Corn Facts
UNIVERSITY OF MISSOURI Extension
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for more information contact:
Bill Wiebold (wieboldw@missouri.edu)

Growing Degree Days and Corn Maturity

Bill Wiebold

Most grain crops, including corn and soybean, are classified as summer annuals. Summer annuals produce flowers, fill seeds, mature, and die within a single growing season. Grain crop plants respond to environmental signals that regulate the timing of stages of development. Plants of adapted varieties and hybrids are signaled to flower so that sufficient time is available to develop mature and viable seeds before freezing temperatures occur in the fall. Two common environmental signals that affect plant growth and development are photoperiod and temperature.

Modern corn hybrids respond little to photoperiod, but are affected by temperature. The responses to temperature for corn growth rate and the amount of time to progress from one stage of development to the next stage are nearly linear from about 50°F to 86°F. Understanding the accumulation of heat units and the relationship of heat units to corn development allows us to predict when important stages will occur. Heat units can also be used to compare hybrids for adaptation.

Heat units have many applications including several outside of agriculture. In agriculture, heat units are often expressed as growing degree days (GDD). Sometimes growing degree days are called growing degree units (GDU), but the two terms are identical. Calculating GDD for a specific day uses a simple formula that involves subtracting a base or threshold temperature from the average temperature for the day. The base temperature is the threshold temperature for which plant growth begins. Plant species differ for base temperature. The base temperature for corn is 50°F. Average temperature for the day can be calculated in several ways. The simplest method that fits commonly available information is to add the maximum and minimum temperatures and divide by 2.

So, the formula for corn is [(Tmin + Tmax)/2] – 50. Because plant growth cannot be negative, the lowest temperature used in the formula is 50°F. If the low temperature for the day is below 50°F, then 50 is used in the formula. There is some evidence that corn growth slows at temperatures above 86°F, so the highest temperature used in the formula is 86°F. Examples for calculation of grow degree days:

Tmin	Tmax	Formula	GDD	Notes
77°F	85°F	[(77 + 85)/2] – 50 = 81 – 50 =	31	
48°F	63°F	[(50 + 63)/2] – 50 = 56.5 – 50 =	6.5	48 is less than 50 so 50 used as Tmin
38°F	49°F	[(50 + 50)/2] – 50 = 50 – 50 =	0	both Tmax and Tmin are less than 50
78°F	98°F	[(78 + 86)/2] – 50 = 82 – 50 =	32	98 is greater than 86 so 86 used as Tmax

Growing degree days are often accumulated over a specified number of days. For example, the number of growing degree days published in the Weather Update section of the University of Missouri *Integrated Pest and Crop Management* newsletter begins with April 1. Some seed companies describe the maturity adaptation of their hybrids as the number of growing degree days from planting to silking and/or maturity. Be aware that a few companies use corn emergence as their beginning date for GDD information and that the beginning point for GDD accumulation is not always clearly described in company information.

Although GDD is the best way to compare corn hybrids and to assess progress toward important development stages, sometimes GDD information for a specific hybrid is not available. Most seed companies provide some type of relative maturity rating. Unfortunately, many persons add the word "day" to the ratings, but the ratings have nothing to do with calendar days. So, a "112 day hybrid" does not mean 112 days from planting to maturity. Also, companies differ in their definition of maturity. Dr. Nielsen wrote an excellent article titled "Interpreting Hybrid Maturity Ratings" (Chat 'n Chew Café, May 2002,
URL: http://www.agry.purdue.edu/Ext/corn/news/articles.02/Hybrid_Maturity-0506.pdf) in which he explains some of the complexities and vagaries of comparing of comparing corn hybrids for maturity. Dr. Nielsen found a reasonably good relationship between relative corn maturity ratings and GDD from planting to maturity for the one company he studied. Suffice it to say that actual GDD is the best information, but relative maturity can be a useful alternative.