

The Nightshades

Tomatoes, Potatoes and Peppers

Objective

Students will learn about foods we eat from the nightshade family and participate in activities related to the nightshades, including spelling, creative writing, scientific experiments with tomatoes and potatoes, math activities using potatoes, visual art activities with potatoes and tomatoes, map reading activities and practice reading a chart about the hotness of peppers.

Background

Tomatoes, potatoes, eggplant, and peppers are in the nightshade (*Solanaceae*) family. With the exception of eggplant, all are native to tropical America and all grow very well in Oklahoma gardens. Potatoes grow best as a cool season crop. Tomatoes, eggplant and peppers thrive in Oklahoma's long, hot summers. They are versatile, delicious and nutritious. Tomatoes, potatoes and peppers are all good sources of Vitamins C. Peppers provide Vitamin A, and tomatoes are well-known for their high lycopene content. (See Vocabulary for an explanation of lycopene.) Tomatoes and potatoes are even celebrated in our state song:

Brand new state! Brand new state, gonna treat you great!
Gonna give you barley, carrots and pertaters,
Pasture fer the cattle, Spinach and termayters!

Language Arts

1. NIGHTSHADE KNOWLEDGE

Review with students the correct spelling of "potato," "pepper" and "tomato" along with the plural forms ("potatoes," "peppers," "tomatoes"). In addition, review the preferred dictionary spelling of the word "chili."

—Read the statements from "Nightshade Knowledge," included with this lesson.

—Students will write the correct spelling of each vegetable as you read the sentence.

2. HEIRLOOM TOMATOES

An heirloom is an old item or antique that has been passed down from one generation to another. In gardening and agriculture, an heirloom plant is one that was commonly grown long ago but has been largely replaced in modern times.

Heirloom plants are open-pollinated cultivars, which means

Oklahoma C3 Standards

GRADE 1

Science Process—1.2; 2.2; 3.1,2; 4.1

Life Science—2.1

Social Studies PALS—1.A.1, B.4

Social Studies Content—3.2; 4.2

Visual Art—3.2

Music—3.3

COMMON CORE

Language Arts—1.W.2; 1.L.1,2

Math Process—MP.1,2,3,4,5,6,7,8

Math Content—1.NB.3;

1.OA.1,2,4,6,7; 1.G.3; 1.NBT.5,6;

1.MD.4

GRADE 2

Science Process—1.2; 2.2; 3.1,2; 4.1

Life Science—2.1,2

Social Studies PALS—1.A.1,B.4,5,
C.7

Social Studies Content—1.2; 2.2; 3.4

Visual Art—3.2

Music—3.3

COMMON CORE

Language Arts—2.SL.6; 2.L.1,3,6;
2.W.2,3,7

Math Process—MP.1,2,3,4,5,6,7,8

Math Content—2.G.3; 2.OA.1,2,3,4;

2.NBT.5; 2.MD.9,10

(Continued on Next Page.)

Standards (Cont.)

GRADE 3

Science Process—1.2; 2.2; 3.1,2; 4.1

Life Science—2.1,2

Social Studies PALS—1.A.1, B.5, C.7

Social Studies Content—2.1; 3.1ade;
4.2

Visual Arts—3.2

Music—3.3

COMMON CORE

Language Arts—3.W.2,3,4,10; 3.L.1

Math Process—MP.1,2,3,4,5,6,8

Math Content—3.OA.1,2,3,4,6,7,8,9;
3.NF.1,2,3; 3.NBT.1,3; 3.MD.3

GRADE 4

Science Process—1.2; 2.2; 3.1,2,3; 4.2

Physical Science—2.1,2

Life Science—4.1,2,3

Social Studies PALS—1.A.1,2

Social Studies Content—1.2ab,3; 2.2,
4

Visual Arts—3.1

COMMON CORE

Language Arts—4.W.1,2,3; 4.L.1,3

Math Process—MP.1,2,3,4,5,6,8

Math Content—4.OA.2,3; 4.NBT.2;
4.NF.1,2,3,4,5,7

they are pollinated naturally, by bees and other insects, and their seeds will produce plants just like the originals. This is in contrast with hybrid plants, which are artificially cross-bred to combine characteristics from two different varieties to produce something entirely different. Seeds from these plants may produce plants with characteristics that are different from the parent plants. Often hybrids are bred for their resistance to diseases.

Many Oklahoma gardeners grow heirloom tomatoes in their home gardens. They come in many colors, shapes and sizes. They can be big, small, fluted, smooth, red, orange, pink, purple, yellow, green, white, striped, round or pear-shaped. They also have very interesting names.

Below is a list of some heirloom tomato varieties. Students will write stories based on some or all of the names.

| | |
|------------------|--------------------|
| mortgage lifter | Arkansas traveller |
| banana legs | black prince |
| box car Willie | giant beefsteak |
| green zebra | lucky leprechaun |
| Nebraska wedding | |

Science

Most of the tomatoes available year round in grocery stores are shipped from places far away from Oklahoma. Most of the tomatoes sold in the US come from California, Florida, Texas and Mexico. Tomatoes grown for shipping are often picked before they are ripe and ripened in storage with ethylene. Ethylene is a hydrocarbon gas produced by many fruits that acts as the cue to begin the ripening process. Tomatoes ripened in this way tend to keep longer, but have poorer flavor and a mealier, starchier texture than tomatoes ripened on the plant.

1. Bring green tomatoes to class.

—Students will experiment with various methods of ripening the tomatoes (on a windowsill, wrapped in newspaper and stored in the dark, in a paper bag, in a bag with a ripe peach or other ripe fruit.)

—Students will keep journals to track how long it takes for the tomatoes to ripen.

—Conduct a taste test to see which tastes best—homegrown or store bought tomatoes.

—Students will design their own criteria for evaluating flavor, e.g., sweetness, smell, etc.

—Students will design graphs to record the comparisons.

2. Students will save seeds from tomatoes and plant them in February.

—Students will use online or library references to find instructions for saving tomato seeds.

3. MAKE YOUR OWN KETCHUP

Hand out the student worksheet “Make Your Own Ketchup.”

—Read and discuss the background included on the page.

—Students will work in groups and experiment with making their own ketchup, beginning with the basic ingredients listed on the page.

—Students will conduct taste tests and create graphs to compare and contrast the ketchup they have made with store-bought and with the ketchup made by other groups. Use a scale of 1-10 to judge factors such as saltiness, sweetness, bitterness, smoothness, etc. How might you make the ketchup more nutritious?

—Students will use the chart provided to compare ketchup with fresh tomatoes and salsa, and discuss which would provide more nutritional value. Consider nutrient content, calories, fat, sugar, fiber content, etc. Make sure to note that this analysis is based on eating 100 grams of each food. Have students measure out 100 grams of each to see how much they would have to eat to get the nutrients listed. Discuss serving sizes. (Ketchup = 17 grams, Salsa = 30 grams, fresh tomatoes = 225 grams)

4. POWERFUL POTATO

—Potatoes are covered with small dents, called eyes. Potatoes stored for a long time sprout from the eyes. Many farmers and gardeners plant seed potatoes which are grown especially for that purpose. A potato plant may produce as many as 20 potatoes, but there are usually 3-6.

—Bring a large baking potato to class, and set it on a paper plate. Share background material above. Students will keep track of how many days pass before the eyes begin to sprout.

—Students will make up a classroom story explaining why a potato needs so many eyes.

—Plant a potato in a large clay pot or gallon bucket. You may purchase seed potatoes from a seed outlet in early spring or use a potato from home that has started to sprout. Make sure your container has drainage holes.

a. Place the potato, eye end up, in moist potting soil. Cover the potato with more soil until the pot is half full. Place the pot in a sunny spot. Water when dry.

b. As shoots appear and get tall, tie them to a stake. When flowers start to appear, stop watering to prevent the potatoes from rotting. As the potatoes grow they may push up the dirt around the stem or even crack the container in which they are planted.

c. After six to eight weeks, when the top of the potato plant starts to die, harvest them by gently pulling the plant out of

Vocabulary

culinary—of or relating to the kitchen or cooking
an agricultural or horticultural variety or strain originating and persistent under cultivation

heirloom—a piece of personal property handed down from generation to generation

hybrid—an offspring of parents with different genes especially when of different breeds

hydrocarbon—a compound containing only carbon and hydrogen

labor-intensive—requiring greater expenditure on labor than in capital

lycopene—a powerful antioxidant which fights free radicals which damage cell membranes, attack DNA, and cause disease.

recessive—producing a characteristic when homozygous and not masked by a copy of the gene that is dominant

tariff—a list of taxes placed by a government on imported exported goods

tuber—a short fleshy usually underground stem (as of a potato plant) having tiny scalelike leaves each with a bud at its base that can produce a new plant

Tomato: Fruit or Veggie?

Botanically speaking, a tomato is the ovary, together with its seeds, of a flowering plant. So it is a fruit, or, more precisely, a berry. However, from a culinary perspective the tomato is typically served as part of a meal, and is considered a vegetable.

In the late 19th Century, this argument had to be settled by law. At that time, the US tariff laws imposed a duty on vegetables but not on fruits. The U.S. Supreme Court settled the controversy in 1893, declaring that the tomato is a vegetable, using the popular definition which classifies vegetable by use. Since tomatoes are generally served with dinner and not dessert, the court reasoned, it should be classified as a vegetable. The case is known as *Nix v. Hedden* (149 U.S. 304). While the tomato can be classified botanically as a fruit, it is officially categorized as a vegetable in the United States. The USDA considers the tomato a vegetable.

Some people like to put salt on their tomatoes, and some like them with a little sugar sprinkled on top. Discuss: Would sprinkling sugar on top change the tomatoes from a vegetable to a dessert? What other “vegetables” we eat would be classified botanically as a fruit? (Hint: Vegetable is not a botanical classification.)

Students will poll their parents and other family members to find out the preferred method for eating sliced tomatoes: plain, with salt or with sugar? Students may also poll classmates to find out the most popular tomato dish: salsa, tomato sauce, ketchup, other?

the pot. Lay the plant on newspaper, and have students sift through the dirt to find the potatoes.

d. Use your crop to make potato soup.

4. POTATO BATTERY

Bring the following to class: potato, plate, 2 pennies, 2 galvanized nails, digital clock with attachments for wires, 3 8-inch lengths insulated copper wire, each with 2 inches of the insulation stripped off one end

—Cut a potato in half, and put the two halves on a plate so they stand on their flat ends. The plate is there to keep your table clean.

—Wrap the end of one piece of wire around a galvanized nail, and wrap the end of a second piece of wire around a penny.

—Stick the nail and penny into one half of the potato so that they're not touching each other.

—Wrap the third piece of wire around the other penny, and put it into the other half of the potato.

—Put the other nail into the second half of the potato.

This nail should not have wire wrapped around it.

—Connect the wire from the penny on the first half of the potato to the nail that has no wire on it in the second half of the potato.

—Touch the free ends of the wires to the wires coming out of the digital clock.

—Does it work? You'll probably have to try connecting the wires to the clock in different ways to get the energy to flow through the clock in the right direction. It's just like putting batteries into a clock; they have to go in the right way.

5. GREEN-HAIRED POTATO

Using a big potato, scoop out a hollow in the top, and slice off the bottom so it will stand upright.

—Line the inside of the hollow with cotton.

—Stand the potato in a dish of water.

—Sprinkle alfalfa or grass seed in the hollow.

—Keep it watered, and within a few days the potato will sprout a head of hair.

—Give the potato eyes, ears and a nose with cloves or anything that will stick into the potato

6. POTATO BOATS

Will potatoes sink or float? Students predict and then experiment.

—Students carve potatoes in the shape of boats and float

them in a tub of water.

Math: Nightshade Numbers

1. Bring a bag of white potatoes and a bag of red potatoes to class.
 - Students will arrange them by size.
 - Students will create patterns and addition and subtraction problems using the two different colors of potatoes.
2. Bring red, yellow and green bell peppers.
 - Cut the peppers into 1/8 pieces to demonstrate fractions.
 - Students will arrange the pieces in patterns before eating them.
3. Students will solve these math problems:
 - Mr. Sims planted eight rows of tomato plants in his garden. He planted 12 tomato plants in each row. How many tomato plants did Mr. Sims plant? ($8 \times 12 = 96$)
 - It takes 12 tomatoes to make one large bottle of ketchup. How many tomatoes are in 1/2 bottle of ketchup? (6) How many in five bottles? (60)
 - One acre of potatoes will produce 52,000 servings of French fries. Students will write their own math problem based on this fact.
 - One out of every four people on the planet eat chili peppers every day. If one of four students in your classroom ate chili peppers every day, how many students would that be?
4. Conduct a poll to find out how many students in your classroom eat chili peppers once a day. How many eat French fries once a day? How many eat tomatoes, potatoes and chili peppers (in any form) once a day?
 - Students will graph the data they have collected.
5. Use this old counting chant: One potato, two potato, three potato, four, / five potato, six potato, seven potato more. / Icha bacha, soda cracker, / Icha bacha boo. / Icha bacha, soda cracker, out goes Y-O-U!
 - All players put their fisted hands together in a circle, and one person starts the chant by tapping each fist in succession.
 - When "Y-O-U" is said, the person whose fist is tapped puts that fist behind his/her back.
 - Then the chant starts again with the chanter starting with the fist of someone else.
 - As soon as one person has both hands out of the circle they are "It".

Visual Art

1. POTATO STAMPS
 - Cut a potato in half.
 - Draw a letter or design on the cut side with a pencil.
 - Use a knife to cut away the portion around the design. The design will then be raised.
 - Use the potato as a stamp.

Let's Call the Whole Thing Off

The pronunciation of tomato differs in different English speaking countries. The two most common variants are to-may-to and "to-mah-to." Speakers from the British Isles and older generations among speakers of Southern American English typically say to-mah-to, while most other American speakers say "to-may-to." Most other languages have a word that corresponds more to the former pronunciation, including the original Nahuatl word, *tomatl*. (See the list below.) The two English pronunciations were the subject of the song by George Gershwin, "Let's Call the Whole Thing Off" ("You like to-may-to and I like to-mah-to").

Italian=pomodoro
French=tomate
Dutch=tomaat
German=tomate
Danish=tomat
Spanish=tomate

A similar controversy occurs concerning the spelling of the word chili. In the dictionary the preferred spelling is c-h-i-l-I, but in New Mexico most people spell it c-h-i-l-E. In 1983, NM Sen. Pete Domenici stood in the US Senate and declared the dictionary wrong in order to have the declaration recorded in the *Congressional Record*.

Hot Potato

1. Everybody stands in a circle.
2. Students pass a potato around the circle to music.
3. When the music stops the person holding the potato is out.
4. Students pretend the potato is very very very HOT.

2. TOMATO BOUQUETS

Tomatoes come in a beautiful array of colors. Provide seed catalogs.
—Students will cut out pictures of tomatoes to make tomato bouquets, use the photos to paint pictures of tomatoes.

Social Studies: Hot! Hot! Hot!

1. Hand out copies of the student worksheet included with this lesson, “Hot! Hot! Hot!”
—Read and discuss background and the Scovill Heat Unit chart.
—Students will answer the questions, based on the chart.
—Students will research to find the origins of some of the chili peppers listed and mark the locations on a world map.
2. Read and discuss the “Tomato: Fruit or Veggie” section.
—Discuss the basic roles of federal agencies and how their decisions can impact agriculture.
—As you read the information, point out the words “tariff laws” and “duty.” Discuss with your students how those terms relate to modern taxes. Help your students to understand the connection between taxes and the community services they finance.

Extra Reading

Basel, Roberta, *From Tomato to Ketchup*, Capstone, 2005.
Child, Lauren, *I Will Not Ever Never Eat a Tomato*, Candlewick, 2007.
Landau, Elaine, *Tomatoes (A True Book)*, Children's, 2000.
Llewellyn, Claire, *What's for Lunch? Potatoes*, Franklin Watts, 2003.
Thurman, Kathryn K., and Lindsay Ward, *A Garden for Pig*, Kane Miller, 2010.
Weiss, Ellen, *From Eye to Potato*, Children's, 2007.

Listening Exercise: Forming Plurals

Nightshade Knowledge

Review with students the correct spelling of “potato,” “pepper” and “tomato” along with the plural forms (“potatoes,” “peppers,” “tomatoes”). In addition, review the preferred dictionary spelling of the word “chili.” Read and discuss the following statements. Students will write the correct spelling of each vegetable as you read the sentence.

1. Potatoes will keep for up to a year if they are kept in a cool, dark place.
2. In the early 19th Century Irish peasants depended on potatoes as their main food.
3. When disease wiped out the Irish potato crop in 1845, 2 million people starved to death.
4. The heaviest tomato on record was grown in Edmond, Oklahoma, by Gordon Graham in 1986. It weighed 3.51 kg (7 lb, 12 oz)
5. Tomatoes are a labor-intensive crop. They require a lot of work and attention from farmers and farm workers.
6. The US is one of the world’s leading producers of tomatoes, second only to China.
7. Mexico and Canada are important suppliers of fresh market tomatoes to the US.
8. There are more than 10,000 varieties of tomatoes.
9. The tomato is native to central, south, and southern North America, from Mexico to Peru.
10. A potato is a tuber, a fleshy underground stem where food is stored for the plant.
11. There are 5,000 different kinds of potatoes.
12. Potatoes first grew in the Andes Mountains of South America, probably in Peru.
13. Potatoes are cultivated all over the world but grow best in cool areas. In Oklahoma they are grown early in the spring or in the fall.
14. Tomatoes, potatoes, and peppers are in the nightshade family.
15. One bell pepper has more vitamin C than an orange or a cup of strawberries.
16. The Incas believed that eyesight was improved by eating chili peppers.
18. The Mayans rubbed hot chili peppers on their gums to stop toothaches.

Oklahoma Ag in the Classroom is a program of the Oklahoma Cooperative Extension Service, the Oklahoma Department of Agriculture, Food and Forestry and the Oklahoma State Department of Education.

Name _____

Make Your Own Ketchup

The word “ketchup” is from the Chinese word "*ke-tsiap*," which means “the brine of pickled fish.” English and Dutch sailors carried this fish sauce to Europe, where a variety of ingredients were added—mushrooms, anchovies, nuts, blueberries, kidney beans, cucumbers, cranberries, lemons and grapes. Tomatoes were added after the sauce made its way to America. The basic ingredients in modern ketchup are tomato paste, vinegar, sugar, salt, allspice, cloves, and cinnamon. (Tomato paste is tomatoes that have been condensed by cooking for a long time until the composition changes. This raises the sugar content.)

INGREDIENTS

tomato paste
vinegar
sugar
salt
allspice
cloves
cinnamon

additional ingredients, as desired (mushrooms, nuts, blueberries, kidney beans, cucumbers, lemon, grapes)

1. Working in groups, mix the ingredients above.
2. Experiment with the right combination for making your own ketchup.
3. Create a graph to compare and contrast the ketchup you have made with store-bought ketchup. Use a scale of 1-10 to judge factors such as saltiness, sweetness, bitterness, smoothness, etc. What can you add or subtract to make the ketchup more nutritious?
4. Use the chart at left to compare ketchup with fresh tomatoes and salsa. Which provides more nutritional value. Consider nutrient content, calories, fat, sugar, fiber content, etc. Make sure to note that this analysis is based on eating 100 grams of each food. Measure out 100 grams of each to see how much they would have to eat to get the nutrients listed. Discuss serving sizes. (Ketchup = 17 grams, Salsa = 30 grams, fresh tomatoes = 225 grams)

| Nutrient (per 100 g) | Ketchup | Ripe Raw Tomatoes | Salsa |
|----------------------|----------|-------------------|------------|
| energy | 100 kcal | 18kcal | 36kcal |
| water | 68.33 g | 94.5 g | 89.7 g |
| beta carotene | 560 mcg | 449 mcg | not listed |
| lycopene | 16709 | 2573 mcg | not listed |
| protein | 1.74 g | .88 g | 1.5 g |
| fats | .38 g | .20 g | 6.16 g |
| sodium | 1114 mg | 5 mg | 430 mg |
| vitamin C | 15.1 mg | 12.7 mg | 4 mg |
| fiber | .3 g | 1.2 | 1.4 g |
| sugars, total | 22.77 g | 2.63 | not listed |
| potassium | 382 mg | 237 | 270 mg |
| Vitamin A | 933 IU* | 833 IU | 550 IU |

Source: USDA

Name _____

Hot! Hot! Hot!

The chili pepper was first cultivated by the people of Central and South America around 3000 BC. The first European to "discover" chili peppers was Christopher Columbus in 1493. He called them "peppers" because he thought they were related to European black pepper. He was wrong. They are not related. Today chili peppers are the second most common spice in the world, following salt.

All wild forms of chili are hot. They get their heat from capsaicin, which is found on the ribs inside of the chili pepper. Bell peppers and other sweet peppers are in the same family as the hot chili pepper, but they contain a recessive gene that eliminates the capsaicin in the fruit.

Bell peppers can be green, red, yellow, orange and, more rarely, white, purple and brown, depending on when they are harvested. Green peppers are unripe bell peppers, while the others are all ripe, with the color variation due to cultivar selection. Because they are unripe, green peppers are less sweet and slightly more bitter than yellow, orange, or red peppers, which all taste similar. The taste of ripe peppers can also vary with growing conditions and post-harvest storage treatment; the sweetest are peppers allowed to ripen fully on the plant in sunshine, while peppers harvested green and after-ripened in storage are less sweet.

Paprika is the dried form of sweet pepper.

Stuffed Bell Pepper

Cut peppers lengthwise, and remove the tops and ribs. Provide tuna or chicken salad and a 1/2 cup measure. Provide every two students with a (half) pepper shell. Have students measure 1/2 cup of the salad into a pepper shell. Cut in half again so that each student has 1/4 stuffed pepper. Eat.

In general, the smaller the pepper, the hotter it will be. All the world's most potent peppers are under three inches long. A yellowish-orange color around the veins of a chili pepper that has been cut open usually indicates the pepper will be a potent one.

Since capsaicin (the stuff that makes the pepper hot) is an oil, drinking water only spreads the heat to other parts of your mouth. If the pepper is too hot, it's usually best to eat bread or drink milk to neutralize the heat. It's also best to use gloves when handling hot peppers.

The Scoville Heat Unit Scale was developed to help determine which chili peppers are the hottest. Use the scale at right to answer the following questions.

1. Which chili pepper is hotter, jalapeno or ancho? (jalapeno)
2. Place these peppers in order according to how hot they are: Chipotle, Pequin, Anaheim, Bell, Cayenne (Bell, Anaheim, Chipotle, Cayenne, Pequin)
3. What is the hottest pepper? (Habanero)
4. Which pepper is the least hot? (Bell)

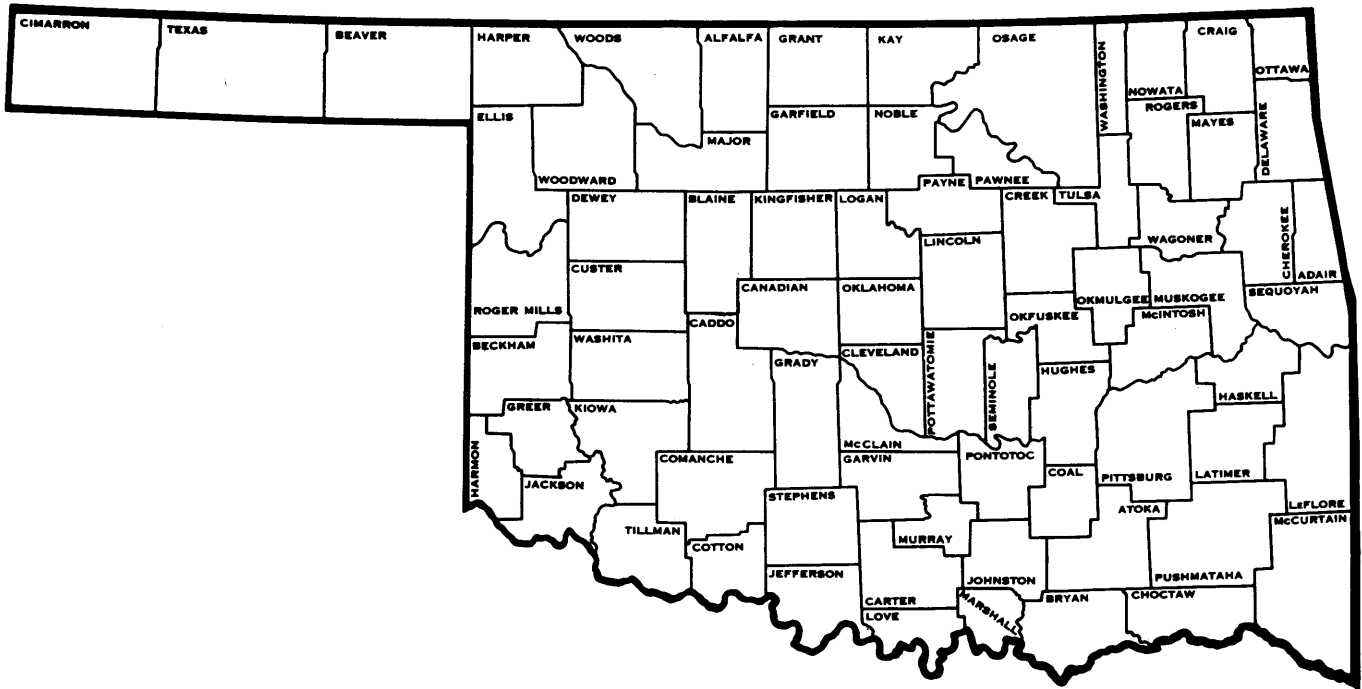
Scoville Heat Unit Scale
*in Scoville Heat Rating units

| PEPPER TYPE | HEAT RATING* |
|-------------|-----------------|
| Habanero | 200,000-300,000 |
| Pequin | 75,000 |
| Tabasco | 30,000 |
| Cayenne | 35,000 |
| Chipotle | 10,000 |
| Serrano | 7,000-25,000 |
| Jalapeno | 3,500-4,500 |
| Poblano | 2,500-3,000 |
| Anaheim | 1,000-1,400 |
| New Mexican | 1,000 |
| Ancho | 1,000 |
| Bell | 0 |

Research to find the origins of some of the chili peppers listed and mark the locations on a world map.

Name _____

Where Do They Grow?



Color in the counties producing the largest acreages of these crops:

- bell peppers—Cleveland, Pottawatomie, Stephens
- chili peppers—Caddo
- potatoes—Atoka, McClain, McCurtain
- tomatoes—Tulsa, Adair, Leflore

*Based on most recent US Census

Create a legend for the map to show the following.

1. Locate and label your community. Your community is located in which county?
2. Locate and label the major metropolitan centers and cities in Oklahoma. The major metropolitan centers and cities are located in which counties?
3. How close are bell peppers, chili peppers, tomatoes, and potatoes grown in relationship to these cities?
4. Which direction would you travel from each city to get to the closest county that produces these foods?