Drought stress in corn

In most of the state, rains have been somewhat sporadic in recent weeks. Some of the dryland corn crop is experiencing a combination of heat and drought conditions. Moisture levels have varied from excessive in many areas early in the season to very dry now as corn is entering or already at the reproductive stages. Since the growing season is progressing very quickly, it is best to be prepared to take a close look for symptoms of potential drought stress.

Early-to-late vegetative stages

One of the first visible corn responses to insufficient water availability is leaf rolling. If the stress is severe, the leaf rolling process can be detected even very early in the morning. Leaf rolling is just a plant defense mechanism to reduce transpiration and plant canopy temperature, and with an overall improvement in water use efficiency. Under continuous drought for several days, reductions in leaf elongation and in plant height should be expected.
Figure 1. Leaf rolling in corn under drought stress. Photos by Ignacio Ciampitti, K-State Research and Extension.

Shorter, less leafy plants are also among the most visible symptoms of drought stress conditions. Plants may not be as green as usual if chlorophyll production is affected. In addition, root systems will be smaller under drought conditions since all below- and above-ground plant growth will be affected. Those symptoms are the outcome of plants that are less efficient in growing as photosynthesis is slowing down.

Figure 2. Effect of drought stress on root systems. On the left is a plant with a smaller root system and stalk diameter caused by drought stress. On the right is an unstressed corn plant, with greater root system, more nodal roots, and greater stalk diameter. Photo by Ignacio Ciampitti, K-State Research and Extension.

Critical period bracketing silking

At what stage of growth is corn most sensitive to drought stress? To answer the question, we need to know the most important growth stages for grain determination. The final number of kernels for corn is determined around the pollination period (2 weeks before and 2 weeks after flowering). Thus, corn is extremely sensitive to drought stress during that period. Drought stress directly affects the final number of kernels through different processes, such as:

1. Potential delays in silking (asynchrony between the development of male and female reproductive parts). This happens when the tassel is shedding pollen but the ear is not yet receptive (silks are not yet out of the husk).

2. Potential reductions in ear size (smaller ears with less physical space for bearing grains).
3. Shorter time for pollen receptivity. This occurs when the silks dry out very fast under warm temperatures, impeding a successful pollination.

4. Pollination is concentrated in just a few days. In general, pollination takes place earlier and with a short duration under drought stress. High temperatures can also potentially impact pollen viability.

5. Even when pollination is effective, kernel abortion or cessation can occur right after flowering, in the blister and milk stages, if drought stress continues.

Under extreme drought and heat stresses, plants may be barren, with no ears being formed at all, if conditions were severe well before pollination time.

Figure 3. Leaf rolling in corn under drought stress during early reproductive stages. Photos by Ignacio Ciampitti, K-State Research and Extension.

Overall reductions in potential yield can be expected whether the stress occurs early (10-leaf to 15-leaf stages) or late (dough and dent stages) in the crop growing season.
Management practices and other factors

From a management practice perspective, situations that tend to make corn more susceptible to drought stress include high plant densities, narrow row spacing, and excessive applications of fertilizer or manure. Also, sandy soils are prone to the drought stress due to reduced water holding capacity.

Summary

Scout your acres for drought symptoms. The impacts of the drought stress on grain yield can be known with more precision right after flowering. If stress is impacting the potential kernel number, and if conditions for the coming weeks continue to be on the dry side, yield reductions can be expected. Continuing drought stress could potentially reduce yields further by lowering seed weight, on top of a reduction in kernel numbers.

This information was provided by Dr. Ignacio Ciampitti, KSRE Crop Production and Cropping Systems Specialist, in the July 21st edition of the Extension Agronomy eUpdate.

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