Drought conditions across the country may continue or worsen as corn and soybean crops enter grain and pod fill. Risk of potential corn yield loss is greatest during pollination and remains high from the blister stage through dough stage. Soybean yield potential is most at risk from drought stress from the 2nd to 4th week of seed fill. Reviewing some physiological concepts may help evaluate the current crop status.

**Corn**

**Drought** 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. 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.

The potential number of cells that can accumulate starch is determined by cell division that occurs in the endosperm during the first seven to ten days after pollination. Dry weight accumulation is the yield component that is affected after the kernels have reached the dough stage. Limited amounts of photosynthate to nourish the developing kernels can cause kernels to be smaller and lighter, or "shallow kernels". Premature formation of black layer during high temperature periods can also reduce grain fill because further kernel development is terminated.

**Heat** 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 with temperatures 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.

**Management** 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. Corn for silage is preferred over hay, and plants should have 65 to 75 percent moisture. Fields that are drought stressed to the point 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. Haying high nitrate corn will 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

![Figure 1. Future management of drought stressed corn should be based on success of pollination. Some kernel development improves the quality of silage.](image)
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.

**Soybean**

**Drought** Moisture stress during the soybean reproductive stages causes floral abortion, reduced pod number, fewer seeds per pod, and reduced seed size. Moderate drought stress can significantly reduce or irreversibly stop nitrogen fixation, disrupting seed development. From the second through the fourth week of seed fill, a 39 to 45 percent yield decrease can occur when there are four days of visible moisture stress. Soybean flowering stops, and plants cannot compensate for lost pods when drought stress occurs during the R4 through R6 (full pod through full seed).

**Heat** It can be difficult to separate effects of high temperature from the effects of water stress in plants. Often these stresses occur together and magnify the effects of each other. Extension Soybean Specialist Jim Dunphy, North Carolina State University, indicated that "when temperatures get above about 95° F, soybeans simply can’t pump enough water to keep up with transpiration and evaporation. The plants close the stomates in their leaves and water can’t get out. That also means carbon dioxide can’t get in, and the plants can no longer get the carbon they use to make the sugars that fuel everything that goes on inside the plant.”

**Management** Effects from drought are expected to be less on soybeans compared to corn. If adequate rainfall occurs and photosynthesis is available after R5, the plant may compensate for earlier losses by producing larger seeds (within its genetic capacity). Once the plant reaches R6, pods are not normally aborted. Managing stress from insect, disease, or nutrient sources can help reduce the overall stress load on the plant and potentially limit yield losses.

**Summary**

Drought conditions of the 1930s and 1980s covered 70 and 36 percent of the United States, respectively. As of July 10th, 2012, nearly 60 percent of the contiguous United States is experiencing moderate to exceptional drought conditions. Short term drought (less than six months) affecting grass and agriculture in parts of the Midwest could have effects on productivity. Careful management of crops via stress mitigation is needed to minimize damage from these uncontrollable environmental conditions.

**Sources**