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Water Stress in Corn: Estimating from Stress Degree Days (SDD)

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Abstract

“Water Stress Begins at 86F” according to 10- year-old research on corn in the Midwest. This is better stated: “At temperatures of 86F (30C) corn plants reach incipient water stress more than 50 percent of the time.” Naturally, this does not apply to irrigated crops and specifically it applies to non-irrigated corn in the Midwest. In a year with ideal moisture, a perfectly healthy corn plant in prime soil does not begin to experience water stress until temperatures exceed 92F and perhaps not then if humidity is high. Still, 86F is the average and because the government tends to work with the average, the average was set as the upper bound for the U.S. Corn Growing Degree Day and as the lower bound for water stress. The number is rarely the exact switch-over point, but it is “good enough for government work.” Because we have the government’s critical point numbers, we can make use of them (while remaining keenly aware of the limitations).

Keywords

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Water Stress in Corn: Estimating from Stress Degree Days (SDD)

By Elwynn Taylor, Department of Agronomy

“Water Stress Begins at 86F” according to 10- year-old research on corn in the Midwest. This is better stated: “At temperatures of 86F (30C) corn plants reach incipient water stress more than 50 percent of the time.” Naturally, this does not apply to irrigated crops and specifically it applies to non-irrigated corn in the Midwest. In a year with ideal moisture, a perfectly healthy corn plant in prime soil does not begin to experience water stress until temperatures exceed 92F and perhaps not then if humidity is high. Still, 86F is the average and because the government tends to work with the average. the average was set as the upper bound for the U.S. Corn Growing Degree Day and as the lower bound for water stress. The number is rarely the exact switch-over point, but it is “good enough for government work.” Because we have the government’s critical point numbers, we can make use of them (while remaining keenly aware of the limitations).

Looking at averaged Midwest corn yields over the past 30 years, I note that when the SDD (Stress Degree Day based on temperature exceeding 86F) total exceeds 140 it is tough to find corn yields above trend.

How does 2012 stand as of July 2nd? Just a sample of the Corn Belt gives us a hint: Most states have nine crop reporting districts. District 5 is the most central of the nine in most states. District 5 is not necessarily the best district to represent the conditions for an entire state; I simply chose it as an example. As of the reports of July 2nd, 2012, the SDD totals since May 1st are:

- ND 13, SD(District 7) 65, MN 28, WI 62, MI 33
- NE 170, IA 87, IL 103, IN 118, OH 82
- KS 360, MO Missing, KY(district 2) 160

With the exception of the Northern Corn Belt (ND, SD,MN, WI, MI), it is likely, according to current National Weather Service outlooks, that the remaining eight Corn Belt states will accumulate SDD well in excess of 140. Only under extraordinary conditions could we expect all of them to exceed their trend yields for corn in 2012. The U.S. corn trend is about 161 BPA for 2012 according to NASS.USDA.GOV (figure 1). Should the eight other major producing states of the Corn Belt fall below their trend yields it becomes likely that the U.S. yield will also be below the trend.

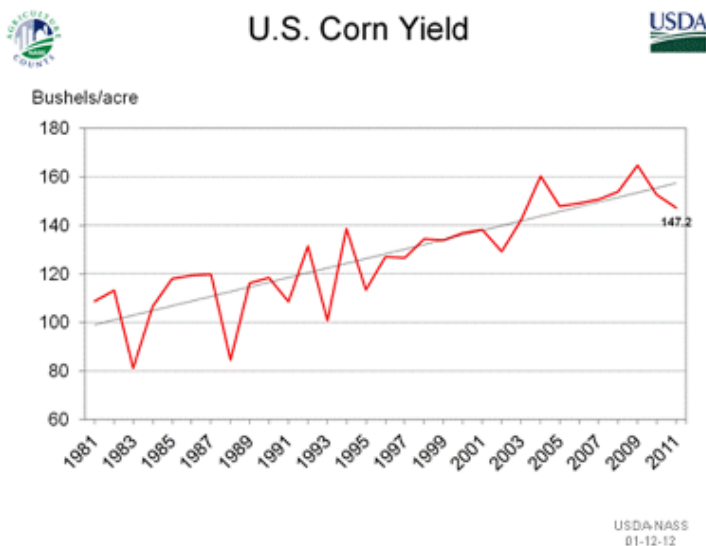


Figure 1. The 2012 US Corn trend yield estimated from the USDA yield records back to 1981 is about 160BPA. The trend is the “best” straight line through a 30-year yield record extrapolated to the subsequent year.

Graph source:

http://www.nass.usda.gov/Charts_and_Maps/Field_Crops/cornyield.asp

The accumulated SDD through June 12, 2012, for Washington, Iowa was near 30 (Figure 2). This early accumulation was a hint of things to come in that it was significant and began accumulating rapidly at about the same time the SDD accumulation began during the disastrous crop year of 1988. In both cases, the accumulation by June 12th was not an indication of crop loss as of that date, but in 1988 it did show the trend of things to come.

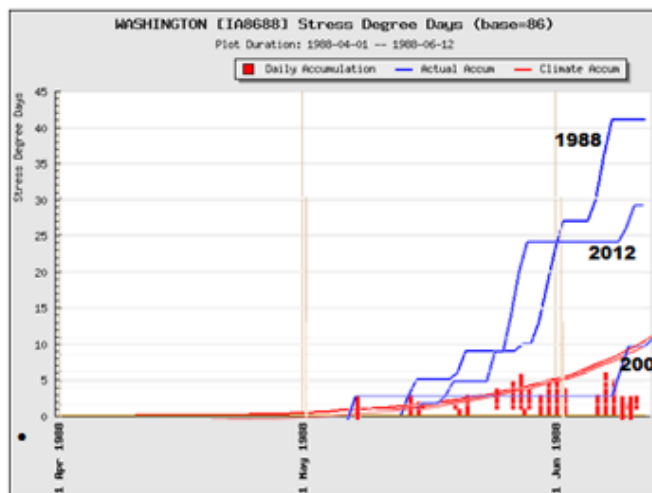


Figure 2. Stress Degree Days (SDD) at Washington, Iowa, for May 1st through June 12th for the years of 1988 (severe drought year), 2004 (record high crop yield year), and 2012 (current year). The graphic indicates that the SDD buildup in 2012 began about the same relative date as in 1988, but temperatures in 2012 were to date less severe than in 1988. The total SDD at this location in 1988 reached 650 by mid-August. Graph source: Elwynn Taylor from <http://mesonet.agron.iastate.edu/>

Farmers concerned about SDD at their farm may find the Iowa Mesonet of

benefit to them. To use the Mesonet position your computer browser to:

- <http://mesonet.agron.iastate.edu/>
- then click on “Ag Weather,”
- and click on “single site graphs.”

Farmers using this service throughout the Corn Belt can locate a site that is representative of their area.

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