Growing Degrees and Crop Development – Corn

By studying crop development, agronomists learned that corn growth rate could be defined using temperature. This concept grew out of the observation that corn growth rate increases as temperature increases. Later research revealed that corn does not grow well at temperatures below 50 degrees Fahrenheit (F) or above 86 degrees F. We now routinely predict corn growth rate using temperature as the primary input in a mathematical equation. The unit of measurement in this equation is called a growing degree unit, or GDU, and it is calculated using the following formula:

GDUs = Maximum Temperature + Minimum Temperature ÷ 2 - 50

Fifty represents the base temperature below which corn does not grow. The minimum and maximum temperature are the actual daily low and high, unless those values are outside of the optimum temperature range (50 to 86). If the low is lower than 50 or the high is higher than 86, these temperatures become the default values for the low and high temperature. In other words, if the actual low is 60, you use 60 because it is between 50 and 86, but if the low is 48, you would use 50. The same philosophy is used for the high temperature. A high of 80 is in the 50/86 range, so you would use 80 in the calculation, but if the high is 90, which is outside the optimum range, you use 86. The GDU accumulation for a day with a low of 60 and a high of 84 is 22 (84 + 60 ÷ 2 = 72 - 50 = 22). The same low with a high of 90 would be 23 GDUs (86 + 60 ÷ 2 = 73 - 50 = 23).

Temperature Extremes and GDUs

Weather forecasters mention historical average high and low temperatures during their forecasts. Actual temperatures only match average temperature part of the time, in fact some would say the average is only the midpoint between the extremes! GDUs are similar to the average temperature for a date – they effectively predict crop growth rate under average conditions. Temperature has a large bearing on corn growth and development, but other factors interact with temperature to influence the actual crop growth rate observed in a field. If these other factors exert a stronger influence on crop growth rate than temperature, the GDU formula may not accurately predict actual crop development over a given time period. Common environmental factors that can modify how well GDUs correlate to growth stage include plant population, fertility level, and soil moisture content. Maturity can be slowed by too much fertilizer or higher than optimum plant populations, for example.

It is important to weigh what we know about GDUs with good common sense about how plants interact with their environment. GDUs are an excellent way to represent hybrid maturity over years or multiple locations. They are also the best way to compare the maturity of two hybrids in any given year or location, but they won't always accurately predict how a hybrid will interact with its environment in a specific situation. See the Rob-See-Co Seed Guide for GDU requirement of Innotech Brand corn hybrids. The GDU value represents the average number of GDU required from planting to maturity (black layer).