BETWEEN THE ROWS

July 14, 2011 | HEAT AND DROUGHT STRESS IMPACT ON CORN PERFORMANCE | ISSUE: 12

Background

During July most of the Midwest corn crop goes through the pollination process to set seed. In any particular field, this process takes about 5-8 days. When corn is planted within the typical window (late April to early May), most corn will pollinate during the early part of July. This normal pollination window is ahead of the hottest period of July. The average summer temperatures peak about July 22. When corn planting is delayed until the end of May, the pollination process takes place near the end of July and can coincide with the hottest temperatures for the summer season.

Current Crop Situation

Because heavy rains early this season reduced oxygen levels and soil temperatures, root systems in those saturated soils are shallow or reduced in size. Reduced root growth is important today because we're facing high temperatures and potentially dry conditions in some areas. With little moisture in the top 2 to 4 inches of soil, plants will begin to exhibit drought stress symptoms earlier than corn with normal root development.

High temperature in itself will not always be detrimental to completing pollination and seed set, but coupled with drought stress, the combination can significantly reduce yield. Temperatures above 95° F along with dry conditions can reduce the viability or longevity of pollen. Under extreme temperatures and drought, "tassel blast" can occur when moisture cannot be translocated to the upper part of the plant as fast as it is lost. Since most pollen is shed in the morning, the impact temperature has on pollen is usually not a major factor in yield reduction. Pollen is also one of the driest plant parts, so drought has limited impact on pollen production.

Silks, on the other hand, are one of the plant tissues with extremely high water content. When soil moisture is limited, silk growth is slowed and emerged silks may not be receptive to pollen. Hot weather can speed up shed of pollen and dry weather can slow silk growth. Extreme heat and drought can cause a missed nick, resulting in scattered seed set on ears particularly on the top half of the ear or blank ears under severe conditions.

The timing of heat and drought stress can impact the final performance of hybrids. Drought stress prior to pollination can reduce ear length and reduce the number of potential kernels. However, heat and drought stress that occurs during and within 10 days of pollination will have a large impact on final yield. The amount of yield reduction is dependent on severity of drought, field environment, and hybrid.

Management Considerations

Corn pollination is one of the most important phases of crop development, next to planting and stand establishment. Unfortunately, pollination is also one of the least controllable aspects of corn production because its success or failure is dependent on weather conditions (temperature and moisture). Water use requirements for corn is at its maximum during the R1 stage of growth. Several management factors can mitigate some of the stress that can negatively impact hybrid performance.

- Proper fertility management is necessary for optimum kernel set. Rapid uptake of nitrogen and phosphorous during pollination and grain fill requires available nutrients and can reduce some mobilization of nutrients from the stalk.
- Utilize adapted hybrids for your area that exhibit heat and drought tolerance suitable for your conditions. Spread your risk by planting a mix of maturities and along with a spread of planting dates.
- Early planting provides the best opportunity for pollination to occur ahead of the average hottest (and possibly driest) days of summer.
- Manage fields to reduce variability in corn emergence and early growth. Slow growing or stunted corn can be impacted more by stressful conditions as the growing season progresses. Improvements in internal soil drainage can reduce areas of poor stand establishment or slow early growth.

The data displayed in Table 1 below shows potential yield reductions due to stress at different growth stages. The table clearly shows the impact of the timing of stress on potential yield loss, with the greatest potential yield reduction occurring at pollination and immediately following.

Table 1. Potential corn evapotranspiration and yield loss per stress day during various stages of growth.

Growth Stage	Evapotranspiration Inches per day	Estimated Yield Loss Percent Per Day (Avg)
V12-V16	.21	3.0
V16-Tasseling	.33	3.2
Pollination (R1)	.33	6.8
Blister (R2)	.33	4.2
Milk (R3)	.26	4.2
Dough (R4)	.26	4.0
Dent (R5)	.26	3.0
Maturity (R6)	.23	0

Source: Rhoads and Bennett (1990) and Shaw (1988)