Growing Degree Days (GDD)

Introduction to Growing Degree-Days (GDD)

Ambient heat is one of the most important factors for plant growth. Water and direct solar energy are important, along with many other factors, but the overall heat surrounding a plant is one of the simplest and reliable predictors for understanding how well a plant is likely growing and when a crop may be ready for harvest. Plants also grow in a predictable way when exposed to enough heat during a season. Each plant requires a different amount to transition from one stage to the next.

In agronomy the standard metric for heat measurement is the growing degree-day, or GDD (it's also called a growing degree unit, GDU, but GDD is the more common term). While many other factors influence plant development, the GDD is a simple starting point that is used by most farmers for tracking their crop growth. It's a standard metric that provides a common language for discussing when to perform certain actions on the farm. For example, certain pests will only attack a plant at a certain stage. If the plant hasn't received enough heat to reach that stage, then there isn't a need to worry about the bug.

Note: "growing degree-day" is a somewhat misleading name, because it has nothing to do with calendar days. GDD equations are based on daily temperatures, and a single calendar day can accumulate several, even dozens, of GDDs.

How GDDs Relate to Plant Growth

GDDs accumulate over a season, and as they do, the plant grows and will enter its different stages until maturity, when it is ready for harvest or reproduction. But it's not always a 1:1 ratio of heat-to-growth.

Plants behave differently in regards to how they require and use heat. Most have

a baseline temperature that is necessary for any growth to start. If the daily temperature doesn't exceed that threshold, no growth occurs. Likewise, some plants stop growing if it gets too hot, and any heat above that upper boundary doesn't further growth. These varied behaviors result in different equations that are used to calculate the most accurate GDD count for that plant.

Using GDDs in Your Applications

aWhere's API includes GDD data so that you needn't manage the calculation on your own. Several equations are available. Additionally, the Growth Stage Models API is prebuilt with a large variety of models for different crops, each tuned to a unique set of boundaries and growth stage thresholds. These models use the accumulated GDDs to estimate the current growth stage of the selected crop.

There are a variety of ways to use GDD data in your application. You should, of course, work with your users to understand how they use GDDs in their daily operations, but some common implementations include:

- Displaying a line graph of accumulated GDDs since planting
- Comparing that line graph to either the prior year or a multi-year average. Many farmers gauge a year's performance as it compares to last year, or to what's normal, essentially asking "are we ahead or behind last year?"
- Because GDDs are a reliable predictor of plant growth, you can send alerts or make recommendations when certain GDD thresholds are reached on your customers' fields.
- Create a dashboard that shows likely growth stage of all your customers' crops.
- As the season comes to a close, you can predict or alert when a crop will be ready for harvest.

aWhere's Accuracy and GDDs

Ours is the most accurate field-level agricultural weather data available. On a daily basis our global average is accurate to within +/-0.68°C. Over a growing season, that accuracy evens out and the result is a highly accurate measurement of accumulated GDDs. Learn more about our weather data.