AGRONOMIC // UPDATE

Corn Grain Fill During Drought Stress

Pollination and fertilization is a very important phase of corn development; heat and drought stress during this time can result in decreased yield potential. Yield loss during corn grain fill may be 3.0 to 5.8% per day of stress.

Drought Effects

Stand loss, incomplete kernel set, reduced kernel weight, and premature plant death can potentially reduce yield. Moisture stress during corn grain fill increases the chance for leaves to die and plants to lodge, while reducing kernel weight and the time period for grain fill. 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.[1,2]

Kernel abortion and reduced dry weight accumulation in the 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.[2] 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 black layer formation, which can also reduce grain fill because further kernel development is terminated.

Heat Effects

Even with sufficient moisture, high temperatures can cause a high degree of stress on the plant. Both high day and night temperatures can have an effect on corn yield potential. Iowa State University reports a one percent corn yield loss can occur after four consecutive days of temperatures at 93°F or greater.[3] 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.[4] High humidity can compound problems from high daytime temperatures by slowing the temperature cool down that occurs in the evening.

Managing Stressed Corn

Future management decisions should be made based on the success of pollination. 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.[5] Corn for silage is preferred over hay, and plants should have 65 to 75% moisture. Fields that are drought stressed to the point that plants have lost some bottom leaves, and the 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. Cutting height should be at least 6 to 8 inches above the ground to avoid nitrate toxicity. It is strongly recommended that the hay be tested for nitrates before feeding.

Sources: [1] Wright, J., Hicks, D., and Naeve, S. 2006. Predicting the last irrigation for corn and soybeans in Central Minnesota. University of Minnesota, Minnesota Crop eNews. [2] Lauer, J. 2006. Concerns about drought as corn pollination begins. University of Wisconsin. Field Crops 28.493-42. [3] Elmore, R. and Taylor, E. 2011. Corn and “a big long heat wave on the way”. Iowa State University. https://crops.extension.iastate.edu/cropnews/. [4] Wiebold, W.J. 2012. None like it hot. University of Missouri. https://ipm.missoui.edu/IPCM/. [5] Crunch time for Kansas corn crop. 2011. The Pratt Tribune. www.pratttribune.com. Web sources verified 9/4/2018. 180525083945