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What Exactly Do You Mean by 'Growing Degree Day'?

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- Crop development is dependent on temperature.
- Thermal time (heat accumulation over calendar time) can be called heat units or growing degree days.

Growth and development of corn are strongly dependent on temperature. Corn develops faster when temperatures are warmer and more slowly when temperatures are cooler. For example, a string of warmer than normal days in late spring will encourage faster leaf development than normal. Another example is that a cooler than normal grain filling period will delay the calendar date of grain maturity.

The phrases "string of warmer than normal days" and "cooler than normal grain filling period " can be converted mathematically into measures of thermal time by calculating the daily accumulations of heat. Commonly used terms for thermal time are Growing Degree Days (GDDs) or heat units (HUs). Different methods exist for calculating heat units depending on a) the crop or biological organism of interest and b) the whim or personal preference of the researcher. In Purdue's Pest & Crop Newsletter (http://www.entm.purdue.edu/Entomology/ext/targets/newslett.htm), you will often see more than one type of calculated GDD or HU reported depending on the insect or crop of interest.

The calculation method most commonly used in the U.S. for determining heat

unit accumulation relative to corn phenology is the formula first suggested by the National Oceanic and Atmospheric Administration in 1969 and labeled as the 'Modified Growing Degree Day' formula in 1971.

This method calculates daily accumulation of GDDs as the average daily temperature minus 50 degrees F. The 'modification' refers to the limits imposed on the daily maximum and minimum temperatures allowed in the calculation. Daily maximums greater than 86 degrees F are set equal to 86 in the calculation of the daily average temperature. Similarly, daily minimums less than 50 degrees F are set equal to 50 in the calculation.

Example 1: If the daily maximum temperature was 80 degrees F and the minimum was 55 degrees F, the GDD accumulation for the day would be ((80 + 55)/2) – 50 or 17.5 GDDs.

Example 2 (Illustrating the limit on daily maximums): If the daily maximum temperature was 90 degrees F and the minimum was 72 degrees F, the GDD accumulation for the day would be ((86 + 72)/2) – 50 or 29 GDDs.

Example 3 (Illustrating the limit on daily minimums): If the daily maximum temperature was 68 degrees F and the minimum was 41 degrees F, the GDD accumulation for the day would be ((68 + 50)/2) – 50 or 9 GDDs.

In late April to early May, normal daily GDD accumulations for central Indiana are about 10 GDDs. By late July, the normal daily accumulation rises to about 23 GDDs. For a typical corn growing season in central Indiana, say from late April to late September, the total seasonal accumulation of GDDs is about 2800 GDDs. Historical normal GDD accumulations on a weekly basis for Indiana's nine Crop Reporting Districts are available in Purdue's *Corn & Soybean Field Guide*, Extension publication # ID-179. Daily or monthly normal GDD accumulations for Indiana are also available at the Indiana Climate Page on the Web at http://shadow.agry.purdue.edu/sc.norm-geog.html.

Obviously, the ability to calculate daily heat unit accumulations is dependent on your having access to daily maximum and minimum temperatures. If you do not have your own max/min recording thermometer, you can guesstimate the daily highs and lows by manually recording the temperatures shortly after sunrise (approximate daily low) and late in the afternoon (approximate daily high). Daily temperature data for specific locations are also recorded and reported at the Indiana Climate Page on the Web at http://shadow.agry.purdue.edu/sc.obs-geog.html.

For other information about corn, take a look at the Corn Growers Guidebook on the World Wide Web at http://www.kingcorn.org

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