Growing Seasons, Temperature & Climate

WHAT YOU SHOULD LEARN IN THIS EXERCISE:

- **Understand how temperature & climate vary by latitude.**
- **Recognize how temperature & climate affect crop growth.**

BACKGROUND INFORMATION

This program and exercise were developed to help you learn how crop growth can be affected by weather and climate. During the next half hour, you will run virtual experiments in an attempt to grow various crops at three different locations in the United States. You will save information from each experiment and use this information to answer a series of questions at the end of this exercise.

The program will access actual temperature data for each of the locations from the past 50 or 100 years. The data will be used to calculate the number of growing degree-days that accumulated for a specific crop for one random year, determining when the crop reaches maturity. However, events like frosts and heat waves can kill your crop before it matures.

This program uses histograms to help you determine when you want to plant. A histogram is a chart that shows the distribution of a variable. In this case the variable is growing degree-days. (You may be familiar with histograms that show the distribution of test grades in your classes.)

The large histogram that you will see shows the probability that you will accumulate a specified number of growing degree-days between a crop plant date and November 30. You will have the ability to change the plant date and see how the accumulated number of growing degree-days changes (decreases) as the growing season progresses. Your challenge is to find a date for which the probability that you will reach the desired amount of growing degree-days (or larger) is the highest possible, yet your crop is not killed by frost or heat. There are also histograms that show the date of last frost (in the Spring) and first frost (in the Fall) to help you adjust your plant date so that your crop has a better chance of surviving.

Start the exercise on the next page.

WHAT YOU NEED TO DO IN THE COMPUTER LAB:

Part A: Getting Started

A1. Create a folder on the Desktop called "growing seasons." You will save all your data to this folder.

A2. Launch the growing seasons application:
→ Access the Hands-On Meteorology page via Blackboard | External Links
→ Open the "Growing Seasons" program

A3. Begin the program and follow the instructions on the screen and outlined below.

→ Progress through the windows to choose a plant date. When you are ready to plant choose the "Ok, I'm ready to plant" button.

Planting Season Window

Choose the "Begin" button to start growing your crop. The program will progress through the rest of the data for the month you chose. The program will stop for one of three reasons:

1. The end of the month is reached and your crop is not mature
   — choose the "Get Data for Next Month" button.

2. A drought or heat wave killed your crops
   — go to A4 below.

3. A frost killed your crops
   — go to A4 below.

4. Your crops are mature and ready to harvest
   — go to A4 below.

A4. You have the option of saving a summary of your experiment – you do not have to save the summary for this exercise if you do not want to.
→ Choose the "Summary" button.
→ From the Summary window choose "Save Summary."
→ Enter your name and save the summary in the "growing seasons" folder. Include the experiment number, the city, and crop in the filename, e.g., "champaign-corn2"
→ Close the Summary window.

Part B: Testing Year-to-Year Variations in Weather

The software program is designed so that every time you conduct an experiment it picks a random year of actual temperature data for the respective city. If you plant the same crop in the same city on the same date, you will likely get a different harvest date each time. Here you will test how year-to-year variability of the weather influences crop production.

B1. From the "Planting Season" window, choose "Start Over With New Experiment." Choose the appropriate city and crop (found at the top of the data tables on the next pages) and pick a reasonable plant date.
Begin the experiment.

B2. When the experiment is over, record your results in the tables below. (You do not have to save the summary files for each experiment.)

B3. Repeat this same experiment a total of 5 times by choosing "Conduct Same Planting Experiment." You can adjust your plant date if you think it would make you more successful. (To adjust your plant date you will have to choose to conduct a new experiment.)

(i) Oklahoma City – corn Needed number of growing degree-days: _____

	Plant Date	Actual Harvest Date	Number of Days in Ground	Growing Degree-Days Accumulated	Reason for End	Date of End
#1						
#2						
#3						
#4						
#5						

What is the primary problem with planting corn in Oklahoma?

Did you adjust your planting date? Explain your reason. Did it work?

(ii) Billings, Montana – sunflowers Needed number of growing degree-days: _____

	Plant Date	Actual Harvest Date	Number of Days in Ground	Growing Degree-Days Accumulated	Reason for End	Date of End
#1						
#2						
#3						
#4						
#5						

If you were a farmer in Billings, Montana, would you plant sunflowers? Why or why not?

Did you adjust your planting date? Explain your reason. Did it work?

(iii) Billings, Montana – corn Needed number of growing degree-days: _____

	Plant Date	Actual Harvest Date	Number of Days in Ground	Growing Degree-Days Accumulated	Reason for End	Date of End
#1						
#2						
#3						
#4						
#5						

Explain any problems you had trying to grow corn in Billings.

If you were a farmer in Billings, would you choose to grow corn?

(iv) Oklahoma City – sunflowers Needed number of growing degree-days: _____

	Plant Date	Actual Harvest Date	Number of Days in Ground	Growing Degree-Days Accumulated	Reason for End	Date of End
#1						
#2						
#3						
#4						
#5						

How successful were you at growing sunflowers in Oklahoma?

Compare your results here with the results in (ii) where you tried to grow sunflowers in Billings. Explain any differences you observed.

Part C: Testing Crop Growth in Different Regions

C1. Conduct the planting experiments listed in the tables below. You can record your data directly from the program (you do not have to have a successful experiment).

Crop: corn Plant Date: April 20

	City	Actual Harvest Date	Number of Days in Ground	Growing Degree-Days Accumulated	Reason for End
#1	Champaign				
#2	Oklahoma City				
#3	Billings				

Crop: barley Plant Date: April 20

	City	Actual Harvest Date	Number of Days in Ground	Growing Degree-Days Accumulated	Reason for End
#4	Champaign				
#5	Oklahoma City				
#6	Billings				

Crop: sunflower Plant Date: April 20

	City	Actual Harvest Date	Number of Days in Ground	Growing Degree-Days Accumulated	Reason for End
#7	Champaign				
#8	Oklahoma City				
#9	Billings				

Crop: cotton Plant Date: April 20

	City	Actual Harvest Date	Number of Days in Ground	Growing Degree-Days Accumulated	Reason for End
#10	Champaign				
#11	Oklahoma City				
#12	Billings				

Work in groups of at least 3 people to answer the following. List all your group members.
Name: _____ Group: _____

_____

_____

1. (a) For the same plant date, what relationship can you find between the geographical location and the amount of days that the crop has to spend in the ground to reach maturity? (Consider only crops that reached maturity.)

   (b) What about the relationship between location and the number of growing degree-days accumulated before failing? (Consider only crops that failed to reach maturity.)

2. Which region was the easiest to grow sunflowers in? Where were they most difficult to grow? What is the reason for this?

3. Which region was the easiest to grow cotton in? Where was it most difficult to grow? What is the reason for this?

4. Considering all the experiments your group conducted today (including part B), which city had the biggest problems with frost killing the crop?

5. Overall, which city had the biggest problem with heat killing the crop?

6. Write down one thing that you leaned from this exercise that surprised you or was unexpected.