



Activity 5.3.2 Grown in the Sun

Purpose

Plant maturity is determined by the accumulation of thermal units during the growing period of plants. Growing Degree Units (GDU) is the total number of heat units calculated by using the average daily temperature and subtracting a base temperature for a specific plant. The base temperature is the minimum temperature requirement a plant needs to grow.

For example, a plant may require a temperature of 40 degrees. Until the air temperature around the plant reaches 40 degrees, the plant will not experience any growth. If the temperature exceeds 40 degrees, the plant will accumulate GDU. Each plant has a GDU requirement based on research from growers of the specific plant variety. Therefore, you can predict when a plant will be mature based on examining historical climate data for your growing region.

To calculate growing degree days, find the average daily temperature by adding the maximum temperature and the minimum temperature and dividing by two. Then subtract the base temperature for that plant. See the formula below.

$$\text{Daily GDU} = \frac{\text{max temp} + \text{min temp}}{2} - \text{base temp}$$

Temperature for different locations depends upon many factors. Latitude and elevation are major factors that influence the average daily temperatures of a location. However, what if you wanted to raise the same crop in two different locations? How would you determine the anticipated date of harvest?

Materials

Per student:

- Highlighter
- Calculator
- Pencil
- *Agriscience Notebook*

Procedure

Calculate GDUs for two locations and determine the date of maturity for cucumbers. To understand how GDUs are calculated, complete a practice set of data and report the answer to your teacher.

Part One – Determining GDUs

Determine how many GDUs are accumulated for a 10-day period. The daily temperatures are listed in Table 1 on the student worksheet. You are calculating the GDU for a wheat crop, which has a base temperature of 40° Fahrenheit.

Check your answer with your teacher to verify that you are correct.

Part Two – Comparing Locations

Calculate when cucumbers will be ready to harvest in two different geographic locations. You will assume the cucumbers are planted on May 1 at each location. The total number of accumulated GDUs for cucumbers to reach maturity and set fruit is 1100 units. Use the temperature data in Table 2 to determine the approximate harvest date for each geographic location.

Cucumbers require a **base temperature of 50°** for growth. The **maximum temperature for cucumber growth is 90°**. Calculate the daily growing degree days using the following formula. Record your calculation in the “Daily GDU” column.

$$\frac{\text{temp} + \text{max temp} + \text{min}}{2} - 50 = \text{Daily GDU}$$

- If the average temperature does not exceed 50°, enter 0 in the table.
- If the maximum temperature exceeds 90°, use 90° as the maximum temperature for your calculation that day as plants do not grow faster over 90°.

In the “Acc GDU” column for each location, keep a running total of the accumulated GDUs until you reach the 1100 threshold. Highlight the date when each location reaches 1100 GDUs. The first three dates for each site have been done for you.

Conclusion

1. How do environmental conditions affect plant growth?

The temp around it.

2. As a producer, how could you use differing maturation dates to your advantage?

Find the weather they do the best in and grow better in

3. Why do environmental conditions differ from one area to another?

Because places near the equator are hotter than places away from it.

Activity 5.3.2 Student Worksheet

Table 1. 10-Day Trial (Base temp 40)

Day	Daily Low Temperature	Daily High Temperature	GDUs
1	33	45	-1
2	34	50	2
3	36	50	3
4	38	52	5
5	40	54	7
6	42	52	7
7	40	60	10
8	33	44	-1.5
9	36	47	1.5
10	43	61	12
Total GDUs for 10-Day Period			45

Table 2. Temperature Data

DATE	Lubbock, Texas				Indianapolis, Indiana			
	MAX	MIN	Daily GDU	Acc GDU	MAX	MIN	Daily GDU	Acc GDU
May 1	79	51	15	15	67	46	6.5	6.5
May 2	79	51	15	30	67	47	7	13.5
May 3	79	51	15	45	68	47	7.5	21
May 4	80	52	16	61	68	47	7.5	28.5
May 5	80	52	16	77	68	48	8	36.5
May 6	80	52	16	93	69	48	8.5	45
May 7	80	53	16.5	109.5	69	48	8.5	53.5
May 8	81	53	17	126.5	69	49	9	62.5
May 9	81	53	17	143.5	70	49	9.5	72
May 10	81	54	17.5	161	70	50	10	82
May 11	81	54	17.5	178.5	70	50	10	92
May 12	82	54	18	196.5	71	50	10.5	102.5
May 13	82	55	18.5	215	71	51	11	113.5
May 14	82	55	18.5	233.5	71	51	11	124.5
May 15	83	55	19	252.5	72	51	11.5	136
May 16	83	56	19.5	272	72	52	12	148
May 17	83	56	19.5	291.5	72	52	12	160
May 18	83	56	19.5	311	73	52	12.5	172.5
May 19	84	57	20.5	331.5	73	53	13	185.5
May 20	84	57	20.5	352	73	53	13	198.5
May 21	84	57	20.5	372.5	74	53	13.5	212
May 22	84	58	21	393.5	74	54	14	226
May 23	85	58	21	414.5	74	54	14	240
May 24	85	58	21	435.5	75	54	14.5	254.5
May 25	85	59	22	457.5	75	55	15	269.5
May 26	85	59	22	479.5	75	55	15	284.5
May 27	86	59	22.5	502	76	55	15.5	300
May 28	86	59	22.5	524.5	76	56	16	316
May 29	86	60			76	56		

Table 2. Temperature Data

DATE	Lubbock, Texas				Indianapolis, Indiana			
	MAX	MIN	Daily GDU	Acc GDU	MAX	MIN	Daily GDU	Acc GDU
May 30	87	60			77	57		
May 31	87	60			77	57		
June 1	87	61			77	57		
June 2	87	61			77	58		
June 3	88	61			78	58		
June 4	88	61			78	58		
June 5	88	62			78	58		
June 6	88	62			79	59		
June 7	89	62			79	59		
June 8	89	63			79	59		
June 9	89	63			79	60		
June 10	89	63			80	60		
June 11	90	63			80	60		
June 12	90	64			80	60		
June 13	90	64			80	61		
June 14	90	64			81	61		
June 15	90	64			81	61		
June 16	90	64			81	61		
June 17	91	65			81	62		
June 18	91	65			81	62		
June 19	91	65			82	62		
June 20	91	65			82	62		
June 21	91	65			82	63		
June 22	91	66			82	63		
June 23	91	66			82	63		
June 24	91	66			82	63		
June 25	91	66			82	63		
June 26	91	66			83	64		
June 27	92	66			83	64		
June 28	92	66			83	64		
June 29	92	67			83	64		
June 30	92	67			83	64		
July 1	91	67			84	64		
July 2	92	67			84	64		
July 3	92	67			84	65		
July 4	92	67			84	65		
July 5	92	67			84	65		
July 6	92	67			84	65		
July 7	92	67			84	65		
July 8	92	67			84	65		
July 9	92	67			84	65		
July 10	92	68			84	65		
July 11	92	68			84	65		
July 12	92	68			84	65		
July 13	92	68			84	65		
July 14	92	68			84	65		
July 15	92	68			84	66		
July 16	92	68			84	66		
July 17	92	68			84	66		
July 18	92	68			84	66		
July 19	92	68			84	66		

Table 2. Temperature Data

DATE	Lubbock, Texas				Indianapolis, Indiana			
	MAX	MIN	Daily GDU	Acc GDU	MAX	MIN	Daily GDU	Acc GDU
July 20	92	68			84	66		
July 21	92	68			84	66		
July 22	92	68			84	66		
July 23	92	68			84	66		
July 24	92	68			84	66		
July 25	92	68			84	66		
July 26	92	68			84	65		
July 27	92	68			84	65		
July 28	92	68			84	65		
July 29	92	68			84	65		
July 30	91	68			84	65		
July 31	91	68			84	65		

Analysis Questions

- When did the cucumber reach maturity in Texas compared to Indiana?

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- Why do growing degree unit counts vary between the two locations?

Because of the location they are located in one is next to a gulf and the other in the midwest