CORN TALK NEWS
PENNSYLVANIA MASTER CORN GROWERS ASSOC., INC.

Growing Degree Days Swayed By Observation Time

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Growing degree day (GDD) accumulations are widely used to evaluate crop varieties and manage their cultivation and harvest. Although calculating GDD accumulations is relatively straightforward, differences in the time of day that thermometers are checked for daily maximum and minimum temperatures can lead to significant differences in GDD accumulations over weekly or longer periods.

Simulations using hourly temperature data indicate that the time required to reach a given GDD threshold value during the growing season often varied by two weeks or more solely due to observation time differences. Generally, thermometers are observed for daily temperature extremes at one of three times, either in the morning (7 a.m.-8 a.m.), the early evening (4 p.m.-7 p.m.), or at midnight, and cover the preceding 24 hours.

Whereas temperature readings taken at midnight tend to be similar to those taken at the most common observation hours, 7 a.m. and 8 a.m., average temperatures calculated from afternoon observations tend to be warmer. This warm bias results because these observation hours coincide with the normal time of maximum temperature occurrence.

If a warm afternoon is followed by a day with cooler temperatures, the maximum temperature observation taken during the warm afternoon will likely represent the maximum temperature of both the current and subsequent 24-hour periods because, once reset, the thermometer will remain at or near the maximum temperature. (These thermometers can't be reset to lower than the current air temperature.) In effect, this maximum temperature is recorded twice. Thus, sites that make observations about the time of the daily maximum temperature tend to accumulate GDD at a faster rate than stations taking morning or midnight observations.

In contrast, GDD calculated from daily temperature observations taken near the time of the daily minimum temperature occurrence (generally 5 a.m.-6 a.m.) tend to accumulate at a relatively slow rate, because the minimum temperature on a particularly cold morning is often recorded as the minimum for two successive days. Since maximum and minimum temperatures can occur at any time of the day, a certain degree of observation time bias is associated with each observation hour. However, when compared to GDD calculated using the average of 24 hourly temperature values, this bias tends to be small for observations taken at 8 a.m.

A correction method has been developed by the Northeast Regional Climate Center for use in the northeastern United States. Using the procedure, weekly base 50 GDD, 86-50 GDD, and Canadian corn heat unit totals based on any observation hour can be standardized to an 8 a.m. observation time. For each month, correction factors representing the average difference between the weekly GDD accumulation calculated using a given observation hour and that of an 8 a.m. observation schedule are used as a basis for standardization. Correction factors for several hours are given in Table 1.

To standardize the weekly GDD accumulation for a given hour, the tabulated correction factor is simply subtracted from the GDD total.

For example, assume 140 GDD50 have accumulated during a week in August using an 6 a.m. observation. To standardize this total to that of an 8 a.m. observation, -6 GDD50 should be subtracted (actually adding 6 in this case) from the 6 a.m. value, giving a standardized total of 146 GDD50.

Similarly, if 100 GDD50 have accumulated during a week in June based on a 4 p.m. observation, 8 GDD50 should be subtracted from this value to arrive at the standardized total of 92 GDD50. Additional refinements to the standardization procedure are also possible.

An additional correction is also included for GDD totals calculated from late afternoon or evening temperature observations. In these cases, the maximum temperatures

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TABLE 1
Weekly Correction Factors GDD50 (86-50 GDD)

Observation Hour	May	June	July	Aug.	Sept.
Midnight	-3 (0)	-3 (-3)	-3 (-3)	-4 (-4)	-4 (-3)
6:00 a.m.	-6 (-3)	-5 (-4)	-5 (-5)	-6 (-5)	-6 (-4)
7:00 a.m.	-2 (-1)	-2 (-1)	-2 (-2)	-2 (-2)	-3 (-2)
4:00 p.m.	7 (9)	8 (8)	6 (5)	6 (5)	7 (7)
6:00 p.m.	4 (6)	4 (5)	3 (3)	2 (2)	3 (3)
7:00 p.m.	2 (4)	2 (3)	1 (1)	1 (1)	1 (1)