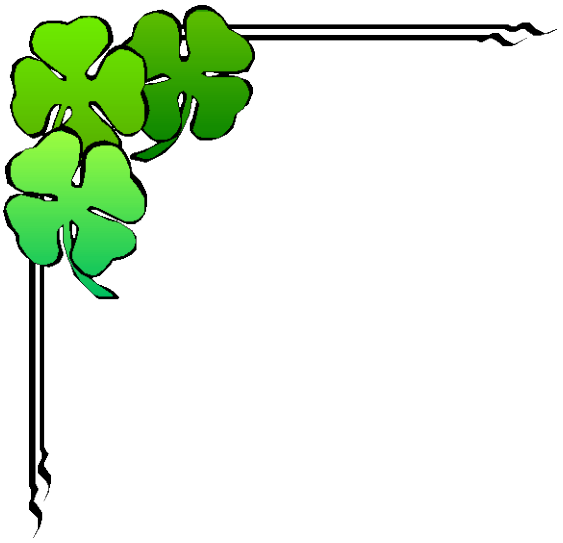

# WHEAT SCIENCE

*Making Bread in the Classroom*

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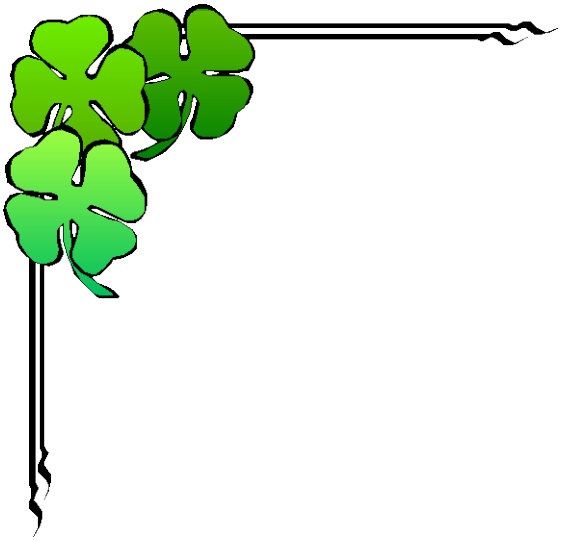

# WHEAT SCIENCE

***Making Bread in a Bag***

Kansas is one of the largest wheat producing states. Nearly one fifth of all wheat grown in the United States is grown in Kansas; an average of 364 million bushels each year. If all the wheat grown in one year could be placed on a train, that train would stretch from western Kansas to the Atlantic Ocean. About half the wheat grown each year is exported to countries around the world.

Wheat is a storehouse of nutrients essential to the human diet. It contains complex carbohydrates, protein, B vitamins, and fiber. One 60 pound bushel of wheat provides about 42 pounds of flour, which is enough to make 70 one-pound loaves of bread. The U.S. Department of Agriculture recommends that children include about 9 servings of grain food products in their diet each day.

*How is wheat grown and processed into food?*

*Why is wheat production important in Kansas?*

# OBJECTIVES

- Students will be able to describe the complete process of growing wheat and turning it into food
- Students will be able to describe how grain foods fit into the food guide pyramid and why they are important in the daily diet
- Students will work in groups of four to make individual loaves of bread

# MATERIALS

Each group of four students will need:

- One Wheat Science kit (*Kits are available at cost from the Sedgwick County Extension Office. Please contact the 4-H Department at 660-0100 for more information)*
- One "Modern Marvels: Bread" DVD
  *(Can be borrowed from the Sedgwick County Extension Office)*

OR

* One two-gallon heavy duty freezer bag
* 2 packages of dry yeast
* 4 teaspoons sugar
* 3/4 cup nonfat dry milk
* 2 Tablespoons vegetable oil
* Non-stick vegetable spray
* Measuring cups and spoons
* 4 cups all-purpose flour
* 2 1/2 cups warm water
* 3 3/4 cups whole wheat flour
* 1 Tablespoon salt
* 4 individual loaf pans
* Permanent Markers
* Access to ovens for baking

# PREPARATION ACTIVITIES

* Contact school kitchen personnel, parents or community members to schedule the use of the kitchen for baking.

* Contact room parents or other adult volunteers to assist student teams with bread-making. You will need one adult for each four-student group.

* Reserve a TV/DVD player to use during the first 45 minutes of the activity.

* Cover the work area with bulletin board, brown or butcher paper. Tape the paper in place with *two or three* strips of tape (too much tape impedes cleanup after the activity)

* Have the children wash their hands thoroughly before beginning the activity.

* Assign the children to groups of four with an adult chaperone. Remind the chaperones that the children will be completing the activity; the adults are to provide supervision *only*.

# PROCEDURAL STEPS

* This activity takes about 2 ½ hours from start until the bread is baked, cooled and ready to take home. The dough preparation takes about one hour; the remaining 1 1/2 hours can be used for regular classroom instruction while the bread is rising, baking and cooling.

* Distribute the bread kits or ingredients to the work groups. Identify each ingredient before the activity begins. Use a permanent marker to write the name of each child on the bottom of a bread pan and set the pans aside.

* Combine in the plastic bag:
    - 1 cup all-purpose flour
    - 2 packages of dry yeast
    - 1 cup warm water (105° to 115° F)
    - 2 teaspoons (2 packets) sugar

* Hold the top of the bag securely while the bag rests on the table. Mix thoroughly by gently working the bag from the outside with your fingers until all the ingredients are blended. The mixture will be very liquid.

* Fold the top of the bag loosely and place upright in the wheat kit box or other secure location. Let the mixture rest for 15 minutes to form a sponge while the students watch the first portion of "Modern Marvels: Bread" DVD. (Stop the video after the section about yeast)

* Add and mix these ingredients:
    - 1 ½ cups warm water
    - 2 teaspoons (2 packets) sugar
    - 2 Tablespoons (one plastic portion cup) vegetable oil
* Add the whole wheat flour mix from the Wheat Science kit

* OR measure and add:
    - 3 3/4 cup whole wheat flour
    - 3/4 cup nonfat dry milk
    - 1 Tablespoon salt

* Add 2 scant cups of all-purpose flour to the mixture and mix thoroughly until a stiff dough is formed. All the dough should be the same color when the mixing is completed, and the mixture should begin to pull away from the sides of the bag.

If using the Wheat Science kit:

* Place 2 fingers at the top rim of the styrofoam measuring cup. Use your fingernail to make a mark on the cup below the bottom finger. This is the line to measure a scant cup.

* If using a regular measuring cup, a scant cup equals about 3/4 to 7/8 of flour.

* The adult or teacher should turn the dough out of the bag onto a floured surface and divide into quarters. Each child in the group will flour his/her hands and

knead his/her bread dough until it is smooth and elastic (about 5 minutes). If the dough is too wet add more flour, but be careful not to add too much!

* Shape the loaf by flattening it into a rectangle. Fold the corners at one end to form a point. Beginning at the point, roll the dough into a fat cylinder. Fold the ends under towards the seam, and place the roll seam-side down into the bread pan. Do NOT flatten the bread dough once it is placed in the pan!!!

* Cover the bread loosely and let rise in a warm place for about 30 minutes or until the dough has doubled in size.

* Uncover and bake at 375 for 5 minutes, then reduce the temperature to 350 and bake an additional 30-35 minutes until the loaf is deep brown in color. A well-baked loaf sounds hollow when thumped lightly with a finger.

* Cool the bread on a rack until it is safe to handle. Place the loaf into the brown paper bag provided by Sedgwick County 4-H and write the student's name on the label.

## INQUIRY AND FOLLOW UP ACTIVITIES

**1. Experiment with the amount of yeast, sugar and salt in the recipe.** Some recipe variations can affect the quality or taste of finished loaf of bread. To explore these changes, divide the class into small groups. Each group will change only one variable in the bread recipe, predict the effect of the change and record the actual results. Each group then shares their predictions and results with the class.

Discuss the results of the experiment using the following questions:

Did you correctly predict the results of each change in the bread recipe?
Why do you think each change had the effect that it did?
Did any of the changes improve the quality of the bread? How?

**2. Learn more about yeast growth** with a series of simple experiments using a small plastic drink bottle, water, sugar, yeast and a balloon.

Using the following charts as a guide, experiment with several variables to see how the changes affect the growth of yeast. Experiment with only one variable at a time.

Put the listed ingredients in a small pop bottle and mix them well. Attach a balloon to the

top of the bottle and wait 20-30 minutes. Use a tape measure to measure the circumference of each group=s balloon and compare the results.

Yeast Experiment #1

| Group Number | Yeast | Water | Sugar | Water Temperature | Balloon Circumference |
|---|---|---|---|---|---|
| Group 1 | 1 teaspoon | 1 cup | 1 teaspoon | 110º – 115 ºF | |
| Group 2 | 1 teaspoon | 1 cup | 2 teaspoons | 110º – 115 ºF | |
| Group 3 | 1 teaspoon | 1 cup | 3 teaspoons | 110º – 115 ºF | |
| Group 4 | 1 teaspoon | 1 cup | 4 teaspoons | 110º – 115 ºF | |
| Group 5 | 1 teaspoon | 1 cup | 5 teaspoons | 110º – 115 ºF | |

Yeast Experiment #2

| Group Number | Yeast | Water | Sugar | Water Temperature | Balloon Circumference |
|---|---|---|---|---|---|
| Group 1 | 1 teaspoon | 1 cup | 2 teaspoons | 110º – 115 ºF | |
| Group 2 | 1 1/4 teaspoons | 1 cup | 2 teaspoons | 110º – 115 ºF | |
| Group 3 | 1 1/2 teaspoons | 1 cup | 2 teaspoons | 110º – 115 ºF | |
| Group 4 | 1 3/4 teaspoons | 1 cup | 2 teaspoons | 110º – 115 ºF | |
| Group 5 | 2 teaspoons | 1 cup | 2 teaspoons | 110º – 115 ºF | |

Yeast Experiment #3

| Group Number | Yeast | Water | Sugar | Water Temperature | Balloon Circumference |
|---|---|---|---|---|---|
| Group 1 | 1 teaspoon | 1/2 cup | 2 teaspoons | 110º – 115 ºF | |

| | | | | | |
|---|---|---|---|---|---|
| Group 2 | 1 teaspoon | 1 cup | 2 teaspoons | 110º – 115 ºF | |
| Group 3 | 1 teaspoon | 1 1/2 cups | 2 teaspoons | 110º – 115 ºF | |
| Group 4 | 1 teaspoon | 2 cups | 2 teaspoons | 110º – 115 ºF | |
| Group 5 | 1 teaspoon | 2 1/2 cups | 2 teaspoons | 110º – 115 ºF | |

Yeast Experiment #4

| Group Number | Yeast | Water | Sugar | Water Temperature | Balloon Circumference |
|---|---|---|---|---|---|
| Group 1 | 1 teaspoon | 1/2 cup | 2 teaspoons | 85º – 90 ºF | |
| Group 2 | 1 teaspoon | 1 cup | 2 teaspoons | 95º – 100 ºF | |
| Group 3 | 1 teaspoon | 1 1/2 cups | 2 teaspoons | 105º – 110 ºF | |
| Group 4 | 1 teaspoon | 2 cups | 2 teaspoons | 115º – 120 ºF | |
| Group 5 | 1 teaspoon | 2 1/2 cups | 2 teaspoons | 125º – 130 ºF | |

**3. Watch the activity of yeast in food** as you make a sourdough starter and bake Friendship Bread.

Sourdough Starter Ingredients

1/4 cup warm water (110 degrees F/45 degrees C)
3 cups all-purpose flour, divided
3 cups white sugar, divided
3 cups milk
1 tsp yeast

Starter Directions

In a small bowl, dissolve yeast in water. Let stand 10 minutes. In a 2 quart container glass, plastic or ceramic container, combine 1 cup flour and 1 cup sugar. Mix thoroughly or flour will lump when milk is added. Slowly stir in 1 cup milk and dissolved yeast mixture. Cover loosely and let stand at room temperature until bubbly. Consider this day 1 of the 10 day cycle.

On days 2 thru 4; stir starter with a spoon. Day 5; stir in 1 cup flour, 1 cup sugar and 1 cup milk. Days 6 thru 9; stir only.

Day 10; stir in 1 cup flour, 1 cup sugar and 1 cup milk. Remove 1 or 2 cups to make your first bread, give three cups to friends along with the recipe. Store the remaining starter in a container in the refrigerator, or begin the 10 day process over again (starting with step 2). You can also freeze this starter in 1 cup measures for later use. Frozen starter will take at least 3 hours at room temperature to thaw before using.

Friendship Bread Recipe

1 cup starter
1 cup oil
1 tsp. Vanilla
4 eggs
1 cup brown sugar
2 cups flour
1 tsp baking powder
1 tsp baking soda
2 tsp cinnamon
1 pkg instant vanilla pudding mix

Pre-heat the oven to 325 degrees F. Grease two medium size loaf pans. Combine starter, oil, vanilla, and eggs; stir and add brown sugar. Combine thoroughly flour, baking powder, baking soda, cinnamon, pudding and nuts etc. Add wet mixture to dry mixture and stir well by hand.

Spoon the thick mixture into loaf pans and sprinkle with brown sugar. Bake medium loaves for 50 to 60 minutes, large loaves for 70 minutes or mini muffins for 20 minutes. This bread freezes well.

**4. Experiment with wheat grains in the classroom.** Using a bag of wheat taken from a farm combine and some math skills, calculate the percentage of foreign material in this wheat

* Ask students what they know about harvesting wheat. Use the following questions to discuss what they know about wheat as a food crop.

Has anyone ever seen a combine in a field?

*(answers will vary)*

What did it look like? What was it doing?

*(answers will vary)*

What do farmers use combines for?

*(to harvest crops)*

When you look at a wheat field, what else might you see besides wheat?

*(weeds, flowers, insects, old machinery, livestock etc)*

When a farmer harvests his crops what do you suppose might happen to those other things in the field?

*(they might get mixed in with the crop)*

* Show the students a bag of wheat from the combine and let them see the foreign material in it. Can they recognize any of the non-wheat items in the bag? Make a prediction of the percentage of foreign material that is mixed in with the wheat.

* Tell the students that they are going to examine some of the combined wheat and see if their prediction is correct. Divide the class into groups of three or four students and give each group a metal pie pan or foam tray with about 1/4 cup of the wheat mixture.

* Ask each group to use toothpicks to separate the wheat grains from the foreign materials. Divide the foreign material into three categories: plants, insects and other. Count the number of particles in each category and record it on the chart below or on a similar type of chart.

| Number of wheat kernels | Number of plant parts | Number of insect parts | Number of other materials | Total amount of foreign materials |
|---|---|---|---|---|
| | | | | |

* Use math skills to calculate the class average for each type of foreign material. How much variation was there between groups? Why do you think it was that way?

* Use math skills to calculate the percentage of foreign material in this wheat. Farmers are paid a reduced price if there is more than 1% foreign material in their wheat. Based on the class percentage, will this farmer's price be reduced or not? Why?

* Look up today's price for wheat in the newspaper or online. If a farmer harvested 350 acres and each acre produced 30 bushels, how much grain would he have? How much would the farmer earn if he sold his wheat today at full price?

* If the price was reduced by 5% because there was too much foreign material in his wheat, how much would the farmer earn at today's price? How much difference is there between the full price and the reduced price?

**5. Experiment with germinating wheat.**

* Count out 100 wheat grains for each student and place them on a wet (not dripping) paper towel in a plastic zipper bag. Close the bags and place them in a shaded location in the classroom.

* Check the bags at one week, 10 days and 2 weeks and record how many grains have sprouted.

* Use math skills to calculate the germination percentage for each time period. Did the percentage change over time? How?

* Did all the grains germinate? Why do you think it was that way? Use math skills to calculate a class germination average.

* Most local farmers like to plant their wheat in October each year, so it can grow a little bit before winter. When it gets too cold the wheat plant goes *dormant* until springtime. The wheat begins to grow again as soon as the nights start to warm up, and it is usually ready to harvest in the middle of June in south central Kansas.

  What do you think would happen to the wheat if it were planted in a warmer location? What would happen if it were planted in a colder location?

* A farmer uses 300 pounds of wheat to plant his field. Use math skills and the class germination average to calculate how much of the wheat might not grow.

* What could the farmer do to adjust for the seeds that won't germinate? How many extra pounds of wheat would he need to put in his planter to make sure that enough wheat seeds germinate?

# OTHER RESOURCES

The Kansas Wheat Commission will provide one copy of a number of educational materials to Kansas educators free of charge. To receive an order form, contact the Commission at:

Kansas Wheat Commission
2630 Claflin Rd.
Manhattan, Kansas 66502-2743
Phone: 1-866-759-4328
Fax: 1-785-539-8946
http://www.kswheat.com

Wheat bran, flour and germ may be purchased from your local grocery store or from Kansas State University Department of Grain Science and Industry. Please call 1-785-532-6161 for more information.

A reusable paper strip thermometer and a bread cookbook may be ordered from :

Red Star Yeast and Products Educational Materials
433 E. Michigan St.
Milwaukee, WI 53202-5106
http://redstaryeast.com/science-yeast/information-for-educators/

The Kansas State Historical Society offers a traveling trunk of activities called "Wheatland" for grades K-2. For more information contact their Education Division at 785-272-8681.

The Kansas Foundation for Agriculture in the Classroom has additional wheat learning units for educators. Please contact them at:

Kansas Foundation for Agriculture in the Classroom
124 Bluemont Hall
Kansas State University
Manhattan, Kansas 66506
1-785-532-7946
http://www.ksagclassroom.org

The USDA's National Agriculture in the Classroom program has classroom agricultural resources from every state. Its website can be accessed at:

http://www.agclassroom.org

# LESSON SOURCE

**Lesson Source:**
Wheat Science 4-H School Enrichment Program
K-State Research and Extension
Manhattan, Kansas

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# COMMON CORE CURRICULAR CORRELATIONS
# Kansas History and Social Studies Standards

**Standard 3.** Societies are shaped by the identities, beliefs, and practices of individuals and groups.
3.1 The student will recognize and evaluate how societies are shaped by the identities, beliefs and practices of individuals and groups.

**Standard 4**. Societies experience continuity and change over time.
4.1 The student will recognize and evaluate continuity and change over time.

**Standard 5.** Relationships among people, places, ideas, and environments are dynamic.
5.1 The student will recognize and evaluate dynamic relationships that impact lives in communities, states, and nations.

# COMMON CORE CURRICULAR CORRELATIONS
# Kansas Mathematics Standards

**2nd grade Math Standards:**

2.MD.1. Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes. (2.MD.1)

**3rd grade Math Standards:**

3.NF.1. Understand a fraction $\frac{1}{b}$ as the quantity formed by 1 part when a whole is partitioned into *b* equal parts; understand a fraction $\frac{a}{b}$ as the quantity formed by *a* parts of size $\frac{1}{b}$. (3.NF.1)

3.MD.1. Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l) (Excludes cubed units such as $cm^3$and finding the geometric volume of a container). (3.MD.2)

**4th grade Math Standards:**

4.NF.2 Explain why a fraction $\frac{a}{b}$ is equivalent to a fraction $\frac{(n \cdot a)}{(n \cdot b)}$ by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.

4.NF.1. Understand a fraction $\frac{a}{b}$ with *a* > 1 as a sum of fractions $\frac{1}{b}$.

4.MD.1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs* (*1, 12*), (*2, 24*), (*3, 36*), … (4.MD.1)

**5th grade Math Standards:**

5.NF.1. Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. *For example,*

$\frac{2}{3}+\frac{5}{4}=\frac{8}{12}+\frac{15}{12}=\frac{23}{12}$ *In general,* $\frac{a}{b}+\frac{c}{d}=\frac{ad+bc}{bd}$ (5.NF.1)

5.MD.1. Convert among different-sized standard measurement units within a given measurement system *(e.g. convert 5 cm to 0.05 m),* and use these conversions in solving multi-step, real world problems. (5.MD.1)

# COMMON CORE CURRICULAR CORRELATIONS
# Kansas Science Standards

**2nd grade Science Standards:**

2-PS1-4. Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

**3rd grade Science Standards:**

3-LS1-1. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.

**4th grade Science Standards:**

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

**5th grade Science Standards:**

5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water.

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.