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Grain Crops Update

June 26, 2009 Erick Larson

Heat Stress, Pollination and Irrigation Scheduling

Well above normal temperatures the last few weeks have prompted questions about its effect on corn pollination and productivity. High temperatures, especially nighttime temperatures in the 70's and 80's, reduce corn yield potential, by increasing wasteful respiration. However, high temperatures should not generally prohibit pollination, unless severe water deficit is also present. Pollination problems are extremely rare when soil moisture is adequate to promote plant growth and maintenance functions, which serve to cool plants. Therefore, proper irrigation should minimize potential pollination problems. Pollination problems can occur in dryland fields with extremely low soil moisture reserves. The excessive saturation during vegetative stages most corn endured earlier this spring, increases likelihood of water deficit of dryland corn during this critical period, because it limited root growth and depth, and promoted crown rot in inundated areas. Severe stress stunts corn silk growth and slows silk emergence relative to pollen shed – in other words, stress stunts the plants just prior to and during fertilization, promoting failure, because fertilization is no longer synchronized. Since pollen shed occurs in a relatively short (5-8 day) period and silks emerge slightly later than pollen shed initiation, pollination failure occurs if silks fail to emerge in time to receive pollen. This synchrony problem often results in more blank kernels near the ear base, because basal silks are the last to normally emerge.

Figure 1. Although high temperatures will reduce productivity, high temperatures alone rarely promote pollination failure. If soil moisture is adequate, corn plants can cool themselves and develop normally, albeit not as efficiently.

Will irrigation or rainfall hurt pollination? - Corn possesses a vast overabundance of pollen and several traits, which make the pollination process relatively immune to overhead irrigation or rainfall disturbance. Corn produces a huge overabundance of pollen grains (more than 4000 pollen grains per silk). Physical disturbance caused by overhead irrigation occurs over a very short time period in relation to corn pollination capacity. Pollen shed normally lasts 5 to 8 days, during which pollination may occur at any time. Corn plants also have an innate ability to stop pollen shed when the tassel is too wet or dry and trigger pollen shed when conditions are favorable. Additionally, silks are quite sticky, which makes pollen grains hard to wash off after they land on a silk. Thus, the physical disturbance caused by rainfall or overhead irrigation will not reduce corn pollination in a normal field environment.

Figure 2. Corn pollination is relatively immune to mechanical disruption. However, severe drought or other types of stress can disrupt synchrony between pollen shed and silk emergence, causing pollination failure.

Irrigation scheduling – The drastic change from wet to dry conditions this season can make irrigation scheduling more difficult in some respects. Of course, early-season saturation limited root growth and depth, which makes plants more prone to water stress, if moisture becomes limiting. However, because the onset of hot, dry conditions came so quickly and near peak water corn demand, soil moisture levels were still quite high when irrigation began in many cases, particularly on heavy clay soils. Thus, our predominant furrow-irrigation systems may require longer intervals between irrigation cycles than normal, to prevent prolonged, unnecessary saturation. Prolonged saturation during corn grain filling can reduce yield potential even more substantially than during vegetative stages. Prolonged soil saturation during hot conditions can also promote the swift onset of severe heat stress, because plants cannot function without adequate soil aeration. The key to proper irrigation timing is simply checking soil moisture using a probe, shovel or other tools, rather than basing timing on the calendar. Weather, soil moisture and crop conditions can vary widely from field to field and year to year, and this year has certainly been extreme, so I highly encourage you to closely monitor soil moisture level and schedule accordingly.

Figure 3. Crown rot is evident in many plants subjected to prolonged saturation, especially areas with drainage limitations. This problem can restrict nutrient and water uptake, causing plants to appear nutrient deficient, despite adequate nutrient levels. Vigilant irrigation timing is needed in this case, because excessive or limited moisture can aggravate plant health.

To add your address to the Corn and/or Wheat email list, please send a request to: **elarson@pss.msstate.edu**

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