



Freeze Injury to Corn and Silage

An early frost can impact grain and silage corn and the severity of the injury depends on the temperature, the duration, and what stage of maturity the crop was in when the frost occurred.

What temperature is the threshold for freeze injury to corn?

A temperature of 32°F will take a few hours for corn to be killed, and at 28°F corn can be killed in few minutes. When temperatures are near 32°F frost can damage the plant, especially in conditions where rapid heat loss can occur, such as clear skies and no wind. Variations in topography within the field can alter the environment to the degree where parts of the field can be more adversely impacted. Signs of injury, water-soaked leaves that become brown, usually take at least a day to three days to appear; therefore, assessment of the extent of injury should be delayed by a minimum of five days.

Will the grain quality be impacted?

The extent of the impact on grain quality depends on the stage of maturity and the amount of damaged leaf tissue. If the grain is in the mid-dough (R4) growth stage, the impacts on quality can be substantial. If the grain is in the dent stage (R5), usually the impacts are moderate. When the grain is in the R5.5 stage (half-milk line), there is usually only minor impacts on grain quality. Generally, if corn is at the R4 stage and completely killed by frost, yield loss may be about 55% and at R5.5 (half-milk line) the loss may only be about 12%. With a light frost and only the leaves killed, yield loss may be 35% at R4 and 5% at R5.5.

If the plant is not completely killed, but the leaves are damaged, will the stalk provide resources to the developing grain?

If the stalk is alive after the frost event it can provide carbohydrates to the grain. While this may reduce grain yield losses, the cannibalization of the stalk resources may increase susceptibility to root and stalk lodging prior to harvest.

Will field drydown rates be impacted after a frost event?

The drydown rate of frost-damaged corn should be normal; however, if the grain was frozen before full maturity, it may take an extra 7 to 10 days for grain to reach the 22 to 30% moisture range.

What are the characteristics of frost-damaged grain?

The grain will be soft, small, oddly shaped, easily broken and can generate many fines. The starch will be undeveloped and have a “pithy” appearance. Protein content will be average at a test weight above 45 lb/bushel, but will be reduced along with digestibility at lower test weights. Test weight will not increase after grain drying.

A word of caution: grain moisture meters tend to indicate a lower moisture reading for immature frosted corn than actual levels when the grain is dried.

What is the best use of frost-damaged corn grain?

Frost-damaged grain is best used as animal feed, so it is recommended to test the grain for protein and amino acid levels as well as mycotoxins if the grain has low test weight. If the test weight is below 45 lb/bushel, then the value may only be reduced 2 to 5% than normal corn test weight on per pound basis if used for large animals. Usually ethanol millers will not want to take frost-damaged light corn as it is not as efficient or predictable as normal corn in the milling or fermentation processes.

Can frost-damaged immature grain be stored?

Yes, but care must be taken in handling, drying, and storing the grain. When harvesting, set the combine

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so that threshing is balanced between the need to retain the kernels, which will be small, and limiting the damage to the kernels when the grain is removed from the cob. Try to reduce the fines and chaff as much as possible in the harvesting process as they can increase mold problems in the grain. Achieving a consistent grain moisture level with the grain drier will be challenging as grain moisture levels from the field will be variable. Lower dryer air temperatures to below 160°F and store grain with at least 14% moisture. Cooling the grain mass slowly after artificial drying to a storage temperature of 20° to 30°F can also help with lower quality concerns.

If possible, keep immature frost-damaged grain separate from normal grain as frost-damaged grain can go out of condition quicker and storage life is only about half as long as normal corn. Keep the bins aerated as much as possible and use or sell the grain prior to summer months.

What impact will a killing freeze have on corn to be used for silage?

If the corn was frost-damaged or killed prior to the dent stage, plant moisture will be too high for ensiling. Allow the crop to dry in the field for several days while whole plant moisture is monitored. If the corn was in the dent stage, harvest should begin as soon as possible as excessive leaf loss can occur after frost or freeze injury.

Complications can occur if mold forms on ears or grain due to the increased moisture, so harvest should begin as soon as possible. To help reduce the excess moisture, it can be mixed with straw or chopped to reduce the overall moisture level. A rule of thumb is about 30 pounds of dry material per ton of silage to reduce the silage moisture by one percentage unit.

Is checking the whole plant moisture necessary if the plant is killed by frost?

Absolutely. The plant will look drier and give the false impression that it is ready for harvest. Using the whole plant will provide a more accurate measure if it is acceptable ensiling.

Will nitrate concentrations be too high in frosted corn used for silage?

Perhaps. If the plant is still alive and photosynthesizing, even if it is just the stalk, it may accumulate nitrates particularly in the lower stalk. However, cutting the silage higher on the stalk, around 18 inches, can reduce the risk. The impact will be lower yield, but the corn stalk below this height is wetter and of poorer quality. Cutting at 18 inches decreases whole plant moisture by about 4%, and tonnage decreases by about 10 to 15%, but quality is increased by about the same percentage as the decrease in tonnage. This results in a milk per acre yield reduction of 3 to 4%.

Green chopping may be a way to salvage the frosted corn if it is not at ensiling moisture levels, but nitrates may also be a concern.

Sources

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