Wheat Lesson Plans

Grades 7-12

Provided by

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California WHEAT COMMISSION

California Foundation for Agriculture in the Classroom

INCORPORATING WHEAT EDUCATION INTO 7TH – 12TH GRADE CURRICULUM

GEOGRAPHY AND ECONOMICS

Obtain samples of various types of wheat for your students to observe. Have them predict where each type is grown and what it is used for. Determine why different types of wheat are grown in certain regions of the United States and the world. Investigate how wheat production and value-added products made from wheat affect regional and national economies.

HEALTH

Obtain various samples of wheat kernel components – the endosperm (white flour), bran and germ. After the students have learned about the anatomy of a wheat kernel, have them research the nutritional value of each component. Have the students analyze how much wheat they consume each day and determine how an increase or decrease in wheat consumption could affect their general health.

SCIENCE

- Wheat contains both simple and complex carbohydrates. Have your students build molecular models of both types of carbohydrates and analyze how they are utilized by the human body.
- Determine the starch content of various types of wheat flour. Compare wheat's starch content to the starch content of potatoes, sweet potatoes, cassava root and rice. Discuss how starch is utilized by the human body. Investigate how starch research includes the use of starches as a substitute for fossil fuels in plastics and other recyclable materials.
- Do experiments related to bread production. Discuss the function of the gluten in bread and cake making. Analyze the gluten content of various wheat flours and have the students determine which flour samples would be best for bread production. The use of yeast in bread production can also be analyzed.

LANGUAGE ARTS

Have your students research a particular aspect of wheat production – seed selection, planting cycles, irrigation procedures, harvesting techniques, straw utilization, storage techniques, transportation methods, milling procedures, flour types, nutritional value, processed wheat products, etc. Have the students write a poem or paper on their research and illustrate their written work. Display their work in a sequential format so that the class and other readers can learn about wheat – from seed to food.

STARCH

Starch is a compact structure found in grains. When water is added to starch and heated, the structure absorbs the water and expands. As the starch absorbs the water it becomes sticky and adheres to other starch particles to form a gel. Therefore, it is called a thickening agent. If you have ever eaten pudding, pie filling, gravy, or cream of wheat, you have seen starch at work.

Experiment:

Materials needed:

- Cream of Wheat or flour
- Water
- Range or heating element
- Wooden spoon

Part 1:

Place 1 cup of cold water and ½ cup Cream of Wheat or flour in a clear glass bowl. Mix with a wooden spoon until water turns white then allow the flour particles to settle.

Part 2:

Using a range or heating element, cook the Cream of Wheat according to package directions. Explain to the students that starch absorbs water as it is heated and becomes sticky, which forms the cooked cereal.

Part 3:

You may also illustrate starch by pouring the Cream of Wheat into the boiling water, but DO NOT STIR. This will create large lumps. The surrounding starch granules stick together and prevent the center granules from absorbing the water. By cutting the lumps in half, you can see the individual granules.

(Reprinted with permission from the Idaho Wheat Commission)

Gluten Balls

Have you ever wondered why bread products have so many holes? When flour is mixed with water, the protein in the wheat flour causes the mixture to form a sticky, elastic structure called a gluten complex. This complex stretches when mixed with a leavening agent such as baking soda, baking powder, cream of tartar or yeast. These leavening agents produce a gas that expands the gluten strands to produce the structure of the baked product.

Different types of flour will create slightly different gluten structures because of the amount of protein found in the flour. Flours made from hard wheat, such as bread flour, have higher protein content and will form a stronger gluten complex. This is the reason that bread flour is used when making yeast breads. Yeast produces a gas which will expand the gluten in the dough and produce a high volume loaf of bread and create the holes that you see in bread.

In the process of making gluten balls, starch and other particles are removed from flour by washing a dough ball with cold water. Once all of the starch is washed out, the remaining substance is stringy material called gluten. This can be formed into a ball and cooked in the stove. The gluten strands are expanded by steam and hardened by heat. Depending on the flour, the ball can expand greatly. Once the ball is finished cooking and cut open, the structure can be seen.

In the activity attached, students can make gluten balls to see the difference in each type of flour. Gluten can be separated from flour by adding water to form stiff dough and then kneading in water to wash away the other components, largely starch. The wet, sticky gluten will expand greatly when baked to form a light, porous ball. Baking the gluten illustrates how much the ball will expand with steam and that the heat will form the structure of the baked product.

(Reprinted with permission from the Idaho Wheat Commission)

HOW TO MAKE GLUTEN BALLS:

1. Measure 1 cup each of:
    a. Cake flour
    b. All-purpose flour
    c. Bread or whole wheat flour
2. Add 4-6 tablespoons water to each of the flours and mix with a fork to make stiff dough.
3. Let the dough rest for 5 minutes to allow the flour to hydrate (soak up the water).
4. Knead each dough ball for 10 minutes until it is smooth and elastic. – If the dough is not smooth and elastic, make some new dough with the same amount of flour, adjusting the amount of water.
5. Place each set of dough in bowls of cold water and let it soak for 5 minutes.
6. After soaking, place a double piece of cheesecloth on a wire sieve or in an embroidery hoop. Wash starch from the dough by squeezing it gently under a stream of tap water or in a bowl filled with tap water, keeping the cloth under, but not around, the dough. Add to the dough any particles that collect on the cloth. If a bowl is used, change the water several times. The white color of the water shows that starch is being removed.
7. Preheat oven to 450° F.
8. Continue kneading under cold running water until all the starch has been removed. After about 10 minutes, squeeze 1 or 2 drops of wash water from the dough into a container of clear water. If the water remains clear, the starch has been completely extracted. If it is cloudy, continue washing until water is clear.
9. Squeeze out as much water as possible.
10. Shape the strand into a ball. Measure height and width with a ruler.
11. Place each gluten ball on a greased cookie sheet far enough apart to allow room for expansion.
12. Bake 10 minutes at 450° F. Lower heat to 300° F for additional 30 minutes.
13. Measure baked gluten balls and measure height.
14. Observe surface appearance. Cut in half. Observe interior appearance and texture.

NOTE: If desired, after STEP 6, the gluten balls can be divided into small pieces and students can knead and work the balls into a bubble gum-like substance.

MUFFINS

RECIPES

Peanut Butter and Jelly Muffins

2 cups flour
3 tablespoons sugar
1 tablespoon baking powder
3/4 cup creamy peanut butter
1 large egg
1 cup low-fat milk
1/3 cup (approximately) fruit spread or jelly

Heat oven to 350° F. Spray muffin tim with non-stick vegetable spray or line with baking cups. In a large bowl, mix flour, sugar and baking powder.

In another bowl, beat peanut butter and egg until smooth. Add milk a little at a time, stirring after each addition.

Pour peanut butter mixture over dry ingredients; fold in with a rubber spatula just until dry ingredients are moistened. Batter will be still.

Spoon 2 scant tablespoons batter into each muffin cup and smooth the surface out to the edge of the cup. Then top each muffin with a heaping teaspoon of fruit spread; cover with 2 more tablespoons of batter.

Bake 20-25 minutes or until lightly browned. Makes 12 muffins.

Let the children make their own muffins:

Step 1:	Give each child a 5-ounce kitchen cup (paper, with wax coating, such as Solo, Dixie)
Step 2:	Let the child measure 3 tablespoons of muffin mix and put in the cup.
Step 3:	Add 1 tablespoon water.
Step 4:	Stir with spoon.
Step 5:	Place cup in electric frying pan. Cover and bake at 375° F for 12-15 minutes. Cool and eat.

ACTIVITIES

The Muffin Man Song

Have the children learn and sing the Muffin Man Song.

CEREAL

RECIPES

One very popular Swiss cereal is granola. The following recipe has less fat than many commercial granolas. Have the children help measure the dry ingredients into a large bowl and help mix. Use dry measuring cups for dry ingredients and liquid measuring cups for liquids. Spoon dry ingredients into the cup and level off for accurate measurement.

Granola

6 cups old-fashioned or quick oatmeal
1 1/2 cups whole wheat flour
1 cup wheat germ
1/2 cup sunflower kernels
Chopped nuts or coconut
3/4 cup water
1/2 cup vegetable oil
1 cup honey
2 teaspoon vanilla
1 tablespoon cinnamon
1 teaspoon salt
1 cup raisins or dried fruit pieces (optional)

Preheat oven to 250° F and lightly grease 2 cookie sheets or baking pans.

In a large bowl, combine the oatmeal, whole wheat flour, wheat germ and sunflower kernels or nuts. In a separate bowl, combine the water, vegetable oil, honey, vanilla, cinnamon and salt.

Mix the liquid mixture into the dry mixture. Divide the combined moisture between the two cookie sheets and spread out evenly.

Bake one hour, stirring the mixture on each baking sheet three times, until the granola is dry and golden. Cool. Add raisins or dried fruit pieces. Store in a sealed container. Serve dry, with yogurt or with low-fat milk. Makes 24 – 1/2 cup servings.

ACTIVITIES

There are many hot cereals to choose from. Some are simply cracked or rolle grain such as wheat, oats, barley, triticale and rye. Others, such as Malt-O-Meal, Cream of Wheat and Rice, are milled from grains. Avoid introducing wheat cereals before the age of 2. Add calcium by stirring in powdered milk while cooking.

Let the children try "designing" their favorite cereal by:

- Adding raisins, chopped dry apricots, or canned (drained), frozen or fresh fruit.
- Drizzling honey or sorghum over the top.
- Stirring in a spoon of peanut butter.
- Sprinkling with wheat germ, bran or sunflower kernel.

(Provided by the Kansas LEAN Food Professionals Task Force)

PANCAKES

RECIPES

Gingerbread Pancakes*

1 cup whole wheat flour
1 cup white flour
1/2 teaspoon salt
1 1/2 -2 cups buttermilk
2 eggs
3 tablespoons molasses
1 teaspoon ginger
1/2 teaspoon cinnamon
1 tablespoon oil

Mix dry ingredients together. Mix wet ingredients together. Mix wet and dry ingredients together. Cook on a lightly greased griddle.

***Source:** "Meals Without Squeals." By Christine Berman and Jackie Fromen.

Pumpkin Pancakes

Add about 1 cup of pumpkin and 1 teaspoon of pumpkin pie seasoning to regular pancake batter made with 1 cup flour or pancake mix. They are really good, especially in the fall, and the vitamin A value zooms up.

Animal Shapes

Pour batter into oiled animal-shaped metal cookie cutters on the griddle. When edges are set, remove cutter and flip pancakes.

Surprise Pancakes**

Just prepare regular pancake batter from 1 cup of flour or mix, then stir in any one of the following ingredients and cook as usual:

Monkey's Uncle

Add 1 cup mashed banana and 1/8 teaspoon cinnamon.

Berry Delicious

Add 1 cup fresh or frozen fruit.

Add blueberries after the batter has been poured onto the griddle – the pancakes won't turn blue this way.

Jack Rabbit Flapjacks

Add 1 cup grated carrots and 1/8 teaspoon cinnamon.

Awesome Cheddar

Add 1 cup cheddar or American cheese.

****Source:** Kansas State University Extension Service.

(Provided by the Kansas LEAN Food Professionals Task Force)

TORTILLAS

RECIPES

Tortilla Triangles*

Cut a tortilla into 6 triangles. Using a pastry brush, lightly coat sides of each triangle with vegetable oil or spray with vegetable oil spray. Place triangles in a single layer on a cookie sheet. Bake at 350° F, turning once, until golden brown.

Chilaquiles*

1 dozen corn tortillas
1 tablespoon oil
1 cup onions, chopped
1/4 teaspoon garlic powder
2 teaspoons chili powder
1 teaspoon cumin powder
1 1/2 cups low-fat cottage cheese
1 1/2 cups canned crushed tomatoes
6 ounces grated jack or cheddar cheese

Cut tortillas into wedges or tear into strips. Sauté onion in oil for 5 minutes (a non-stick or cast iron skillet that is oven-proof is ideal for this). Add tortilla pieces, garlic powder, chili powder, garlic and cumin. Toss until the tortilla pieces are wilted. Puree cottage cheese and tomato in blender until smooth. Stir gently into tortilla pieces. Sprinkle with grated cheese. Bake at 350° F for about 20 minutes.

Egg Fajitas*

Fix a platter of scrambled eggs, preparing one egg for each child for lunch or supper. Serve with heated flour tortillas, shredded cheese, shredded lettuce, sliced tomatoes, other fresh cooked or crisp vegetables, and sliced fresh fruits. Let the children make their own fajitas.

Quick Quesadillas

1 – 8" flour tortilla
2 – 3/4 ounce slices cheese, cut in half diagonally

For each quesadilla, place tortilla on microwave-safe plate. Arrange cheese slices on tortilla and fold tortilla in half.

Cover and microwave on HIGH 25-40 seconds or until cheese begins to melt. Let stand, covered, 1 minute or until cool enough to eat. Fold in quarters. Serve with salsa. Makes 1 serving.

Variations:

- **Top cheese with sliced red and green bell peppers. Continue as directed.**
- **Spread tortilla with 1 tablespoon refried beans. Continue as directed.**

***Source:** "Meals without Squeals," by Christine Berman and Jackie Fromen.

WHEAT FIELD

Do you see that mighty ocean,
lying out there in the sun?
There's no prettier sight recorded
since Creation was begun.
'Tisn't flat, as you'd expect it,
with breakers on the shore,
There's no ship upon its bosom,
there's no seabird flying o'er,
There's no salty breeze to savor,
fact, it isn't even wet,
But it surely is a beauty...
it's a sight you won't forget.

There are gentle little billows
that dip and race and run,
Going off to the horizon
in an ecstasy of fun.
There are hills and sloughs and
hollows,
green and golden over all,
One vast expanse of motion,
standing almost thigh-bone tall.
See it dip and sway and curtsey,
see it bend and hear it sigh,
Many treasured golden acres
stretching out beneath the sky.

And if you want a picture,
you should see it in a storm.
Swaying gently in the breezes
while the purple masses form,
It becomes a tortured frenzy,
whipping madly, to and fro,
With the lighting cracking o'er it
and the thunder crashing low.
Every brittle straw in torment,
'til you'd think its time was done,
But there she'd be a-smiling,
come the shining of the sun.

It casts a spell upon you,
never mind what time the hour,
It awes you with its grandeur,
it holds you in its power.
When it shimmers in the sunshine
or rustles in the heat,
It means that, someplace, someone
is getting bread to eat.
It's a splendid satisfaction,
lying out there in the sun;
A mighty, living symbol
of a farmer's work, well done.

~ Florence R. Renfrow ~

Wheat on the World Market

Skills: Math, Social Studies, Language Arts

Objective: Students compute profit and loss in a wheat trading market and graph their market activity.

Background

Wheat is a grass that is cultivated worldwide. Globally, it is the most important human food grain and is second only to maize in total production.

Wheat grain is a staple food used to make flour for leavened, flat and steamed breads as well as cookies, cakes, pasta, and noodles. Three crops; wheat, rice and corn, account for over 75 percent of our grain consumption. Wheat is also used for fermentation in making alcoholic beverages. Wheat is sometimes planted as a forage crop for livestock. The straw can be used as fodder for livestock. In less-developed countries, straw can also be used as a construction material for roofing thatch.

International trade is defined as the exchange of goods and services across international boundaries or territories. This trade represents a significant share of the Gross Domestic Product (GDP) for most countries. While international trade has been present throughout much of history, its economic, social, and political importance has been on the rise in recent centuries, due, in large part, to industrialization, advanced transportation, globalization, multinational corporations, and outsourcing.

Trade and marketing are vital to American agriculture. The US exports agricultural products to countries that can't grow crops and livestock as efficiently as American farmers or can't grow them at all, due to their lack of space, viable soil, or climate restrictions. The US also imports products from other countries that produce different, less expensive, or better quality goods.

Government trade policies influence the volume of trade between nations. In domestic trade, goods may move freely from one part of the nation to another. In international trade, governments often place artificial barriers against the free movement of goods from one country to another. Several organizations, policies, and/or agreements maintain and control fair trading between the US and other countries.

The United States is the world's leading wheat exporter. Our largest export of wheat, from October, 2006, to January, 2007, was to Egypt, with 876,409 tons shipped. Generally, the US, Canada, Australia, the European Union, and Argentina account for over 70 percent of world wheat exports. In 2002-03, however, that share dropped to 63 percent. This was due to the increased wheat exports of Russia, Ukraine, and India.

P.A.S.S.

GRADE 6
Social Studies—1.3; 4.2
Math Process—1.3; 2.1; 3.3; 4.1; 5.1,4
Math Content—2.3; 5.1,3
Reading—1.1a; 3.1b; 5.2a
Oral Language—1.2

GRADE 7
Social Studies—1.1; 4.1,2
Math Process—1.3; 2.1; 3.3; 4.1; 5.1,4
Math Content—2.1ab
Reading—1.1; 3.1a; 5.2a
Oral Language—1.2

GRADE 8
Social Studies—1.1,5
Math Process—1.3; 2.1; 3.3; 4.1; 5.1,4
Math Content—2.1ab; 5.1,2b
Reading—1.1; 3.1a; 5.2a
Oral Language—1.2

Resources Needed

wooden craft sticks

Vocabulary

biofuel—a fuel (as wood or ethanol) composed of or produced from biological raw materials

cultivated—planted and grown

export—goods or commodities transported from one country to another country

fermentation—chemical breaking down of a substance (as in the souring of milk or the formation of alcohol from sugar) produced by an enzyme and often accompanied by the formation of a gas

fodder—coarse food for cattle, horses, and sheep as cornstalks, hay, and straw

globalization—affecting or relating to the earth as a whole; world-wide

import—goods or commodities brought into one country from another country

industrialization—the change in social and economic organization resulting from the replacement of hand tools by machine and power tools and the development of large scale industrial production

leaven—to produce fermentation in by means of yeast or other ferment

outsourcing—supplying raw materials to other companies, states, or countries for the production of finished products.

The diversity of exporting countries provides significant stability to world wheat trade and prices. In the Northern Hemisphere, most of the wheat production is grown as winter wheat. Parts of Canada, Kazakhstan, Russia, and the United States have large spring wheat production, which is planted much later in the crop year. Other countries, like Australia and Argentina in the Southern Hemisphere, plant winter wheat after the Northern Hemisphere's spring wheat. With wheat being planted and harvested at different times, a shortfall in one area of the world can be quickly responded to by other wheat-producing areas.

Background Sources: Vocke, Gary, Edward W. Allen, and Mir Ali, "Wheat Backgrounder," USDA, 2005; "Grain Trade," *Encyclopedia Britannica*, Eleventh Edition, Wikipedia, 2007; "Wheat," *Wikipedia, the Free Encyclopedia*, http://en.wikipedia.org/wiki/Wheat

Activities

1. Read and discuss background and vocabulary.
2. Follow the directions included in this lesson to set up the "Wheat Market Trading Game" for students to play.
   —To divide students into groups, use popsicle sticks in eight different colors, with three per color.
   —For each group of three, mark one "buyer," one "seller," and one "transaction person."
   —Students draw the sticks as they come into the room.
   —Students arrange themselves into groups according to the colors they have drawn.
   —Provide each group with a copy of the instructions for playing.
3. Use the following questions to lead a post-game discussion:
   —What was the most frequent price for wheat in each round?
   —In which round was the price spread the greatest?
   —Who determines the market price for wheat, buyers or sellers?
   —How does supply and demand determine the market for wheat?
4. Students will complete a graph of their choosing to show buying and selling activity. A review of graphing is included in the "Extra Helpings: Additional Resources" link from the main page of the Oklahoma Ag in the Classroom website.
   —Follow the steps for a complete graph; title, labels, mean, mode, median, etc.
   _Display the graphs.
   —Discuss information gained.

This activity was adapted from Schults, Mindella, "The Wheat Market Game," *Teacher's Manual for Economics Readings for Students in Ninth Grade Social Science*, Pittsburgh Public Schools, 1967.

Extra Reading

Burgess, John, *World Trade—Exploring Business and Economics*, Chelsea House, 2001.

Landau, Elaine, *Wheat (True Books—Food and Nutrition)*, Children's, 2000.

The World Almanac for Kids—2008, World Almanac, 2007.

Wheat Market Trading Game

Preparations

1. Prepare cards ahead of time, as follows.
   —Copy the cards from the pages that follow on heavy cardstock paper. Use a different color card for each group, if possible.
   —Cut cards apart.
   —Separate groups of cards.
   —You will need 14 transaction cards, 32 buy cards, and 32 sell cards in the following distribution:

# of Transactions		Buy Cards		Sell Cards	
Transactions	# of Cards	Buy Price	#	Sell Price	#
1	4	$3.50	2	$3.50	4
2	5	$3.70	2	$3.70	6
3	3	$3.90	2	$3.90	6
4	2	$4.10	2	$4.10	4
		$4.30	4	$4.30	4
		$4.50	4	$4.50	2
		$4.70	4	$4.70	2
		$4.90	4	$4.90	2
		$5.10	4	$5.10	2
		$5.30	4		

   —The teacher can handle the cards or assign one student to be the buyer, one the seller, and one the transaction person.
   —Shuffle each set of cards.
   —Place the cards in the front of the room with a place card by each stack—one marked “transaction,” one marked “buy,” and one marked “sell.”
2. Prepare a copy of the score sheet for each group of students.
3. Make an overhead copy of the “Class Tally Sheet,” included with this lesson, or draw one on the board.

Getting Ready to Play

1. Divide the class into groups of three students each. (The activity works best in a class of 20 or more students.)
   —Each group will need a score sheet.
   —Each group consists of a Buyer, a Seller, and a Transaction Person (TP). Students may change positions at the beginning of each round.
2. You may decide to complete between three and five rounds of play.
   —Stop after each round of play to calculate each group’s gain or loss.
   —After each round, have each group announce how many transactions they completed and whether they had a gain or loss. The students should see a correlation between the number of transactions completed and a gain.

Produced by Oklahoma Ag in the Classroom, a program of the Oklahoma Cooperative Extension Service, the Oklahoma Department of Agriculture, Food and Forestry and the Oklahoma State Department of Education, 2008.

Wheat Market Trading Game

Start of Play—Round 1

1. Inform students as follows:
   —You will be acting as buyers and sellers of wheat on the world market.
   —For each round of transactions you will have a gain or a loss, depending on the card you draw.
2. The transaction person (TP) from each group draws a card.
   —TP returns to his/her seat.
   —On the group score sheet, the TP circles the number of transactions the group gets to complete during round 1 and crosses out all other numbers, e.g., if the card says the group will complete two transactions during this round of play, TP circles the number two under transactions and crosses out the numbers three and four.
3. The buyer from each group draws a Buyer card.
   —Buyer returns to his/her seat.
   —Buyer records the price per bushel on the group's score sheet.
   —Buyer records the value of 10 bushels of wheat.
4. The seller from each group draws a Seller card.
   —Seller returns to his/her seat.
   —Seller records the price per bushel on the score sheet.
   —Seller records the value of 10 bushels of wheat.
5. The group determines whether it had a gain or loss for each transaction.
   —If the group sold its wheat for more than what they bought it for, they made a gain on that transaction, e.g, Bought Wheat – Sold Wheat = Gain or Loss.
6. After each transaction, students use tally marks to record the price for which they sold their wheat on the "Class Tally Sheet."
7. Students return all buying and selling cards to the stacks.
8. Reshuffle.
9. Begin the next transaction round with those groups who can still participate.
   —Groups that participate in only one transaction must return their transaction cards.
10. Continue play until all groups have completed all transactions.
    —Complete the gain or loss total for round 1.

Rounds 2-5

1. Continue play as before for the next rounds, reshuffling cards and drawing new transaction cards at the beginning of each new round.
2. Complete the Grand Total gain or loss at the end of the game.

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Game Cards

Copy on cardstock and cut. You will need 14 transaction cards, 32 buy cards, and 32 sell cards

TRANSACTION CARD You are authorized to complete ONE transaction during this round of play. Return your Transaction Card to the stack when finished.	TRANSACTION CARD You are authorized to complete TWO transactions during this round of play. Return your Transaction Card to the stack when finished.	TRANSACTION CARD You are authorized to complete THREE transactions during this round of play. Return your Transaction Card to the stack when finished.
TRANSACTION CARD You are authorized to complete FOUR transactions during this round of play. Return your transaction card to the stack when finished.	BUY CARD You are authorized to BUY 10 bushels of wheat. The price is $5.30 per bushel for a total of $53.00 for the 10 bushels.	BUY CARD You are authorized to BUY 10 bushels of wheat. The price is $5.10 per bushel for a total of $51.00 for the 10 bushels.
BUY CARD You are authorized to BUY 10 bushels of wheat. The price is $4.90 per bushel for a total of $49.00 for the 10 bushels.	BUY CARD You are authorized to BUY 10 bushels of wheat. The price is $4.70 per bushel for a total of $47.00 for the 10 bushels.	BUY CARD You are authorized to BUY 10 bushels of wheat. The price is $4.50 per bushel for a total of $45.00 for the 10 bushels.
BUY CARD You are authorized to BUY 10 bushels of wheat. The price is $4.30 per bushel for a total of $43 for the 10 bushels.	BUY CARD You are authorized to BUY 10 bushels of wheat. The price is $4.10 per bushel for a total of $41 for the 10 bushels.	BUY CARD You are authorized to BUY 10 bushels of wheat. The price is $3.90 per bushel for a total of $39 for the 10 bushels.

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BUY CARD You are authorized to BUY 10 bushels of wheat. The price is $3.70 per bushel for a total of $37 for the 10 bushels.	BUY CARD You are authorized to BUY 10 bushels of wheat. The price is $3.50 per bushel for a total of $35 for the 10 bushels.	SELL CARD You are authorized to SELL 10 bushels of wheat. The price is $5.10 per bushel for a total of $51 for the 10 bushels sold.
SELL CARD You are authorized to SELL 10 bushels of wheat. The price is $4.90 per bushel for a total of $49 for the 10 bushels sold.	SELL CARD You are authorized to SELL 10 bushels of wheat. The price is $4.70 per bushel for a total of $47.00 for the 10 bushels sold.	SELL CARD You are authorized to SELL 10 bushels of wheat. The price is $4.50 per bushel for a total of $45.00 for the 10 bushels sold.
SELL CARD You are authorized to SELL 10 bushels of wheat. The price is $4.30 per bushel for a total of $43.00 for the 10 bushels sold.	SELL CARD You are authorized to SELL 10 bushels of wheat. The price is $4.10 per bushel for a total of $41.00 for the 10 bushels sold.	SELL CARD You are authorized to SELL 10 bushels of wheat. The price is $3.90 per bushel for a total of $39.00 for the 10 bushels sold.
SELL CARD You are authorized to SELL 10 bushels of wheat. The price is $3.50 per bushel for a total of $35.00 for the 10 bushels sold.	SELL CARD You are authorized to SELL 10 bushels of wheat. The price is $3.70 per bushel for a total of $37.00 for the 10 bushels sold.	

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Name _____

Class Tally Sheet

Price per bushel	Round 1	Round 2	Round 3	Round 4	Round 5	Total for Rounds Played
$3.50						
$3.70						
$3.90						
$4.10						
$4.30						
$4.50						
$4.70						
$4.90						
$5.10						
$5.30						

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Group _____

Group Score Sheet

Transaction Number	BUY Price of 1 bushel	SELL Price of 1 bushel	BUY Price of 10 bushels	Sell Price of 10 bushels	GAIN from transaction	LOSS from transaction
1						
2						
3						
4						
Total for Round 1	NA	NA	NA	NA		
1						
2						
3						
4						
Total for Round 2	NA	NA	NA	NA		
1						
2						
3						
4						
Total for Round 3	NA	NA	NA	NA		
1						
2						
3						
4						
Total for Round 4	NA	NA	NA	NA		
1						
2						
3						
4						
Total for Round 5	NA	NA	NA	NA		
Grand Total for all Rounds	NA	NA	NA	NA	GAIN (for all rounds)	LOSS (for all rounds)

Produced by Oklahoma Ag in the Classroom, a program of the Oklahoma Cooperative Extension Service, the Oklahoma Department of Agriculture, Food and Forestry and the Oklahoma State Department of Education, 2008.

Norman Borlaug, Hunger Fighter

Number Sense & Operation, Measurement; Writing,

Background

Norman Borlaug was a plant breeder. He used high-yield agriculture techniques to help people get more food from their land. For 50 years he worked in developing nations like Mexico, India and Pakistan. Before he began his work, mass starvation had been predicted in many parts of the world. Instead, food production has expanded faster than human population in all parts of the world except sub-Saharan Africa. Borlaug received the Nobel Peace Prize in 1970, mostly for his work reversing food shortages in India and Pakistan during the 1960s.

Norman Borlaug was born in Cresco, Iowa, in 1914. When he was a young man, the Dust Bowl hit the Midwestern US. Some people blamed modern farming methods, but Borlaug believed just the opposite was true. He noticed that the effects of the Dust Bowl were not as bad in Iowa and other places where high-yield agriculture techniques were being tried. He decided that his life's work would be to help people grow more food in places where crop failures were regular facts of life.

Borlaug helped found the International Maize and Wheat Improvement Center (CIMMYT) in Mexico. There he helped develop a high-yielding semi-dwarf wheat varieties. Today this wheat feeds a large portion of the world's population.

Borlaug's leading research achievement was the development of dwarf spring wheat. He found many benefits to growing plants with shorter stalks. Nature favors genes for tall stalks, because in nature, plants must compete for sunlight. Borlaug found that plants with stalks that were short and of equal length would receive equal amounts of sunlight when they did not have to compete with taller-stalked plants. In addition, dwarf wheat used more energy growing valuable grain rather than using its energy to grow tall, stalks with no food value. Stout, short stalks also support wheat kernels better. Tall-stalked wheat may bend over at maturity, making it more difficult to harvest.

Borlaug also developed cereal grains that were insensitive to the number of hours of light in a day, and could therefore be grown in many climates. He particularly favored growing wheat in countries where starvation was a concern because wheat grows in nearly all environments and is resistant to insects.

Activities

LANGUAGE ARTS: READ AND INTERVIEW

1. Students will pair up and read the background information.
2. Students will write a narrative of an interview with Norman Borlaug, based on the reading. The interview should include the following:

P.A.S.S.

GRADE 6
Math Process—3.1
Math Content—2.2b
Writing—1.2

GRADE 7
Math Process—3.1
Math Content—4.2
Writing—1.2

GRADE 8
Math Process—3.1
Math Content—4.1
Writing—1.2

Materials

stalks of wheat (Check with area farmers, local agricultural organizations, agricultural cooperatives, or your local county Extension office, listed under county government in the phone book.)

Research Topics

Norman Borlaug
Green Revolution
Nobel Peace Prize
Internatonal Maize and Wheat Center
High-Yield Agriculture

Vocabulary

agriculture—the science, art, or practice of cultivating the soil, producing crops, and raising livestock
cereal—relating to grain or to the plants that produce it
climate—the average weather conditions of a particular place or region over a period of years
crop failure—reduction in crop yield to a level that there is no marketable surplus or the nutritional needs of the community cannot be met
developing nation—a nation with a low level of material well being
dwarf—an animal or plant much below normal size
energy—the capacity for doing work
environment—the surrounding conditions or forces that influence or modify: as a : the whole complex of factors (as soil, climate, and living things) that influence the form and the ability to survive of a plant or animal or ecological community
food value—the useful quality of a particular food
gene—a part of DNA or sometimes RNA that is usually located on a chromosome and that contains chemical information needed to make a particular protein controlling or influencing an inherited bodily trait or activity or that influences or controls the activity of another gene or genes
grain—the edible seed or seedlike fruit of grasses that are cereals
harvest—the gathering of a crop
high-yield—producing a large amount
insensitive—not readily affected or changed by the action of a certain thing
maturity—full development
pesticide—an agent used to destroy pests
plant breeder—someone who propagates plants sexually under controlled conditions
population—the whole number of people or inhabitants in a country or region
resistant—capable of withstanding the force or effect of
stalk—a plant stem especially of a plant that is not woody
technique—a method of accomplishing a desired aim

- When did Borlaug win the Nobel Peace Prize?
- Why did he win the Nobel Peace Prize?
- How did he become interested in his work on high yield agriculture?
- What difference did his work make in the world?
- Other information students found interesting.

3. If time allows students will perform their interviews for the class—live or videotaped.

MATH

1. Arrange students into groups of two, and hand out worksheets.
   —Students will complete the worksheet and then discuss processes and answers as a class.
   —Have two or three volunteers read aloud their paragraphs from the journal writing.
2. Divide students into groups of three or four, and provide each group with four or five stalks of wheat.
   —(Grades 6-7)Using the bottom of the wheat stalk, students will find the area of the circle.
   —(Grade 8)Students will find the area of the cylindrical wheat stalk
   —Students will weigh the wheat heads.
   —Students will record the data in a table format.
   —Tape a classroom graph to the chalkboard.
   —Students will plot their data on the classroom graph.
   —Students will determine if there is a trend (connection) between the area of the stalk and the weight of the head.

Note: If stalks of wheat are unavailable, students use pipe cleaners and beads or beans to create wheat stalk models to measure and weigh.

Extra Reading

Bartoletti, Susan Camptell, *Black Potatoes: The Story of the Great Irish Famine, 1845-1850,* Houghton-Mifflin, 2001.

Hawkes, Nigel, *Genetically Modified Food*, Copper Beech, 2000.

Hughes, Meredith Sayles, *Glorious Grasses: The Grains (Plants We Eat)*, Lerner, 1998.

Johnson, Sylvia A., *Tomatoes, Potatoes, Corn, and Beans: How the Foods of the Americas Changed Eating Around the World*, Atheneum, 1996.

Smith, David J., *If the World Were a Village*, Kids Can, 2002

Reading Page

Norman Borlaug, Hunger Fighter

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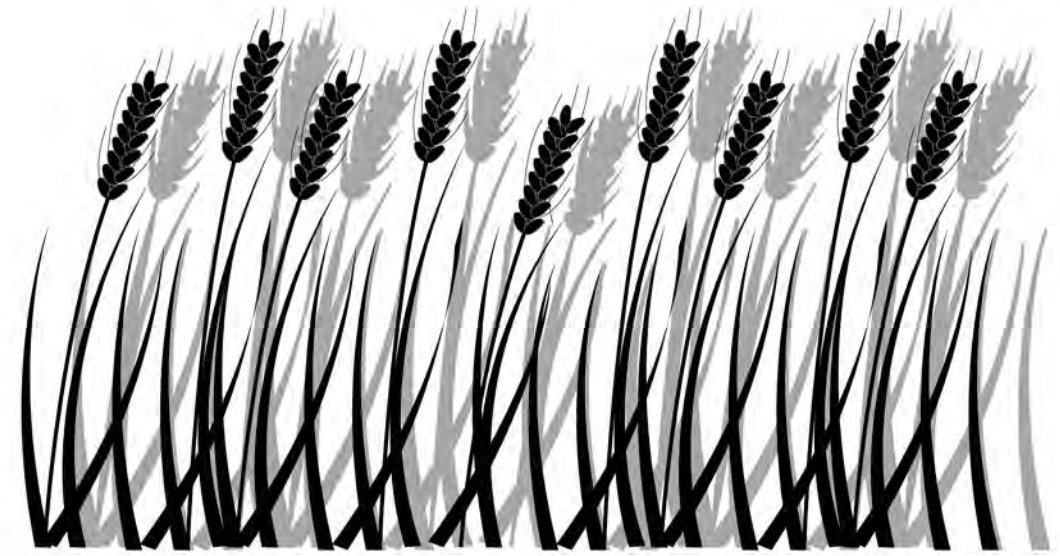
Borlaug founded the International Maize and Wheat Center in Mexico. There he helped develop a high-yield, low pesticide dwarf wheat. Today this wheat feeds a large portion of the world's population.

Borlaug's leading research achievement was the development of dwarf spring wheat. He found many benefits to growing plants with shorter stalks. Nature favors genes for tall stalks, because in nature, plants must compete for sunlight. Borlaug found that plants with stalks that were short and of equal length would receive equal amounts of sunlight when they did not have to compete with taller-stalked plants. In addition, dwarf wheat used more energy growing valuable grain rather than using its energy to grow tall, stalks with no food value. Stout, short stalks also support wheat kernels better. Tall-stalked wheat may bend over at maturity, making it more difficult to harvest.

Borlaug also developed cereal grains that were insensitive to the number of hours of light in a day, and could therefore be grown in many climates. He particularly favored growing wheat in countries where starvation was a concern because wheat grows in nearly all environments and is resistant to insects.



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

Name _____

Norman Borlaug, Hunger Fighter

PROBLEM:

In 1960, before Borlaug's techniques were widely adopted, the world produced 692 million tons of grain for 2.2 billion people. By 1992, largely as a result of Borlaug's pioneering techniques, it was producing 1.9 billion tons for 5.6 billion people—using only 1% more land.

How many pounds of grain per person in 1960?

How many pounds of grain per person in 1992?

How many pounds of grain per person would there have been in 1992 if Norman Borlaug had not done his work and the grain production had stayed the same?

Conjecture what the world hunger situation would have been in 1992 if Norman Borlaug had not committed himself to his life endeavors. Justify your reasoning mathematically.

In your journal write a paragraph or more explaining how one person can make a difference in the world.

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Name _____

Norman Borlaug, Hunger Fighter (answers)

PROBLEM

There is more than one way to solve this problem. The following is only one possibilty.

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How many pounds of grain per person in 1960?

0.692 billion tons divided by 2.2 billion people = 0.314 ton per person

I want to know pounds, so 0.314 x 2000 = 628 pounds per person

How many pounds of grain per person in 1992?

1 billion tons divided by 5.6 billion people = 0.339 ton per person

I want to know pounds, so 0.339 x 2000 = 678 pounds per person

How many pounds of grain per person would there have been in 1992 if Norman Borlaug had not done his work and the grain production had stayed the same?

0.692 billion tons divided by 5.6 billion people = 0.123 ton per person

I want to know pounds so 0.123 x 2000 = 246 pounds per person

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