Degree days Using the Single Sine Method

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Introduction

Development of many organisms is dependent on temperature. All farmers know that crops and pests develop faster in warmer than in cooler years. However, there is not necessarily a yield or quality benefit in cool or warm seasons. Organisms simply grow or develop faster when the air temperature is warmer.

When temperatures are higher, organisms develop faster. However, they are exposed to the greater heat for fewer days and the net accumulation of heat required for development is about the same as for organisms grown under cooler conditions for more days. This accumulation of heat is called "physiological time" and ^{o}D are a measure of physiological time. **One ^{o}D is defined as one degree above a threshold temperature (T_L) during 24 hours.**

There are no ^{o}D when the threshold temperature is higher than the daily maximum temperature. When the lower threshold temperature is lower than the daily minimum temperature, the number of ^{o}D is estimated as the mean of the maximum and minimum temperatures minus the lower threshold. When the threshold falls between the maximum and minimum temperature, calculation of ^{o}D is more difficult and the method will be explained later.

Single Sine Method

The single sine method for determining degree-days from daily maximum and minimum temperature is commonly used in California. The method is described in Zalom et al., (1983). This Quick answer provides an executable program to calculate degree days from daily maximum and minimum temperature. It outputs the results to a comma delimited ASCII file. Click on ddsine to transfer a zip file 'ddsine.zip' containing the ddsine.exe and ddsample.csv files to your computer. The ddsine.exe program is an executable application program to calculate degree days and the ddsample.csv file is a sample data file. Any data set with the same comma delimited format (a csv file) can be read by the ddsine.exe program and the results are output to a file with the same name, but with the extension ".sin". Using Explorer, simply click on the program and enter the lower and upper threshold as requested. Then enter the ".csv" filename as requested, without the extension. The program will read the data and it will output the calculations of degree-days above the lower and upper threshold as well as the degree-days between thresholds. If there is no upper threshold, press enter to skip the threshold entry.

References

Zalom, F.G., P.B. Goodell, L.T. Wilson, W.W. Barnett, and W.J. Bentley. 1983. Degree-days: The calculation and use of heat units in pest management. UC DANR Leaflet 21373.