AGRONOMIC Spotlight

Technology Development & Agronomy by MONSANTO

Effect of Heat and Drought Stress on Corn Pollination

Corn pollination and fertilization is a very important phase of crop development. Heat and drought stress during this time can result in decreased yield potential. Although the number of potential ovules per ear is established earlier in the season, successful pollination and fertilization is required for those ovules to develop into kernels.

Heat and Drought Stress Identification

Corn plants often roll their leaves to protect themselves from excessive moisture loss due to transpiration. Plants may roll their leaves in response to inadequate moisture; however, rolled leaves in the afternoon may not always mean corn is under drought stress (Figure 1). When leaves are rolled from early morning through the evening and plants have a gray or silver cast to them, the drought stress is likely severe enough to delay silk emergence and cause death of leaf tissue[2].

Heat and drought stress often cause the most damage to fields with compaction issues, fields that had extreme soil saturation early in the season, or fields with injury from root-feeding pests. These factors may cause the corn plant to have underdeveloped, injured, or shallow root systems, which decrease water uptake and may increase symptoms of heat and drought stress.

Pollen Shed

Basics. An individual tassel can shed pollen for up to seven days with the majority of pollen generally shed the second or third day following anther emergence[1]. If tassels are wet with dew or rain, pollen shed is greatly decreased. Peak pollen shed generally occurs mid-morning and again later in the afternoon or evening. When evaluating how pollen shed is progressing, note where the pollen is coming from on the tassel. Pollen shed generally begins in the middle of the main tassel spike, then progresses up and down the main spike, as well as out on the tassel branches[1].

Effects of Drought and Heat Stress. Drought stress can decrease the amount of time a tassel sheds pollen. Pollen shed decreases when temperatures are over 86 °F and temperatures over 100 °F can decrease pollen viabiliy[1]. Even in drought situations, the amount of pollen is generally adequate; however, the abbreviated pollen shed coupled with delayed silk emergence can cause dramatic decreases in yield potential.

Silking and Fertilization

Basics. Silks generally emerge from the husks for four to eight days, starting at the base of the ear and progressing toward the tip[2]. For the first couple of days following silk emergence, silks can grow approximately 1.5 inches per day. The growth rate decreases over time. An individual silk will continue to elongate until it is pollinated or until it senesces. Silks can be pollinated up to 10 days after emergence, but most of the successful fertilization occurs within the first 4 to 5 days following emergence[2].

Effects of Drought and Heat Stress. Because silks have a higher water content than any other part of the corn plant, they are the most sensitive to drought stress[2]. Inadequate moisture slows silk elongation and emergence. If pollen shed is accelerated and silk emergence is delayed, pollination and fertilization can be poor. Severe drought stress can also cause desiccation of silks, rendering them unreceptive to pollination. To check fertilization progress, pull an ear and carefully remove the husks. Do not pull silks off with the husks. Once the husks are removed, gently shake the ear (Figure 2). Kernels that have the silk still attached have not been fertilized. Depending on the timing of the stress, kernel set could be good at the base but not at the tip, or it could be scattered (Figure 3).

Continued on next page

Figure 1. Pictured, a corn field with plants exhibiting rolled leaves.

Figure 2. Example of an ear being checked for fertilization progress. Kernels with silks still attached have not been fertilized.

Figure 3.Differed patterns of kernel set.

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Continued from page 1

Stress After Pollination

Corn yield can also be affected if adequate moisture is not available after kernel fertilization. Moisture availability continues to be important during grain-fill stages as the corn plant can abort fertilized kernels (Figure 4). Drought stress during grain fill can result in low test weight grain.

Management Considerations

Flowering is the growth stage during which corn requires the most water per day for adequate development (Figure 5). Where available and when necessary, irrigation can mitigate pollination problems and enhance grain fill. The following are management considerations to help reduce the effects of drought stress.

- Select corn hybrids that are adapted to heat and drought tolerance. Risk may be managed by diversifying with different hybrids that pollinate at different times and have different relative maturities.
- Avoid late planting, which could result in pollination occurring during what is typically the hottest (and possibly driest) part of the summer.
- Monitor fields for corn rootworm adults, Japanese beetles, or pests that may feed on silks.

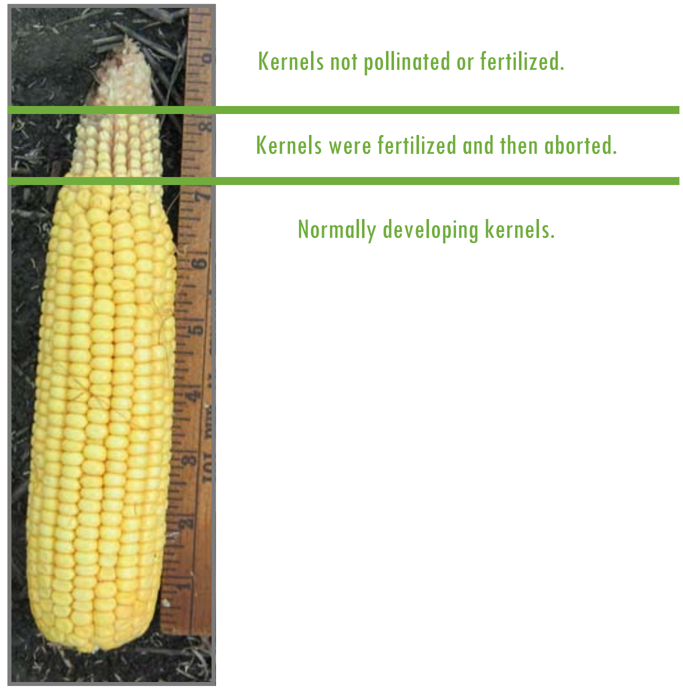

Figure 4. Ear exhibiting normally developing kernels, aborted kernels, and kernels that were not successfully fertilized.

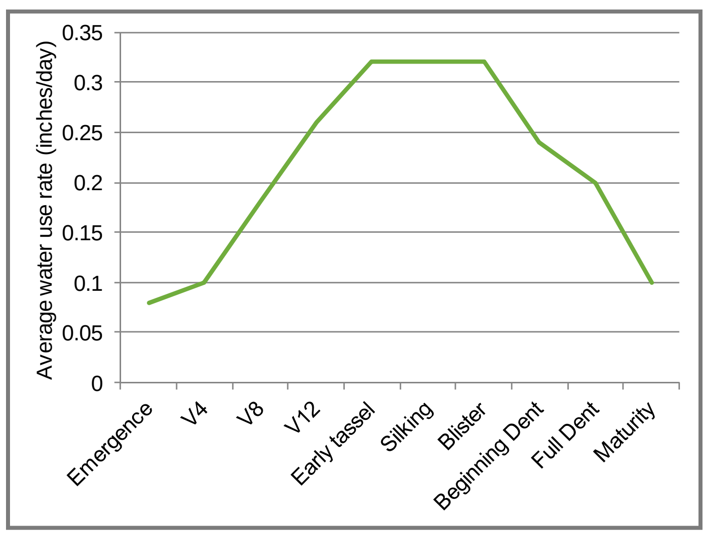

Figure 5. Daily water use for corn across the season[3].

Sources:

[1] *Nielsen, R.L. 2010. Tassel emergence and pollen shed. Corny News Network. Purdue University Extension. http://www.agry.purdue.edu (accessed 6.29.2012)*

[2] *Nielsen, R.L. 2010. Silk development and emergence in corn. Corny News Network. Purdue University Extension. http://www.agry.purdue.edu (accessed 6.29.2012)*

[3] *Kranz, W.L. et. al. 2008. Irrigation management in corn. University of Nebraska Extension. G1850.*