Drought Effects on Grain Fill in Corn

KEY POINTS

- Heat and drought stress during corn pollination and silking can result in decreased yield potential.
- Yield loss during corn grain fill may be 3.0 to 5.8% per day of stress.
- Management decisions for drought- and heat-stressed corn are based on pollination success.

Drought Effects on Corn

Potential yield loss during grain fill can occur due to stand loss, incomplete kernel set, reduced kernel weight, and premature plant death. Corn is most sensitive to drought stress during the pollination process; however, yield loss during grain fill may still be 3.0 to 5.8% per day of stress. Kernel abortion and reduced dry weight in kernels can occur after pollination. Developing kernels, especially those near the tip of the ear, can be prone to abortion if temperatures are high and moisture is limited during the two weeks following pollination.

Cell division that occurs in the endosperm during the first seven to ten days after pollination can determine the potential number of cells that accumulate starch. Dry weight accumulation is the yield component that is affected after the kernels have reached the dough stage. Severe stress that causes premature death of leaves can result in yield losses because photosynthate is greatly reduced. Limited amounts of photosynthate to nourish the developing kernels can cause kernels to be smaller and lighter, or "shallow kernels". Additionally, severe stress during the grain fill period can cause premature kernel black layer formation, which also reduces grain fill because further kernel development is terminated.

Heat Effects on Corn

Even with sufficient moisture, high temperatures can cause a high degree of stress on the plant. Both high day and night temperatures could affect corn yield potential.

Iowa State University reports a one percent corn yield loss can occur after consecutive days of high temperatures at 93°F or greater. On the fifth day of these high temperatures, another two percent yield loss can occur, and on the sixth day another four percent can be expected. A heat wave that lasts longer than six days often results in firing of leaves and lower yield potential is expected, especially when the heat wave coincides with silking.

High temperatures stimulate respiration, and sugars that could have been stored in grain are burned up. This can be especially true when nighttime temperatures remain high and sugars are being used while no photosynthesis takes place. Thus, high nighttime temperatures can reduce yield without plants showing visible signs of stress on plants. High humidity can compound problems from high daytime temperatures by slowing temperature cool down that occurs in the evening.

Figure 1. Some kernel development improves the quality of silage.
Corn Management

Future management decisions should be made based on the success of pollination (Figure 1). If kernel set is good, the crop has some potential to produce grain. However, if potential yield is less than 25 bushels per acre, harvesting for silage/hay may be the best option. Corn for silage is preferred over hay, and plants should have 65 to 75% moisture to cut silage.

Fields that are drought stressed to the point plants have lost bottom leaves, and top leaves have browned off or turned white may be candidates for chopping or haying the crop. However, plants that do not grow normally can have high nitrate levels, especially in the lower portion of the stalk. Haying high nitrate corn does not reduce the level of nitrates, and cutting height should be at least six to eight inches above the ground to help avoid nitrate toxicity.

It is strongly recommended that the hay be tested for nitrates before feeding. The level of nitrates in corn can be estimated by a test kit purchased on the internet or from Extension offices. Samples can be taken before harvest or in the corn after ensiling. Additional samples can be sent to a lab for further analysis, if kit results indicate high levels of nitrate.

Summary

Drought during kernel fill increases death of the leaves, which reduces the amounts of photosynthesize, leading to smaller kernels. Managing stressed corn should be based on the success of pollination. Corn plants have some potential to produce grain if kernel set is good; however, if potential yield is below 25 bushels per acre, harvesting corn for silage/hay is recommended. Cutting height should be more than six inches above the ground to avoid nitrate toxicity.

Sources:


Web sources verified 9/4/2018. 180525083945