Drought Effects on Sensitive Stages of Corn and Soybean

What To Watch For

**WHAT TO WATCH FOR**
Heat and drought stress during soybean flowering and corn pollination and silking can result in decreased yield potential.

**IMPACT ON YOUR CROP**
Yield loss during corn grain fill may be 3.0 to 5.8 percent per day of stress.\(^1\)\(^2\) Drought during full pod to full seed growth stages has a greater negative effect on soybean yield than drought during any other soybean growth stage.

**TIPS TO MANAGE**
Management decisions should be made based on successful pollination. If kernel set is good, the crop has some potential to produce grain. Soybeans can be used for hay or may compensate with larger seed if rains come after R5 growth stage.

What To Watch For

**Drought and Heat Stress on Corn**
Potential yield loss during grain fill can occur due to stand loss, incomplete kernel set, reduced kernel weight, and premature plant death.\(^3\) 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 percent 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 determines the potential number of cells that accumulate starch.\(^1\) 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 the production of photosynthates is greatly reduced. Limited amounts of photosynthates 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 can also reduce grain fill because further kernel development is terminated.

**Drought and Heat Stress on Soybean**
Because flowering occurs over a wider window of time compared to corn, soybean plants can typically withstand drought stress reasonably well. However, plants are most sensitive to intense and prolonged stress during the flowering and early pod fill growth stages. Drought stress can cause floral abortion, reduced pod number, fewer seeds per pod, and reduced seed size. A moderate drought stress can significantly reduce or irreversibly stop nitrogen fixation, disrupting seed development.\(^4\) Drought stress during R4 through R6 (full pod through full seed) can have a devastating effect on yield potential because flowering stops and plants cannot compensate for lost pods.\(^5\) Specifically, drought stress during early seed fill can reduce the number of seeds per pod. Later drought stress (after abortion limit stage) can reduce seed weight.\(^6\)

Impact On Your Crop

**Corn**
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 that a one percent corn yield loss can occur after four consecutive days of temperatures at 93 °F or greater.\(^7\) 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 utilized by the plant. 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. High humidity can compound problems from high daytime temperatures by slowing the cool down that occurs in the evening.

Soybean

It can be difficult to separate the effects of high temperature from the effects of water stress on soybean 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, soybean plants simply cannot pump enough water to keep up with transpiration and evaporation. The plants close the stomata in their leaves and water cannot get out. That also means carbon dioxide (CO₂) can’t get in and plants can no longer get the carbon they use to make the sugars that fuel everything that goes on inside the plant.”

Tips To Manage

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 percent moisture for silage. 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. 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 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 Management

As mentioned earlier, effects from drought are expected to be less on soybean plants than on corn plants. If soybean leaves begin to curl or drop, it is time to decide whether to leave the plants in the field and hope for the best or cut them for hay. This decision depends on the stage of growth and the condition of the crop. Plants with 30 percent of the leaves still attached may be considered for hay. These plants can produce 0.75 to 1.25 tons of dry matter per acre with 13 percent protein and 48 percent in-vitro dry matter digestibility. If adequate rainfall occurs and photosynthesize become 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 also help reduce the overall stress load on the plant and potentially limit yield losses.

Sources


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