Growing Degree Days Student Packet

Name: _____ Period: _____

What Do You Think?

Make a list of five factors that impact the growth of corn:

1.
2.
3.
4.
5.

Growing Degree Days: An A"maize"ing Harvest Calculation

Driving through Kansas, it is difficult to miss fields of corn in the spring and summer. In an average year, more than 500 million bushels of corn are harvested in Kansas. That's a lot! With numbers like that, it might lead one to believe it is easy to grow corn in Kansas. While Kansas is a large corn producer, to be successful, farmer need to know more than just when to plant and water their crop. There's a science behind knowing when to plant corn, when to expect different stages of growth, and when to harvest. It's called *growing degree days* (GDD).

In the spring, there are many important factors to consider when a farmer is thinking about planting corn. Are we done with freezes for the season? Is there moisture on the way? How much light is hitting my plants? While these are in the forefront of a farmer's mind, another major factor is going to be temperature. We are not only talking air temperature, but also ground temperature.

According to the Kansas State University Department of Agronomy, if a farmer plants corn from when the ground temperature is between 50°F and 55°F, it can take 18 to 21 days to see emergence. If the farmer plants corn when the ground temperature is between 60°F and 65°F, it might only take 8 to 10 days to see emergence. What a difference!

Iowa State University's Department of Agronomy adds that corn will not grow below 50°F. Corn grows best in conditions between 50°F and 86°F. Between 86°F and 93°F, corn continues to grow, but the increase in temperature does not give additional benefit to the plant. Above 93°F, there can be a negative impact on the growth of corn. Above 110°F, true heat stress can occur on the plant. In general, warmer weather helps corn grow and cooler weather slows growth.

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Growing Degree Days: An A"maize"ing Harvest Calculation

Temperature Impact on Corn	Temperature
Little to no growth	Below 50°F
Ideal growth conditions	Between 50°F and 86°F
Some negative impacts on growth	Above 93°F
Heat stress and harm to growth	Above 110°F

Calculating Growing Degrees Days for Corn

Lower Base Temperature: 50°F
Upper Limit Temperature: 86°F

$$\text{GDD °F} = \frac{\textit{Daily Max Temp °F} + \textit{Daily Min Temp °F}}{2} - \textit{Lower Base Temperature °F}$$

A few rules:

Rule 1: If the daily maximum and/or minimum temperature < 50°F, it's set equal to 50°F in the equation. (For example, if the temperature is 38°F, we bump it up to 50°F in the calculation.)

Rule 2: If the daily maximum temperature > 86°F, it's set equal to 86°F in the equation.

Examples:

Example 1: If on a beautiful May day, the high (maximum temperature) was 80°F and the low (minimum temperature) was 56°F, then:

The average temperature for the day is = (80°F + 56°F) / 2 = 68°F

And that day's Corn GDD (°F) = 68°F - 50°F = **18 GDD (°F)**

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Examples (Continued):

Example 2: If on a mild April day, the high (maximum temperature) was 66°F and the low (minimum temperature) was 38°F, then:

Remember the rules!

In this case:

The daily minimum temperature of 38°F is replaced with 50°F, according to the rules.

The average temperature for the day is = (66°F + 50°F) / 2 = 58°F

And that day's Corn GDD (°F) = 58°F - 50°F = **8 GDD (°F)**

Now, it's your turn. Follow the process from the previous page to calculate the growing degree days for this example week. Work the problems out in the space below. Remember to add the GDDs you accumulate each day to see how many were accumulated for the week.

	Monday	Tuesday	Wednesday	Thursday	Friday
Maximum Temperature	86°F	91°F	89°F	49°F	89°F
Minimum Temperature	52°F	45°F	50°F	42°F	51°F

Total GDDs for the week:

Sources

- Ground temperature and plant emergence – http://www.agronomy.k-state.edu/extension/crop-production/corn/corn-growth-and-development.html
- Temperatures and corn growth – http://agron-www.agron.iastate.edu/courses/Agron541/classes/541/lesson02b/2b.1.html

Growing Degree Days Student Worksheet

Name: _____

Growing Degree Days for Corn:

(Note: Data available online at tinyurl.com/KSCornGDD)

Table 1. *Approximate Growing Degree Days (GDD) required for a mid-season maturity corn hybrid to reach different growth stages from the time of planting*[1].

Stage	GDD
VE - Emergence	125
V6 - Tassel initiation	475
VT - Tassel emergence	1,150
Silking	1,400
R4 - Dough stage	1,925
R5 - Dent stage	2,450
R6 - Physiological maturity or black-layer	2,700

[1] *Adapted from R.G. Hoeft, et al. 2000. Modern Corn and Soybean Production. Page 8.*

Field #1 (must come from Kansas): In which county is the field?

Earliest First Freeze (Since 1980): Latest:

VE Date: R4 Date:

V6 Date: R5 Date:

VT Date: R6 Date:

Field #2 (must come from North Dakota, South Dakota, Missouri, Iowa, Nebraska, or Minnesota): In which state, and in what portion of the state, is the field?

Earliest First Freeze (Since 1980): Latest:

VE Date: R4 Date:

V6 Date: R5 Date:

VT Date: R6 Date:

Growing Degree Days Student Worksheet

Field #3 (must come from Ohio, Indiana, Illinois, Wisconsin, or Michigan): In which county is the field?

Earliest First Freeze (Since 1980): Latest:

VE Date: R4 Date:

V6 Date: R5 Date:

VT Date: R6 Date:

Reflection

1. Did any of the fields you chose never get to the R4 Date? If so, where? What do you think it means if the corn growth cannot make it to that level?

2. Based on your data, where would be the ideal place to grow corn? What are three reasons why?

3. What do you think would be the worst place to grow corn in the United States? Why?

Sources

- Table showing approximate GDD required to reach different growth stages – Clemson Cooperative Extension https://www.clemson.edu/extension/publications/files/