



“I can
grow”
Weather

How Weather Affects Plant Development

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Burpee Home Gardens acknowledges the National Gardening Association for their participation in developing the “I Can Grow” guide and educational materials.

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There is nothing like seeing the joy of discovery and self-satisfaction in the eyes of a child! At Burpee Home Gardens, we believe the vegetable garden offers the perfect opportunity to sow the seeds of a healthy mind, body and soul. It can teach children the wonders of nature along with hands-on skills that will stay with them – for a lifetime of good eating habits and environmental stewardship.

As the interest in school garden programs rises, so does the need for useful and fun curriculum guides and activities. In partnership with the National Gardening Association, Burpee has developed the “I Can Grow” guide for educators, and now expands that resource with individual lesson activities. These educational guides cover a range of subjects with activities rooted in the ground and in the world around us.

“I Can Grow” remains Burpee Home Gardens’ initiative to support the new, popular interest in vegetable gardening among younger and novice gardeners. The program reflects a growing interest in fresher, more nutritious food; supporting community needs and environmental responsibility; saving money; and finding personal satisfaction through home gardening.

From seed science and plant classification, to basic genetic and heredity lessons, and on to sustainability and nutrition practices, we hope these “I Can Grow” educational resources complement lessons in the classroom to discover a newfound awareness of the benefits of homegrown vegetables.



Weather

Objectives: Students will examine and conduct scientific investigations related to weather and will be able to describe how weather affects plant growth and development.

Grade Level: 4-9

Time: 1 hour per activity with 15 minutes of daily follow-up for two weeks.

Materials:

For Everyone:

- One or more copies of The Old Farmer's Almanac

For Older Students:

- Shoe boxes, for each pair of students
- Three baby food jars, for each pair of students
- Plastic wrap, such as Saran Wrap®
- One thermometer, for each pair of students
- Black tempera paint, enough for the students to paint the inside of their boxes black
- Several paint brushes
- Duct tape
- Scissors*
- One small potted plant, for each pair of students
- Greenhouse Record Sheet, for each pair of students

For Younger Students:

- 18-24 ounce empty glass jar (a peanut butter jar works very well)
- 1 large balloon
- 1 disposable plastic straw
- 1 straight pin or needle
- Tape, clear or masking
- Glue
- Large rubber band
- 1 sheet cardstock or cardboard
- 1 large beaker
- Food coloring
- ¼ inch tubing, 12-inch length
- Duct tape
- 1 plastic ruler
- Markers
- Room temperature water

** Young children should be supervised carefully at all times when using scissors, knives, etc.*

Background:

Growing a garden can be a challenge. There are certain elements that can be controlled and some that cannot be controlled. The weather is one thing that can determine the success or failure of a crop, but it can be very unpredictable. Farmers and gardeners use many techniques and often rely on scientific operations to help them predict how to use the weather to their best advantage.

The Old Farmer's Almanac is a reference book that contains weather forecasts, first and last frost dates, and planting and harvesting charts. It was originally published in 1792 by Robert B. Thomas. Thomas made his forecasting predictions by studying astronomy and weather patterns. Some of his forecasting formulas are still in use today; others lean toward folklore and "old wives tales." The almanac continues to be published for farmers and gardeners, although its forecasting methods have been refined over the years. Today it is based on state-of-the-art technology and the use of solar science, climatology, meteorology and atmospheric study.

Weather is created due to differences in the density of temperature and moisture between different locations on the Earth's surface. As air is heated and cooled by the sun, weather systems are created. Because the Earth's axis is tilted, sunlight strikes the Earth at different angles at different times of the year. We understand these patterns as the changing seasons. Many gardeners rely on greenhouses to extend the growing season for garden plants. They are warmed by radiant energy from the sun. The sunshine is converted into heat, which in turn keeps the interior air warm. The warm air is contained within the greenhouse and if it becomes too warm, the gardener can draw a blind or curtain across the ceiling or open a vent.

The gradual warming of the Earth is known as "the greenhouse effect." This is because the earth's atmosphere is similar to a greenhouse allowing radiant energy to penetrate and be converted to heat energy. This heat allows us to live in a warm place! However, unlike a school greenhouse, the Earth cannot open a vent or easily remove heat once it is added. Maintaining a balance of the Earth's energy will keep the greenhouse effect in check.

Folklore

- Dark clouds in the west; stay home and rest.
- When bees stay close to the hive, rain is close by.
- Red sky at morning, sailor take warning; red sky at night, sailor's delight.
- When teeth and bones and bunions ache, expect the clouds to fill the lake.
- Animals and people have quick tempers when a low pressure area is moving in.
- The higher the clouds, the better the weather.
- If the crow flies low, the wind will blow; if the crow flies high, the wind will die.
- A sun-shiny shower won't last half an hour.
- Onion skin is very thin, mild winter is coming in; onion skin is thick and tough, winter will be cold and rough.
- Sundog in the sky, chance of rain is high.
- The daisy shuts its eye before rain.
- When dew is on the grass, rain will never come to pass.

Lesson Takeaways:

- Weather is unpredictable, but farmers and gardeners use scientific operations to help them forecast.
- *The Old Farmer's Almanac* is a weather resource originally published in 1792.
- Today, weather forecasts are based on technology, solar science, climatology, meteorology and atmospheric study.
- Weather is created due to differences in the density of temperature and moisture on the Earth's surface.

Activity for Everyone: An Old Wives Tale!

1. Show students a copy of *The Old Farmer's Almanac*. Share a brief history of the publication.
2. Ask the students what scientific methods are used to determine a current weather forecast; write their responses on the board. How does this compare to methods and techniques from the past?
3. Share the weather folklore statements from the sidebar. *You may also choose to read several predictions from The Old Farmer's Almanac. If numerous copies are available, you may divide the students into small groups and have them read assigned information from the publication.*
4. Ask the students if they have ever heard some of these weather predictions. Have the students name as many weather myths, legends and folktales as they can.
5. Have the students discuss the potential for accuracy of these statements. How could they better determine the accuracy of these statements?
6. Write the following statements on the board:
 - a. It's a hot day in the garden when...
 - b. It's a cold day in the garden when...
 - c. It's going to be a rainy day in the garden when...
 - d. Its' going to be a snowy day in the garden when...
7. Have the students select one sentence and ask them to fill in the weather statement with either a description or a prediction as a weather forecast.
8. The students should also include a description of how they could provide some evidence surrounding their weather prediction.
9. Place the students' predictions on a bulletin board in the classroom. Have the students record the weather for a period of time (*this time can be determined by the length of the weather unit*). Have a contest to see if any of the predictions can be seen during the weather observations.

[Portions of this activity were adapted from weather-related curriculum from the *Illinois Agriculture in the Classroom*.]

Activity for Older Audiences: Tempering the Elements

Teacher's Note: This activity requires advanced preparation.

1. Divide the students into pairs. Ask three pairs of students be the control groups. The control groups will follow all of the instructions, except in their greenhouse models: 1) The first will not have a plastic window covering; 2) The second will not be painted and will not have a window covering; 3) The third will not be painted, will not have a window covering, and will not have water jars.

2. Have each pair of students create their own greenhouse by following these instructions:

a. Paint the inside of the box black.

b. Cut a large window in the lid of the box, leaving 1 inch of space around the edge.

c. Cut a window on one of the long sides of the box, leaving 1 inch of space around the edge.

d. Tape clear plastic over both windows.

e. Tape a thermometer inside the box where it can be seen from the outside.

f. Place three covered jars of water in the box to provide heat storage.

g. Place a potted plant in the box.

h. Place the completed greenhouses in a place where they can receive about 3 hours of sunlight in the morning.

i. Give each pair of students a *Greenhouse Record Sheet* for temperature readings throughout the day.

j. Water the plant each day. Try to use the same amount of water each day.

3. At the end of the two weeks, ask the students to measure the growth of their plants and analyze the effects of the greenhouse on plant growth.

4. Have the students make these determinations and follow up with a report of their findings:

a. What was the purpose of the water in the greenhouse?

b. How does that concept help us to see what could be used in the garden to create microclimates of either warmth or cooling? When might this practice be most useful?

c. What are some other advantages of growing plants in a greenhouse? What are some disadvantages?

continued on next page

Tempering the Elements *continued*

d. Why are plants so important in tempering the build-up of heat-related gases in relation to the greenhouse effect?

e. When examining the temperature and moisture fluctuations within your greenhouse, what might this tell you about how weather is influenced by the greenhouse effect?

[This activity adapted from *The Growing Classroom: Garden-Based Science* curriculum, published by the National Gardening Association. Copyright 2007]

Activity for Younger Audiences: Batling Barometers

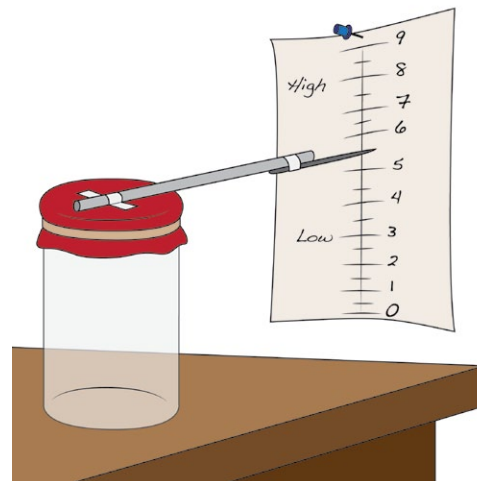
1. Divide the students into two groups. Have one group build the balloon barometer and the other build the beaker barometer.
2. Have the students write a short essay about why measuring barometric pressure is such a good weather indicator.
Decreasing air pressure often indicates the approach of a low pressure area, which often brings rainy weather. Increasing pressure means that fair weather is approaching.
3. The class should monitor the weather each day for one month (*this time can be shortened to accommodate class scheduling*) to determine which barometer is more accurate. You may choose to have students use the Internet to accurately compare and contrast their results with actual recorded weather information.
4. Ask the students why there are variations within each of these scientific investigations. How do meteorologists account for these variations in their weather forecasts? Are all scientific experiments subject to a level of error?
5. When would it be critical for a gardener to have an accurate forecast? What are some ways that a gardener could protect their plants from weather extremes? Have the students design a “weather emergency” plan for their garden.

Balloon Barometer

How it Works: The air pressure around the jar changes with the weather, while the pressure inside remains the same. As the pressure outside increases, the balloon is pushed down, forcing the needle up. As the pressure outside falls, the balloon swells, sending the needle down. When the needle points downward, it indicates a low pressure or increasing chance of stormy weather.

Instructions:

1. Cut the neck off the balloon and discard it. Stretch the balloon over the mouth of the jar and secure it with the rubber band.
2. Tape the needle or pin, point facing out, to the end of the straw. Use a generous pool of glue to attach the other end of the straw to the center of the balloon.
3. Prop the cardboard against a wall with a fairly constant temperature and set the jar just in front of but not touching, it. Label “high” and “low” as shown. Mark the spot at which the needle now points.

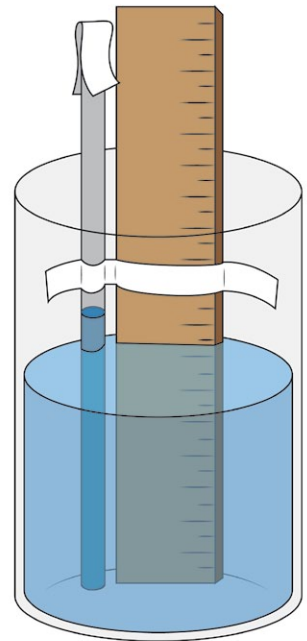


Beaker Barometer

How it Works: The water in the tube rises and falls because of air pressure exerted on the water in the glass. As the air presses down (increased atmospheric pressure) on the water in the glass, more water is pushed into the tube, causing the water level to rise. When the air pressure decreases on the water in the glass, some of the water will move down out of the tube, causing the water level to fall.

Instructions:

1. Place the ruler in the glass beaker and tape it securely to the inside of the glass. Make sure that the numbers on the ruler are still visible.
2. Place the plastic tubing against the ruler in the glass. Make sure that the tube is not touching the bottom of the glass by positioning it $\frac{1}{2}$ inch up on the side of the ruler. Tape the tube to the ruler.
3. Fill the beaker half way with water. Put two drops of food coloring into the water and mix it gently. Use the plastic tube like a straw and draw some water half way up the tube. Use your finger to trap the water in the tube. Quickly place a small piece of duct tape over the hole to prevent the water from going back into the beaker.
4. Make a mark on the ruler to record where the water level is in the tube. Over time, the water level will rise and fall depending upon weather changes.



Greenhouse Record Sheet

Greenhouse Temperatures					
Names:					
Day	Date	In Full Sun	1/2 Hour After	1 Hour Later	Notes
1					
2					
3					
4					
5					

[Adapted from *Growing Classrooms: Garden-Based Science*, published by the National Gardening Association]