



## Utilizing Drought-Stressed Corn for Silage

### Key Points

- A corn crop that has been compromised by drought stress and is expected to yield little or no grain may still be salvageable as a silage crop.
- The main concern with drought-stressed corn is the potential for high levels of nitrates in the plant which can be harmful to humans and livestock.
- Loss of soil nutrients and soil moisture due to stalk removal are other concerns that should be considered when planning the next crop.

A corn crop that has been compromised by drought stress and is expected to yield little or no grain may still be salvageable as a silage crop. With proper management, drought-stressed corn can make good animal feed, but there are several precautions to be aware of before harvesting including: proper moisture content for optimal fermentation, potentially toxic levels of nitrates that can accumulate in plant tissues, harvest intervals of pesticides and herbicides recently applied to the field, and consequences of stalk removal on soil fertility and soil moisture retention. Additionally, be sure to check with your crop insurance agent before harvesting for forage or silage or you may forfeit indemnities.

### Assessing the Crop for Grain or Early Harvest

If corn has successfully pollinated and there is evidence of kernel growth (blisters are forming in the ear) despite drought conditions, the best alternative may be to wait for grain to develop. If pollination is disrupted enough that plants will be barren, the crop may be harvested as soon as whole-plant moisture levels are appropriate for silage.

### Precautions for Harvesting Drought-Stressed Corn

**Potentially toxic nitrate levels.** The main concern with drought-stressed corn is the potential for high levels of nitrates in the plant which can be toxic when fed to animals and may produce a gas that can be lethal to humans and livestock. Nitrates can accumulate in plants when there is a large amount of nitrate in the soil and normal growth is interrupted, such as during drought stress. Nitrate accumulation is higher after a drought-ending rain or an irrigation because the water helps move the nitrates in the soil into the root where they are taken up by the plant. It usually takes three to four days before these nitrates are converted by the plant into proteins. Therefore,

harvesting corn silage following a drought-ending rain or irrigation should be delayed until nitrate levels in the plant recede.

Obtain an analysis for nitrates in the crop prior to harvest. Nitrates will accumulate in the stalks and leaves, with highest concentrations in the lower part of the plant and other conductive tissues (Table 1). Cutting drought-stressed corn for silage is preferred over grazing or green-chopping because fermentation can reduce nitrate concentration by approximately 1/5 to 2/3.<sup>1</sup> Allow silage to ferment at least one to two months prior to feeding. To help reduce nitrates at harvest, raise the cutter bar to 12 inches above the surface and avoid harvesting immediately following a drought-ending rain or irrigation. If high nitrate levels were found at harvest, test the product again before feeding to animals to ensure it is safe for consumption.

**Harvest moisture content.** The optimum harvest moisture will depend on the method of storage to be used (Table 2). Harvesting drought-stressed corn too soon can result in silage with excess moisture, which can lead to poor fermentation and reduced feed value. When moisture levels are too low, fermentation will slow resulting in less breakdown of nitrate. It is important to check whole-plant moisture prior to harvest as

**Table 1. Nitrate nitrogen in 28 samples of drought-stressed corn**

Plant part	Nitrates in parts per million
Leaves	64
Ears	17
Upper third of stalk	153
Middle third of stalk	803
Lower third of stalk	5,524
Whole plant	978

Source: Cassel, E.K. and Vough, L.R. 2002. Harvesting and feeding drought-stressed corn. ExEx4017. South Dakota State University Extension.

# Utilizing Drought-Stressed Corn for Silage

the stalks may contain over 70% moisture even though the leaves appear dry and are turning brown. If whole-plant moisture is greater than 75 to 80%, harvest should be delayed or the corn can be windrowed and allowed to field wilt before chopping for silage. Drought-stressed corn should be chopped to 3/8 inch in length for harvesters without a grain processor and 3/4 inch for harvesters with a grain processor (0.08 to 0.12 mm roll clearance) to help it pack better for fermentation and storage.

## Guidelines for Estimating Yield and Selling Drought-Stressed Corn

The silage yield of drought-stressed corn can be estimated by assuming that one ton of 30% dry matter silage can be obtained for each five bushels of grain per acre. If no grain is expected, plant height can be used to estimate yield. For each foot of plant height (excluding the tassel) approximately one ton of 30% dry matter silage would be predicted. For example, if corn is six feet tall, five feet would be harvested, resulting in five tons/acre.<sup>2</sup>

A producer considering selling drought-stressed corn for silage should have a forage analysis conducted to assess the quality of the feed. The feed value of silage from drought-stressed corn with minimal or no grain is typically between 65 to 100% of that of normal corn silage (Table 3).<sup>3</sup> It is generally lower in energy but higher in protein content than normal silage (Table 4). The producer should also consider tonnage, moisture content and other factors based on current prices. The websites listed below contain resources to aid in pricing decisions. This is not a complete list. Check with your university Extension office for local recommendations.

- Kansas State University - Livestock decision tools, KSU Silage Value. [www.agmanager.info](http://www.agmanager.info)
- University of Wisconsin Extension - Pricing drought stressed corn silage. W-187. <http://corn.agronomy.wisc.edu>
- Ohio State University - Pricing drought stressed corn silage. <http://dairy.osu.edu>
- University of Nebraska-Lincoln - The use and pricing of drought-stressed corn. [www.ianrpubs.unl.edu](http://www.ianrpubs.unl.edu)

## Managing Soil Fertility

The removal of corn for silage can have a negative effect on soil fertility and soil moisture conservation. Because a significant amount of biomass is removed when corn is harvested as silage, several times more nitrogen (N), phosphorus (P) and potassium (K) is removed than would be if the crop was harvested for grain. Without the crop residue cover, more soil moisture can be lost due to evaporation. Producers shouldn't lose sight of the consequences of nutrient removal and plan to replace lost nutrients prior to seeding the next crop, particularly for crops with high K requirements (alfalfa).

### Sources:

<sup>1</sup> Cassel, E.K. and Vough, L.R. 2002. Harvesting and feeding drought-stressed corn. ExEx4017. South Dakota State University Extension.

<sup>2</sup> Hall, R.C. and Twidwell, E.K. 2002. Effects of drought stress on corn production. ExEx8033. South Dakota State University Extension.

<sup>3</sup> Cassel, E.K., Vough, L.R. and Fultz, S.W. 2006. Determining the value of drought-stressed corn. ExEx 4018. South Dakota State University Extension.

Other sources: Barnhart, S. 2009. Harvesting high-quality corn silage. Integrated Crop Management News. Iowa State University Extension. <http://www.extension.iastate.edu>. Web sources verified 6/17/15.

This publication was developed in partnership with Technology, Development & Agronomy by Monsanto.

Individual results may vary, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible. **ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS.** Channel® and the Arrow Design® and Seedsmanship At Work® are trademarks of Channel Bio, LLC. ©2015 Monsanto Company. 120704115800 070915CAM

**Table 2. Recommended moisture content for corn silage stored in various types of silos**

Upright silos	60 - 65%
Upright oxygen-limiting silos	50 - 60%
Horizontal silos	65 - 70%
Bag silos	60 - 70%

Source: Corn silage - Harvesting and storage. 2015. Corn Agronomy. University of Wisconsin Extension. <http://corn.agronomy.wisc.edu/Silage/S004.aspx>.

**Table 3. Silage feed value comparisons**

Condition of drought-stressed corn	Percent feed value of normal corn silage
Short barren stalks	70 - 80%
0 - 20 bu/acre	80 - 90%
20 - 40 bu/acre	90 - 100%

Source: Lauer, J. et al. Pricing drought stressed corn silage. W-187. University of Wisconsin Extension.

**Table 4. Comparison of forage analyses for normal and drought-stressed corn silage**

Silage type	Dry matter	Crude protein	Acid detergent fiber	Total digestible nutrients
Normal	35%	8.5%	28%	68%
Stressed	25%	10%	34%	62%

Source: Cassel, E.K., Vough, L.R. and Fultz, S.W. 2006. Determining the value of drought-stressed corn. ExEx 4018. South Dakota State University Extension.