Name _____

Biometeorology

Lab 6: Temperature and Heat Imbalances: Degree Days Applications

Crop development is dependent on temperature and the heat accumulations over a certain time period can be referred to as heat units or growing degree-days. The growth and development of corn is strongly dependent on temperatures, developing faster when temperatures are warmer and the opposite when cooler. A string of above normal temperatures in late spring will promote faster leaf development. At the same time, a cooler than normal grain filling period will delay the calendar date of grain maturity. Different methods exist for the calculations of growing degree days based on a) the crop of interest and b) the personal preference of the researcher.

The calculation mostly commonly used in the U.S. for determining heat accumulation relative to corn phenology is labeled as the 'Modified Growing Degree Day' formula. 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 to equal 86 in the calculation of daily average temperature. Similarly, daily minimums less than 50 degrees F are set to equal 50 in the calculation. Below are some examples on calculating GDDs based on the 'modified' formula.

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.

More information can be found in the following extension publication from Plant and Soil Sciences: Corn Growth Stages and Growing Degree Days: A Quick Reference Guide

An additional item needed for this lab: Julian Date Calendar

In this lab, you will complete three questions regarding growing degree-day applications here in the state of Kentucky.

Part #1:

A Fayette County farmer recently had a chance to purchase some corn (for seed) very cheap. He was told that this corn needed 3300 corn growing degrees days (Base 50 mod) to mature (reach black layer). He called his local county agent to find out about GDDs, who then called the Ag Weather Center. As Extension Agricultural Meteorologist, run the corn GDD program to determine the date at which 3300 CGDDs had accumulated for the years 2000 thru last year. Use a plant date of May 1 for all years and Lexington as the location. What is the average Julian date to reach 3300 CGDDs over that time span? (For this lab assume all years are non-leap years.

Year	Date	Julian	Year	Date	Julian	Year	Date	Julian
2000			**2006**			**2012**		
2001			**2007**			**2013**		
2002			**2008**			**2014**		
2003			**2009**			**2015**		
2004			**2010**			**2016**		
2005			**2011**					

Average Julian Date (3300 CGDDs) =_____

Part #2:

Now, for the years 2000 thru last year, which year's date of occurrence of 3300 corn GDD's exceeded Lexington's average date of first fall frost (32 degrees or less). Based on this information and assuming the farmer needs at least a 60% success rate; would this corn have been a good buy? YES/NO

Fall Freeze/Frost Occurrence Data

Year	Yes/No	Year	Yes/No	Year	Yes/No
2000		**2006**		**2012**	
2001		**2007**		**2013**	
2002		**2008**		**2014**	
2003		**2009**		**2015**	
2004		**2010**		**2016**	
2005		**2011**			

Total Number of Years = _____

Total Number of "Yes" = _____

Total Number of "No"= _____

Success Rate (= No/Total): _____

Is the success rate greater than 60%? _____

Is this a good buy? _____

Part #3:

I made my recommendation based on the information listed above. But now, let us see how things really turned out. Do part #2 of the analysis again, but this time, instead of using the average frost date, use the date that frost first occurred during the fall for the given years. This will show if corn would have reached maturity before the first frost in that year. Run the UKAWC Threshold Search program to determine frost date.

Year	Date	Julian	Yes/ No	Year	Date	Julian	Yes/ No	Year	Date	Julian	Yes/ No
2000				**2006**				**2012**			
2001				**2007**				**2013**			
2002				**2008**				**2014**			
2003				**2009**				**2015**			
2004				**2010**				**2016**			
2005				**2011**							

Total Number of Years = _____

Total Number of "Yes" = _____

Total Number of "No" = _____

Success Rate (= No/Total) = _____

Is the success rate greater than 60%? _____

Is this a good buy? _____