farm and home

FACT SHEET

AGRONOMY NO. 9

Corn Silage

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The corn producer has three major alternatives when faced with a high moisture corn crop: Silage, drying, or storing ear corn in appropriate cribs. This fact sheet considers silage. Agricultural Engineering Fact Sheet No. 12 considers drying and dry corn storage.

By harvesting the entire corn plant and storing it as silage, Minnesota livestock farmers have been able to produce large quantities of high quality farm grown feed. In recent years, the silo has provided safe storage for corn ears and grain as well as conventional silage.

A. Whole Plant Silage

The whole plant is harvested and stored as silage. About 60 percent of the total dry matter is in the ear. Good quality corn silage must have a high proportion of grain. Putting the corn plants in the silo provides the best possible use of corn that has been badly damaged by moisture shortage, hail, or other bad weather.

1. Harvest at 65-70 percent for safe storage. This assures good packing which excludes air.

2. Harvest in the hard dough stage. Kernels should be fully dented and firm. Kernel moisture will be 35-40 percent.

3. Feeding value if high. A feeding of 30 pounds per day of well-eared corn silage will contain about 3 pounds of corn grain.

Estimating the percent moisture from stage of ear development

Stage of ear development	Approximate moisture in silage
	percent
Ears beginning to form	85
Kernels beginning to form	83
Early milk	80
Late milk	77
Early dent	75
Kernels well dented	72
Kernels hardened, leaves green	70
Kernels hard, few top leaves green	65

B. Ear and Shelled Corn Silage

This is a relatively new approach in utilization of the corn crop, but it fits well into livestock feeding operations. With this type silage the ear is picked and ground or picked, shelled, and ground before ensiling. A hammer mill or burr mill may be used for grinding.

To assure high quality ear and shelled corn, certain practices need to be followed:

1. Check moisture content of the grain. Moisture content is very important in producing a high quality silage with minimum loss of feed nutrients.

- Ear Corn: 30-35 percent kernel moisture has produced good quality silage. Cobs generally run 10-20 percent higher in moisture than grain. The ear (grain and cob) usually averages about 5 percent more moisture than grain alone.

  Example: A sample of corn kernels tests 30 percent moisture. The ear will then contain about 35 percent moisture.

- Shelled Corn: 30 percent moisture has produced good quality silage if corn is ground. If grain is not ground, somewhat higher moisture content will be necessary.

2. Grind coarse for better silage. A hammer mill or burr mill can be used for grinding shell corn, but ear corn should be cut into short lengths before grinding. Special mills that combine cutting and grinding are generally used. This increases grinder capacity. It also avoids separation of cobs and kernels during filling, which may result in storage problems. It assures highest feeding value of the material and helps reduce spoilage during feeding. The grinding is also important if water is to be added to adjust moisture levels.

3. Add water to the silage. Water can be added to either ground ear or shelled corn to adjust the moisture content to safe storage levels. Rule of thumb--add about 4 gallons per ton of green material for each 1 percent rise in moisture. A more accurate method for determining the amount of water to add is as follows:

a. $\text{Initial weight} \times \frac{\text{100-initial \% moisture}}{\text{100-final \% moisture}}$ = final weight

b. Final weight minus initial weight= weight of water to add

c. $\frac{\text{Weight of water to add}}{\text{Weight of 1 gal. of water}}$ = gallons of water to add

d. Example: A sample of corn kernels tests 25 percent moisture, and 35 percent ear corn silage is desired. Since the kernels contain 25 percent water, the ear will contain about 30 percent water, leaving an additional 5 percent to be added water.

$2,000 \times \frac{100 - 30}{100 - 35}$ = final weight

$2,000 \times \frac{70}{65} = 2,200$ lbs.

2,200 - 2,000 = 200 lbs. of water to be added

$\frac{200}{8.33}$ = 24 gallons of water per ton

4. Silo must be airtight. Since ear and shelled corn silage are feed concentrates, losses in this type of silage are more costly than with other types of silage. Spoilage is likely to occur around any air leaks in the silo. Most commonly, leaks are found around the doors and at the top. Covering the doors and top with plastic sheeting will help reduce losses of this valuable feed.

5. Silo may need reinforcement. Masonry silos built for whole-plant silage may need additional hoops to hold grain-corn silage. A good rule is to add one extra hoop between each existing hoop in the middle one-third of the silo. Place extra hoops between doors to eliminate spreaders.

6. How much to feed to avoid top spoilage. There is no particular problem with spoilage when temperatures are below 50°F. Beyond this point, spoilage in the silo and in the feed bunks can be a problem if there are too few animals to feed. Rule of thumb: Remove about 3 inches of ground ear corn or ground shelled corn silage each day when average temperatures are above 50°F.

7. How to calculate the amount of silage in the silo. Well-packed ear corn silage averages about 50 pounds per cubic foot at 35 percent moisture. Shelled corn silage averages about 60 pounds per cubic foot at 30 percent moisture. To find the number of tons of high moisture grain in the silage, the following formulae may be used. .0196 (silo diameter in feet)^2 (depth of silage in feet) = tons ear corn at 35 percent moisture .0235 (silo diameter in feet)^2 (depth of silage in feet) = tons shelled corn at 30 percent moisture.

Example: A 14-foot diameter silo is filled to a depth of 50 feet with ground ear corn at 35 percent moisture. How many tons of corn does it contain? .0196 x 14 x 14 x 50 = 192 tons

8. How to calculate the amount of silage fed. Since silage tends to "fluff up," material will be less dense at the surface than in the depths of the silo. Hence another formula must be used to determine the number of pounds of corn per inch at the surface. This formula is: 2.42 (silo diameter in feet)^2 = pounds ear or shelled corn silage/inch depth

Example: How many pounds of shelled corn silage (30 percent moisture) are in the surface inch of a 14-foot silo? 2.42 (14) (14) = 474 pounds

How many cattle would be required to consume 3 inches per day? Assume: 14 foot diameter silo and cattle fed 25 pounds silage per day--3 inches x 474 pounds = 1,422 pounds silage

$\frac{1,422 \text{ pounds}}{25 \text{ pounds per animal}}$ = 57 head

9. Advantages.

a. Permits earlier harvest.

b. Helps reduce field loss from ear drop, stalk lodging, shattered kernels.

c. Permits plowing in the fall.

d. Gives feeding advantage compared with dry corn resulting in lower costs per pound of grain.

e. Saves labor--grind and store at harvest time.

f. Provides a good way to salvage high moisture corn.

10. Disadvantages.

a. Limited use--livestock feeding only.

b. Feeding problems when outside temperature is above 50°F.

c. Extra weight to handle because of higher moisture content.

C. Modified Whole Plant Silage

Two methods of modifying whole plant silage are used on some farms in Minnesota. One method is to cut as high as possible, leaving 12 to 18 inches of the lower stalk standing in the field. This gives a higher proportion of grain to stalk and leaves and results in a more digestible, nutritious silage. Chemical analysis of the lower 12 to 18 inches of stalk indicates it is considerable lower in protein and digestibility and higher in fiber than other parts of the plant.

The second method is to harvest one load of whole plant silage in the usual manner, but add shelled high moisture corn from one or two rows on top of the load. This works best on farms where picker-shellers are part of the corn harvesting equipment. Elevating the green material into the silo provides good mixing of the shelled corn with the whole plant material. This results in a higher grain proportion and more nutritious silage.

Summary

1. Harvest whole plant silage when the grain is fully dented, but while the stalks and leaves are still green. Average moisture for the green material should be 65 to 70 percent.

2. Ear corn silage with a moisture level of 35 - 40 percent has given good feeding results. Ears should be coarse ground through a hammer or burr mill to facilitate packing, increase feed efficiency, and soak up added water, if needed.

3. Shelled corn silage with a moisture level of 30 percent has given good feeding results. Kernels should be coarse ground.

4. For good corn silage the storage unit should be airtight.

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