stage, green chopping or ensiling may be the

only option. If the corn was frozen in the dough stage, the kernal moisture will be above 60% so the crop must be left to field dry if it is to be harvested as high-moisture grain. If the whole plant is to be harvested as silage it should be ensiled at about 70%-72% moisture content for storage in a bunker silo, bag, or stack. If it is stored in a concrete stave silo, 60% to 65% moisture content is best and 50% to 60% is best for an oxygen-limiting silo.

This means that if corn is damaged by frost, harvest it before the leaves turn brown. If the leaves turn brown, add water to get it to the necessary moisture level of 60-65%. A rule of thumb is to add 7 gallons of water per ton of chop for each percent increase in moisture content below 60%. For maximum absorption, distribute the water uniformly to the crop as it is placed into the silo.

Corn also can be harvested and stored as high-moisture shelled corn or ear corn. The moisture content that will satisfy proper fermentation occurs at or near physiological maturity. An acceptable range for grain moisture content is 25 to 30% with an upper limit of 33%. Table 1 shows the approximate moisture relationship between kernel, cob and the whole ear.

Ground ear corn and rolled or ground shelled corn can be stored safely at lower moisture than whole, shelled corn. Moisture contents recommended most often are listed in Table 2.

Corn below 25% moisture may require additional moisture for safe storage. A rule-of-thumb is to add 3 1/2 gallons of water per ton of corn for each percentage point the corn is below 27%. Water added to rolled or ground kernels will be absorbed more readily than when added to whole corn.

Store high-moisture corn in a method that excludes as much air as possible. In an upright silo, caulk the doors or covered them on the inside with plastic. Place a plastic cover over the top of the corn.

Table 1. Moisture content of kernel, cob and whole ear.

Kernel moisture	Cob moisture	Whole ear moisture
%	%	%
26	46	31
28	48	33
30	50	35
32	53	37
34	55	39
36	57	41
38	59	43
40	60	45

Table 2. Moisture contents for high-moisture corn storage.

	Moisture content %
Kernel	27
Recommended kernel range	25-32
Whole ear	32
Recommended whole ear range	28-38
Outer limits for whole ear range	25-42

If the corn is stored in an upright concrete stave silo, be sure that the silo reinforcing rods are spaced close enough for this type of storage. The correct spacing is in Table 3. Approximate upright silo capacities are shown in Table 4.

You also can store high-moisture shelled or ear corn in bunker silos. Fill the silo as rapidly as possible and cover with plastic to exclude as much air as possible.

Plastic bags offer a good alternative for safe storage of high-moisture corn. Take care to locate the bags to prevent puncturing or tearing of the plastic by tree branches, rodents, etc., which would allow air to enter the grain and induce spoilage.

Soybeans

Harvesting soybeans as a forage is a way to salvage a crop. If used for silage, wilt soybeans down to 40 to 50 percent dry matter before chopping. Finely chop the silage material. Sharp knives are required to do this because of the tough stems. If possible, make the harvest after the pods have formed but before the lower leaves turn yellow and drop.

Yields of two to three tons per acre of dry matter of good quality forage can be obtained. The dry matter yield of beans usually increases from full bloom until the pods are 2/3 to 3/4 filled. Crude protein declines from about 17% at full bloom to 9% with mature pods.

Soybean silage can be stored like corn silage. Some producers have mixed soybeans and corn for silage at a ratio of two parts corn, one part soybeans.

Table 3. Spacing of reinforcing rods for storing high-moisture corn grain in concrete stave silos.

Distance from top (ft)	Diameter of silo (ft)					
	10	12	14	16	18	20
Spacing of horizontal rods (inches)*						
0-5	30	30	30	30	30	30
5-10	30	30	30	30	15	15
10-15	30	15	15	15	15	15
15-20	15	15	15	15	10	10
20-25	15	15	15	10	10	10
25-30	15	15	10	10	10	7 1/2
30-35	15	10	10	10	7 1/2	7 1/2
35-40	10	10	7 1/2	7 1/2	7 1/2	6
40-45		10	7 1/2	7 1/2	6	6
45-50		7 1/2	7 1/2	6	6	6**
50-55			6	6	5	6**
55-60			6	5	5	5**

* 9 1/16-inch-diameter, round rods with rolled threads

** 5/8-inch-diameter, round rods with rolled threads

Table 4. Approximate silo capacities.

Inside silo diameter (ft)	Pounds of material per inch of depth	
	Shelled corn*	Ground ear corn**
10	308	262
12	443	377
14	603	513
16	787	670
18	997	848
20	1230	1047
22	1489	1267
24	1772	1508

* Approximate weight of shelled corn is based on 47 lbs per cu ft

** Approximate weight of ground ear corn is based on 40 lbs per cu ft

Sorghum

Forage sorghum is the most common sorghum harvested for silage. It provides excellent tonnage and generally will have 80-90% of the feeding value of corn silage. Harvest forage sorghum for silage at the medium- to hard-dough stage of growth. The crop will have approximately 70% moisture and can be direct cut for silage. The ideal moisture content is 62-72 percent. This is indicated if a stalk is twisted in the hands and just a little juice is visible on the twisted stalk.

Using a moisture tester is a more reliable testing method, however. Excess moisture may produce run-off and encourage production of butyric acid which produces less palatable silage. Where both are available, high moisture forage sorghum can be mixed with relatively dry corn to help correct the moisture problem in both forages.

The recommended chop length of sorghum is 3/8 to 1/2 inch. The sorghum can be stored using the same methods as were suggested for corn silage.

For More Information

To learn more about handling crops affected by drought and the handling and storage of high-moisture grains, call or visit your local county Extension agent.

This publication and others can be accessed electronically from the SDSU College of Agriculture & Biological Sciences publications page, which is at <http://agbiopubs.sdstate.edu/articles/ExEx1015.pdf>



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ExEx 1015 - pdf by CES. September 1992; updated April 2002.