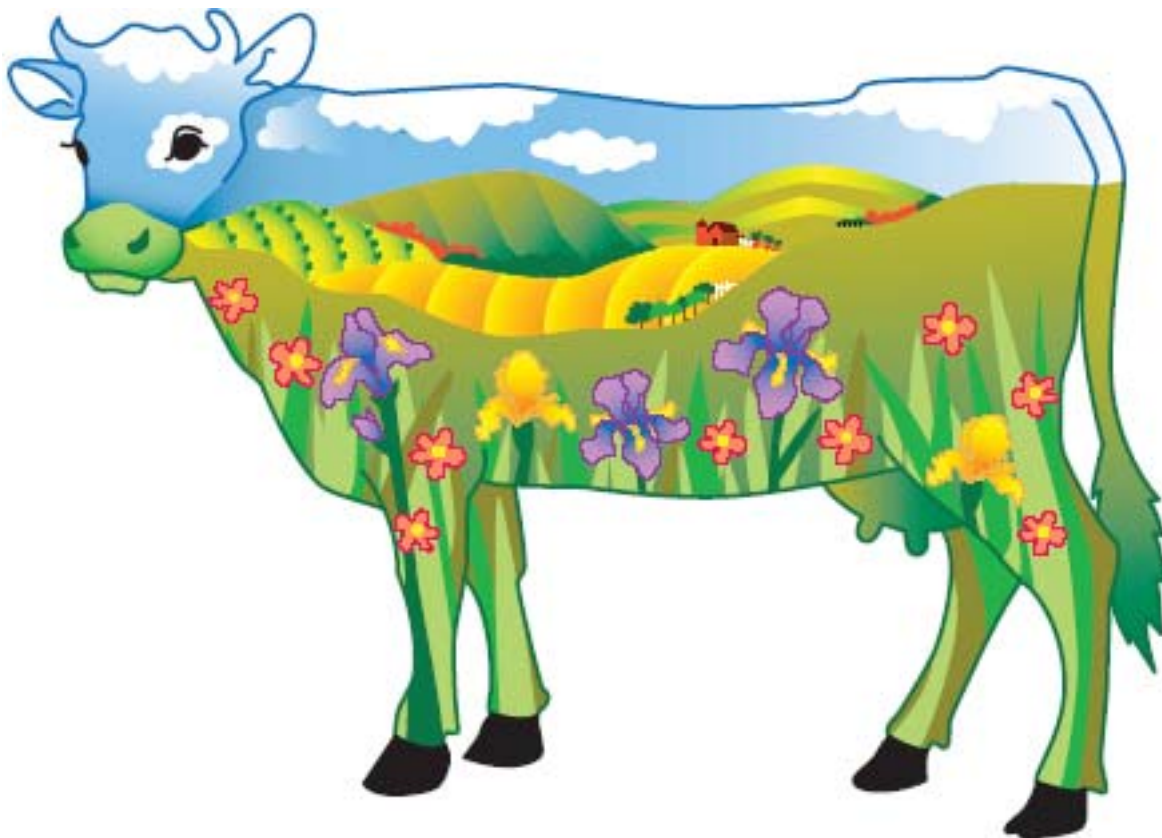


SOLE  
Sciences of Life Explorations:  
Through Agriculture  
Grades 4 and 5



Teacher Guide  
Unit: Corn You Believe It?



## UNIT PLAN

### UNIT TITLE

Corn You Believe It?

### MONTH

September

### GOALS

Students will explain the importance of corn as an agricultural crop in the United States.

### OBJECTIVES

Students will:

1. Recall vocabulary appropriate to corn, by using terms orally and in writing (NYS Standard 1: Communication Skills, Checkpoint B).
2. Dissect a corn **kernel** and observe its parts (NYS Standard 1: Analysis, Inquiry, and Design, Elementary1).
3. **Estimate** the number of **kernels** in an ear of corn (NYS Standard 3: Mathematics, Elementary 5).
4. Ask geographic questions about the **Midwestern** states, and about how their location is related to the growing of corn (NYS Standard 3: Geography, Elementary 2).
5. Compare New York State's output to **Midwestern** corn production (Food & Fiber Systems Literacy I: Understanding Food and Fiber Systems, C 4-5).
6. Locate current high production areas in the United States of corn as a cash crop (Food & Fiber Systems Literacy II: History, Geography, Culture, D 4-5; NYS Standard 3: Geography, Elementary 1).
7. Discover how next year's corn crop is **generated** from this year's **kernels** (Food & Fiber Systems Literacy III: Science, Technology, & Environment, A 4-5).
8. Identify how monetary value is added to raw corn after it is processed into products (Food & Fiber Systems Literacy IV: Business & Economics, B 4-5).
9. Identify ways of processing corn for a variety of products (Food & Fiber Systems Literacy V: Food, Nutrition, & Health, A 4-5).

## TERMS

These terms are highlighted in **Bold** throughout the lesson pages

**Acre** - a unit of land measurement (43,650 square feet) about the size of a football field

**Artifact** - a very old item, usually created by human hands, that tells us something about the past

**Bushel** - a unit of measurement for crops such as corn and wheat, or a basket that holds a **bushel** of something

**By-product** - a secondary product made from what is left over after the original use

**Carbohydrate** - an energy source made by plants, that can also become food energy for people and animals

**Cob** - another word for an ear of corn; the **cob** is where the corn seeds (**kernels**) form

**Complex** - not easy or **simple**, having many parts

**Endosperm** - the largest portion of the corn **kernel**; it is where the food energy is stored.

**Estimate** - to guess what something is or what will happen based on what you know

**Ethanol** - a chemical in the alcohol family, created from plant materials and used as a fuel

**Gene** - the basic unit, inherited from parents, that tells a cell or organism how to be, grow, or act

**Genetic** - having to do with **genes**

**Germ** - the part of a seed which directs how the seed grows (not the same as a **germ** that causes illness)

**Germinate** - the action of the seed **germ** starting to grow into a plant

**Grains** - the seeds of certain grass-like plants which provide food for animals and people

**Kernel** - another name for a seed; it is usually within a husk or shell.

**Maize** - a name for corn used by some Native American peoples

**Midwest** - the area in the center of the United States which is **generally** flat land and used for farming

**Pericarp** - the outer covering of the corn **kernel**

**Petroleum** - liquids, solids and gasses beneath the earth's crust, formed from ancient dead plants. Examples: gasoline, oil, and coal.

**Photosynthesis** - the process where plants use sun, water and nutrients to make their own food energy.

**Seed viability** - the ability of seeds to **germinate**

**Simple** - not difficult or not having a lot of details

**Starch** - a form of **carbohydrates** that provide long-term energy

**Surpass** - to go beyond what is expected or to exceed; to do better than something else or someone else

**Tip cap** - where the corn **kernel** is attached to the ear

*Integrated Pest Management is a specialized form of environmental management wherein scientific research and real world application work together to reduce pests such as insects, diseases or weeds.*

*1. Proper identification of pests*

*2. Learn the pest/ host biology*

*3. Sample the environment for pests*

*4. Determine an action threshold*

*5. Choose the best tactic*

*6. Evaluate results*

## SAFETY

General school safety and proper practices concerning heat from warm surfaces during activities.

## Standards Matrix for this Lesson:

Standards:										
Month	Unit	Math/Science/and Technology	English Language Arts	Social Studies	HEALTH	ARTS	Food & Fiber Literacy	CDOS	Other Languages	Interconnectedness
9	Corn You Believe It	1:7, e1	1:6, e1	3:16, e1			I C 4-5			
		3:9, e5		3:16, e2			II D 4-5			
							III A 4-5			
							IV B 4-5			
							V A 4-5			

### Matrix Key:

NYS Learning Standards arranged by Standard: Category, Level

e = elementary i = intermediate

Categories:

- |   |  |
|---|--|
| 1 Career Development                            | 10 Science                             |
| 2 Universal Foundation Skills                   | 11 Technology                          |
| 3 Language for Information and Understanding    | 12 Interconnectedness: Common Themes   |
| 4 Language for Literary Response and Expression | 13 Interdisciplinary Problem Solving   |
| 5 Language for Social Interaction               | 14 History of the United States and NY |
| 6 Communication Skills                          | 15 World History                       |
| 7 Analysis, Inquiry, and Design                 | 16 Geography                           |
| 8 Information Systems                           | 17 Economics                           |
| 9 Mathematics                                   |  |

## ADDITIONAL RESOURCES

<http://www.ontariocorn.org/classroom/products.html>

[http://nysipm.cornell.edu/publications/corn\\_dis\\_mgmt/corn\\_dis.pdf](http://nysipm.cornell.edu/publications/corn_dis_mgmt/corn_dis.pdf)

*From Corn to Cereal* by Robert Basel. ISBN 0-7368-4284-5

## SUPPLIES AND EQUIPMENT

United States map or globe (optional)

Unpopped popcorn and a microwave or hot air popper (optional)

Crayons or markers

Blank sheets of paper

An ear of corn for each student or group

Soaked **kernels**

A corn stalk

Plastic knives

Magnifying glasses

## BACKGROUND FOR TEACHERS

### Growing corn

Corn is planted when the soil is warm enough for the seeds to grow and **germinate**, but not so early that the plants can be damaged by frost. Corn can be grown on every continent except for Antarctica, but most corn is grown in the middle latitudes where the temperatures are more moderate. The plant grows to be very tall (5-12 feet), with a few ears of corn per stalk. Each ear has about 800 **kernels** (seeds). At the top of each ear, the tassel is found. The tassels are attached to the silks, which play an important role in pollination. The silk gets its name because of its resemblance a strand of real silk. Sweet corn silks are dark, and field corn silks are lighter. Each strand conducts pollen to one site on the developing ear of corn, where it will allow the **kernel** to grow.

### Nutritious corn

Corn is a domesticated grass that originated in Mexico. It co-evolved with human society, and has held historical significance for humans since its development. The rise of civilizations in North, Central, and South America is closely related to the domestication and improvement of corn. The primary nutritional value of corn is the energy we can get from its seeds. Seeds naturally have a lot of energy (**starch**) in them in order to nurture the new plants. Corn also has high levels of such nutrients as thiamin, folate, dietary fiber, Vitamin C, Vitamin A, manganese, and Vitamin B5.

### Products made from corn

Corn can be made into thousands of products. A good list of some of the products we commonly use corn for are given at the Province of Ontario's education website: <http://www.ontariocorn.org/classroom/products.html>.

Corn is used in a wide variety of prepared foods, and high fructose corn syrup is used as a sweetener in many foods and beverages. Corn can be used as an inert ingredient in medicines and toothpaste, rubber, plastic, and paint, and can be made into **ethanol** for fuel. Because corn can be used in so many products, it is a very valuable crop in the United States and in the world.

## Corn in New York State

There are two main types of corn grown in New York: sweet corn, and field corn (also called “dent corn”). Sweet corn is used for human consumption and has a higher amount of sugar in the **kernels** than field corn. It is produced statewide, with higher concentrations grown in the Lower Hudson Valley and Genesee Valley. New York State ranks fourth in sweet corn production.

Field corn is produced largely to support the animal agriculture industries. New York ranks nineteenth in the production of field corn and third in the growth of corn silage, a valuable feed for dairy cows.

Corn is a major crop in New York, and the climate is well-suited for its growth. The difference between the two types of corn is that unlike sweet corn, field corn has a hard outer portion, and the inner portion of the corn **kernel** is soft and floury. Field corn is used to make **starches**, oils, livestock feed, **ethanol**, and many other products like crayons, paints, plastic, paper, sweeteners, and other ingredients in foods. Sweet corn is primarily used for corn on the **cob** and canned corn.

## Monetary value of corn

Farmers rely on corn crops for money, either by selling the crop to industries that use corn or by feeding it to animals. Corn is increasing in demand as the biofuel industry grows, and more **acres** are being planted to corn to take advantage of the high demand. For this reason, the corn price has increased, which is good for corn growers and bad for animal farmers. No matter the price, though, corn will continue to be grown in New York State and will continue to be important to our agriculture and food industries.

Further information and lesson plans can be found on the Education section of the National Corn Growers Association website at: <http://www.ncga.com/education/main/index.html>

## QUESTIONS FOR STUDENTS

Where does corn come from?

What kinds of corn are there?

What is a **kernel**?

How does corn grow?

What do we get from corn?

Why does popcorn pop?

What is **ethanol**?

## INTEREST APPROACH ACTIVITIES

### The Cob Investigation

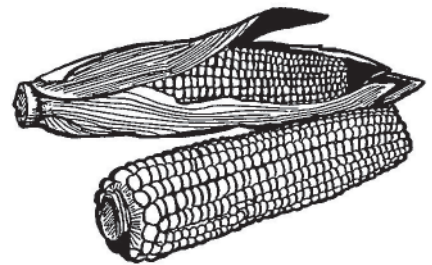
1. Bring in an ear of corn for each student. If there are not enough ears of corn, divide the class into a few small groups so that they can share.
2. Ask them to guess how many corn seeds are on the ear. Have each student write down their answer on paper.
3. Ask them to count the rows and predict how many **kernels** are in one row.
4. Ask them how we can find out the total number of seeds from:
  - A. The number of rows
  - B. The number of seeds in each row.
5. Have the students perform the necessary calculations to find out how many seeds are on an ear of corn.
6. Have them to state their answers orally and write each answer on the board.
7. Some students might miscalculate. Ask the class if any of the answers listed on the board seem significantly different from the others.
8. Have students investigate by rechecking their multiplication.

Inquiry:

What are these corn seeds called?

Let the class use magnifying glasses to investigate the ear.

(For related activities, refer to student worksheet #7)



### The Sensory Stalk

Teacher Background - a short history of sweet corn:

Cultivation of sweet corn began more than 8000 years ago in Central America. Corn was domesticated from an annual grass native to the region. Archaeologists' research concludes that humans first domesticated corn by selecting plants with the largest number of seeds until they eventually had a substantial food source. This method most likely took several **generations**.

Corn facts:

- Corn is a grass
- Corn is a monocot
  - ◊ A monocot is a plant that has only one embryo leaf (cotyledon) in each seed
  - ◊ Other monocots include orchids and some grasses
- Corn is in the same family as crabgrass, bamboo, and sugar cane.
- Corn has male and female flowers
  - ◊ Male flowers are clustered together at the top of the plant (tassel)
  - ◊ Some of the pollen released from the male flowers falls on the silks of immature ears below the tassels
  - ◊ When **grains** of pollen fall on the silks, the female flowers are being pollinated
  - ◊ Female flowers are found about halfway down the plant (these form the **grains** we eat)
  - ◊ Each single silk rises from the top of a single corn ovary, which will become the **kernel**

--Adapted from [www.backyardnature.net/fl\\_corn.htm](http://www.backyardnature.net/fl_corn.htm)



If you ever decide to plant corn as a class project in the future:

#### Planting:

- Plants need full sun
- Plant after danger of full frost has passed
- The warmer the weather, the sweeter the corn
- Generally, early June is good planting time in New York State
- It's important to separate different varieties of corn, because they may cross-pollinate
- Select well-drained soil
- Test soil pH level. 6.0-6.5 is ideal for corn. Add lime if pH is low.
- Water frequently
- Keep ahead of weeds by cultivating around corn.
- Check out NYAITS's *Kids Growing Food* program ([www.cerp.cornell.edu/aitc/kgf.html](http://www.cerp.cornell.edu/aitc/kgf.html)) for information and possible grants for establishing school gardens.

#### Harvesting:

- The best time to harvest is the period called the "milk stage," when the ears are not quite ripe. This lasts about a week.
- You can determine the time to harvest by looking at the silks, husks, and **kernels**.
- Silks should be brown and starting to dry. The process takes about three weeks from the time silks first begin to appear.
- Husks should hold tightly to the ear.
- **Kernels** will emit a milky fluid when pierced.
- Each stalk will produce one or more ears
- Harvest by twisting off the ear at its base and pulling.
- Store corn in the refrigerator.

#### The Sensory Stalk

- Dig a cornstalk out of the garden. (If you do not have access to a garden, contact a local farmer, who will most likely be happy to let you dig one or do it for you.)
- Place cornstalk on classroom table.
- Have students use their senses to explore and discuss the following:
  1. Roots
  2. Stalk
  3. Soil
  4. Tassels
  - 5. Cobs**
  6. Unhusked ears
- Point out the root system, which absorbs water from the ground
- Point out the long stalk and leaves, which absorb sun for **photosynthesis**
- Have students examine tassels and silks. There is one silk for each **kernel** – ask why.
- Point out ears
  - ◇ 12-16 rows on each ear
  - ◇ 30-60 **kernels** per row
- Have students record observations in their journals.



## Dissecting a Kernel

### A. Teacher Information

#### 1. What is a **kernel**?

- Definition
- Parts

**i. Pericarp** - waterproof outer covering that protects the food energy

**ii. Endosperm** - largest part of the **kernel** where energy is stored; provides **starch**

**iii. Germ** - contains the **genetic** information for the corn plant, used for corn oil.

**iv. Tip cap** - attaches the **kernel** to the **cob** (ear); the place where water and nutrients enter the **kernel** from the **cob**

#### 2. Soak **kernels** overnight before dissection.

### B. Student Activity

- Pass out a few **kernels** to each student.
- Students investigate the **kernels** with magnifying glasses.
- Each student will dissect a **kernel** using a plastic knife.
- Find and identify the four seed parts.

### C. Collaborative Activity

- Draw a giant **kernel** on the blackboard and identify **pericarp**, **endosperm**, **germ**, and **tip cap**.

(For related activities, refer to student worksheets #5 & #6)



## Seed viability

### A. Teacher Information

- What is **seed viability**? How do we test it? In pioneer times, farmers needed to know how many seeds would **germinate**. They sprouted a sampling of their seeds in a cloth towel or rag to predict the percentage. This activity will allow students to explore **seed viability** by growing plants in a paper towel.

### B. Questions for Students

- Brainstorm: Why would pioneers utilize the **seed viability** test?
- Brainstorm: Students will use paper towels. Why did they use rags or cloth in the pioneer days?

### C. Student Activity

- Pass out paper towels, (untreated) seed corn **kernels**, rubber bands, and plastic bags.
- Have students dip their paper towels in water and squeeze out the excess.
- Have students lay the paper towels on their desks and place 10 **kernels** in a row near one end.
- Roll up the paper towel and place rubber bands on each end of the roll. Put it in a plastic bag and zip shut.
- Place the bags near sunlight and ask students to observe in a week by unrolling the paper towel.
- Students should count and report how many seeds **germinated**. Since there are 10 **kernels** per experiment, students can easily convert the number to a percentage. Make graphs to illustrate results.

## Monocots and Dicots

### A. Teacher Information

Monocot embryos have a single cotyledon while dicot embryos have two cotyledons. The cotyledons are “seed leaves” produced by the seed’s embryo. Cotyledons absorb nutrients packaged in the seed, until the seedling is able to produce its first true leaves and begin **photosynthesis**.

### B. Student Activity

1. Using potting soil, sprout some corn and bean seeds in two separate containers.
2. Observe the similarities and differences as the plants grow.
3. Do you notice the single blade of the corn seeds? This signifies that corn is a monocot.
4. Do you see the two leaves of the beans? This means that beans are dicots.

(For related activities, refer to student worksheet #8)

## Pioneer Fun Activity: Cornhusker Dolls

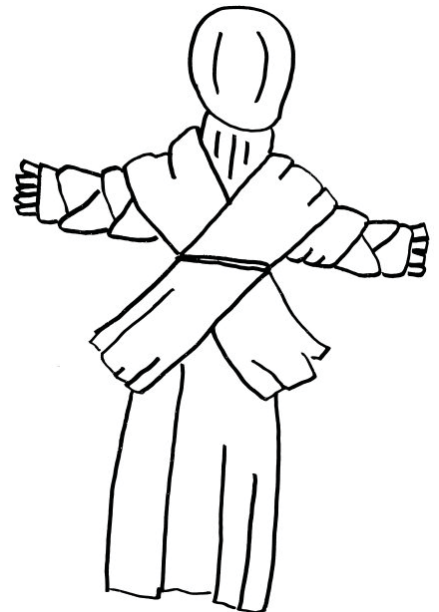
### A. Teacher Information

Cornhusk dolls have been made by Native American tribes for many **generations**, and they were copied by European settlers. Dried cornhusks were soaked in water to become soft so that sturdy dolls could be made for children to use as toys. It was a time when nothing was wasted and a purpose was found for everything. Today we call this recycling.

The dolls were often dressed in cornhusks, animal hide, or cloth. Personal items were produced to help children prepare for everyday activities. Girl dolls were given cradle boards, hoes, sewing kits, or other women’s things, while boy dolls were provided with bows and arrows, canoe paddles, and warrior’s gear.

### B. Student Activity

1. Place a cotton ball or similar-sized object in the middle of a section of husk. Fold it, twist it, and tie it with a piece of string to make a head.
2. Create the doll’s arms by folding a second husk. Tie it near each end to make the hands and slip these arms between the husks below the head.
3. Tie a waist on the doll tightly with string. Place additional husks around the doll’s waist so that they overlap slightly and then tie them in place with the string. Fold the husks down carefully.
4. Trim the husks straight across at the bottom to even the doll’s dress hem. Now let the corn husk doll dry completely.



## SUMMARY OF CONTENT

- I. How much do you know about corn?
  - A. A variety of questions about corn.
- II. Corn is cool!
  - A. How corn is grown
  - B. What corn is used for
  - C. How corn is harvested
  - D. Introduces the terms **kernel**, **cob**, **by-products**, **estimate**, and **photosynthesis**
- III. Where does corn come from?
  - A. A brief history of corn
  - B. Where corn is grown in the U.S.
  - C. A map showing the highest corn-producing states
  - D. Different types of corn
- IV. What is a **kernel**?
  - A. The four parts of the **kernel**
  - B. Dissect a **kernel** by following the interest approach activity.
  - C. Students are introduced to the terms **endosperm**, **pericarp**, **germ**, **genetic**, **cob**, and **tip cap**.
- V. Label the **kernel**!
  - A. A diagram of **kernel** with space to label the different parts
  - B. The concept of food energy
  - C. Introduces the terms **starch**, **carbohydrate**, and **complex**

## TEACHING-LEARNING ACTIVITIES

- I. How much do you know about corn?
  - A. Discuss these questions in a group setting, so students may volunteer their answers.
- II. Corn is cool!
  - A. Read as a class or individually
  - B. Ask students what their favorite fact about corn is.
- III. Where does corn come from?
  - A. Read through this page as a class or individually
  - B. Students should follow the directions and color the corn producing states on the map
  - C. Have students hypothesize why those states produce the most corn.
  - D. Bring in examples or pictures of the four different types of corn for students to look at (optional)
- IV. What is a **kernel**?
  - A. Discuss the four parts of the **kernel** with students and ask them to look at a **kernel** of corn by completing the corn dissection interest approach activity.
- V. Label the **kernel**!
  - A. Students should label the diagram of the **kernel**.
  - B. Review the functions of each of the **kernel**s parts.
  - C. Read through the food energy section as a class or individually. Ask the students if they can think of any other foods that are high in **carbohydrates**.

## SUMMARY OF CONTENT

### VI. Corn Math!

- A. Math problems related to corn.

### VII. How does corn grow?

- A. The different processes which occur from seed to mature plant.
- B. Includes the terms **germinate** and **photosynthesis**

### VIII. What do we get from corn? (2 pages)

- A. Corn word find
- B. The variety of products made from corn
- C. What is a **bushel**?
  - i. Why do we measure by **bushels**?
  - ii. How many **bushels** of corn does the US produce?

### IX. Why does popcorn pop?

- A. A brief history of popcorn.
- B. How and why popcorn pops

## TEACHING-LEARNING ACTIVITIES

### VI. Corn Math!

- A. Have students complete this sheet individually, and go over the answers as a class.
- B. An actual corn **cob** could be provided, if possible.

### VII. How does corn grow?

- A. Read as a class or individually
- B. If possible, bring in a **kernel** and compare to the height of something about 7-9 feet tall (cabinet, bookshelf, etc.)
- C. This will help students visualize the amount of growth that a corn plant undergoes in a short amount of time.
- D. Have students compare their own growth to the growth of a corn plant.

### VIII. What do we get from corn? (2 pages)

- A. Have student complete the word find
- B. Homework assignment
- C. Have students, with their parents, look at the labels of food items in their pantry or refrigerator.
- D. Find products that have corn in them.
- E. If they have an empty box or container, have them bring it in to class.
- F. Check magazines for pictures of items with corn in them and cut them out.
- G. Make a display in class with the pictures and items you brought in from home.
- H. Discuss what a **bushel** is, and why we use them to measure different types of produce

### IX. Why does popcorn pop?

- A. Read as a class
- B. Pop corn in class (optional)
- C. Have student complete the activity sheet

## SUMMARY OF CONTENT

- X. What is **Ethanol**?
  - A. A brief description of what **ethanol** is and how it is made.
  - B. Math problems related to **ethanol**
  - C. Introduces the terms **by-product** and **petroleum**.
- XI. How do farmers protect their corn crops?
  - A. Review of IPM and how farmers use it for corn.
  - B. Introduces the terms integrated and residue
- XII. Test Your Knowledge
  - A. Review questions that cover key concepts
- XIII. Vocabulary
  - A. Includes all of the terms highlighted in bold throughout the lesson

## TEACHING-LEARNING ACTIVITIES

- X. What is **Ethanol**?
  - A. Read this page as a class
  - B. Discuss the benefits of **ethanol**
  - C. Have student complete math problems individually and then discuss them as a class.
- XI. How do farmers protect their corn crops?
  - A. Read this page as a class
  - B. Have students answer question on their own and then discuss as a class
  - C. Ask students why it is important for farmers to keep their corn healthy and pest-free
- XII. Test Your Knowledge
  - A. Have students answer questions individually.
  - B. This page can count as a quiz or as a **simple** review.
- XIII. Vocabulary
  - A. Provided for student reference

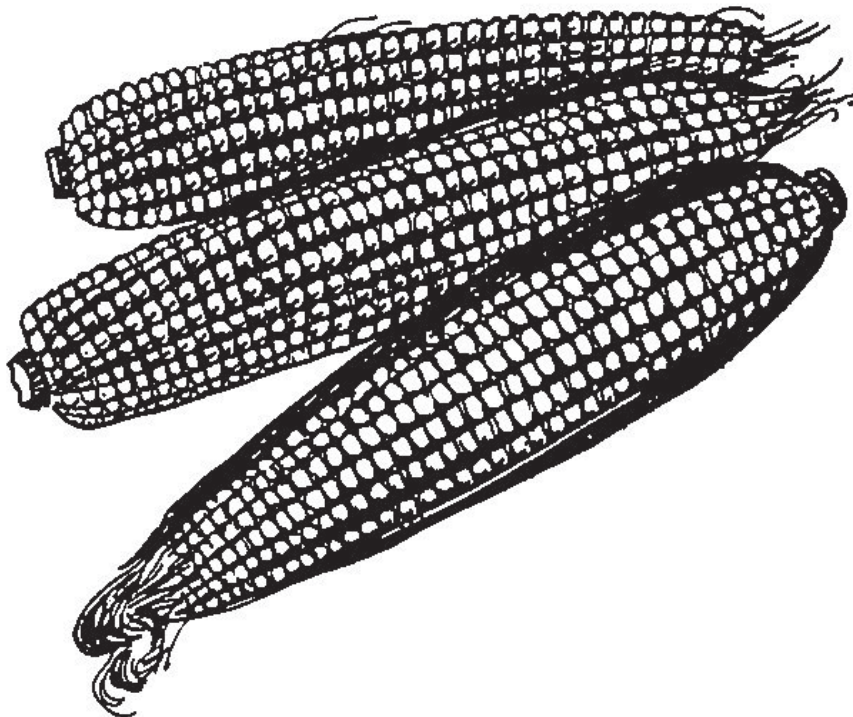
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## Student Lesson: Corn You Believe It?

How much do you know about corn?

It's a vegetable.  
Most people like to eat it.  
It's yellow.  
Anything else?

This lesson will help you learn more about corn. It's a very important crop and is used in many ways.



Where does corn come from?

What kinds of corn are there?

What is a **kernel**?

How does corn grow?

What do we get from corn?

Why does popcorn pop?

What is **ethanol**?

Why is corn an important crop for farmers,  
and for you?



## Student Lesson: Corn You Believe It?

### Corn is cool!

Corn, wheat and rice are the three major **grain** crops in the world. Corn is a plant that has grown in North America for hundreds or thousands of years. The European settlers had not seen it before they came to this continent.

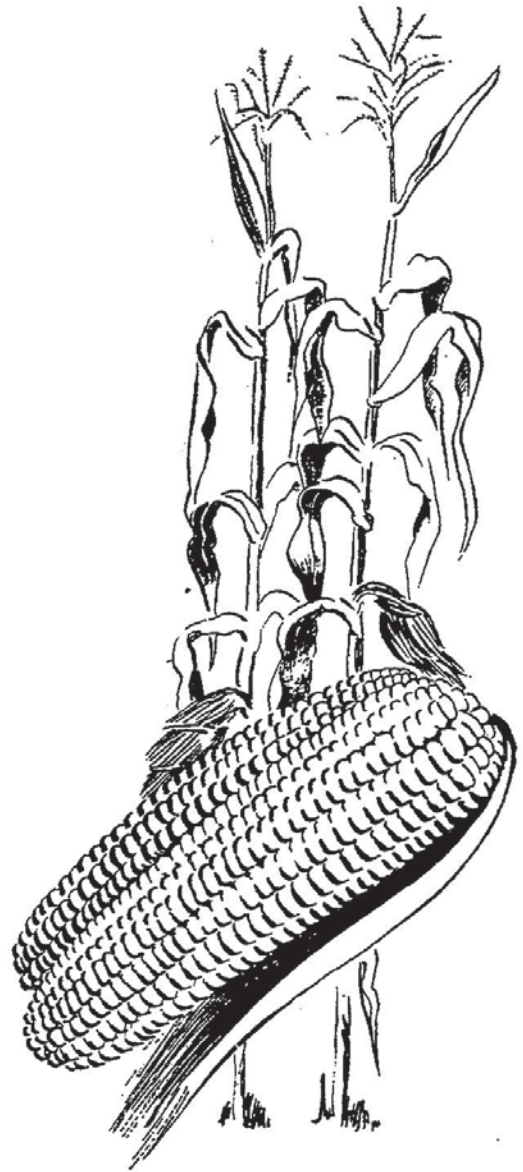
The corn plant is an amazing thing. It starts as a small seed called a **kernel**. Once in the ground, with the right conditions, one small seed will produce a seven or eight foot plant in two months!

Each plant produces more than one ear of corn. That means one small corn seed has produced hundreds more!

All seeds have energy stored inside. When we eat them, we also receive that energy. The energy in the corn seed (**kernel**) is like all other seeds and gives the plant everything it needs to grow until it has enough leaves to make new energy from the sun. This process is called **photosynthesis**

All living things need energy as fuel to function. Animals get food energy by eating something else. Plants don't have to eat anything else, because they make their own energy from the sun.

The corn **cob** is picked by hand or by machine. The **kernels** are used for food in many ways, some for people, some for animals. The rest of the plant is also used, creating many **by-products**. Some sources **estimate** that one out of every four food products sold at the grocery store has a corn product in it.





## Student Lesson: Corn You Believe It?

Where does corn come from?

Corn is actually a type of grass. Remember, all plants make seeds of some kind. Some of the special grasses that give us seeds to eat are called **grains**.

Ancient corn seeds and other **artifacts** show that Native Americans of North America, Central America and South America have been growing corn for over 3000 years. Many Native American peoples call corn **maize**. It has always been a very important crop.

These days corn is a major crop to feed both people and animals in the United States. One part of the country, the **Midwest**, is called the Corn Belt, because so many farmers there grow corn.

What kinds of corn are there?

- Sweet corn is the corn we enjoy fresh or canned.
- Field corn is sometimes called dent corn, and is grown mostly for animal feed. It is also used for some industrial products and food products. As you may have guessed, each **kernel** has a dent in it.
- Flint corn is sometimes called Indian corn or ornamental corn. It is colorful and used mostly for corn meal in Central and South America
- Popcorn is a different kind of corn than sweet corn. It is grown specially to be popped!



Nebraska is called the  
Cornhusker State!  
Color it in with yellow stripes!

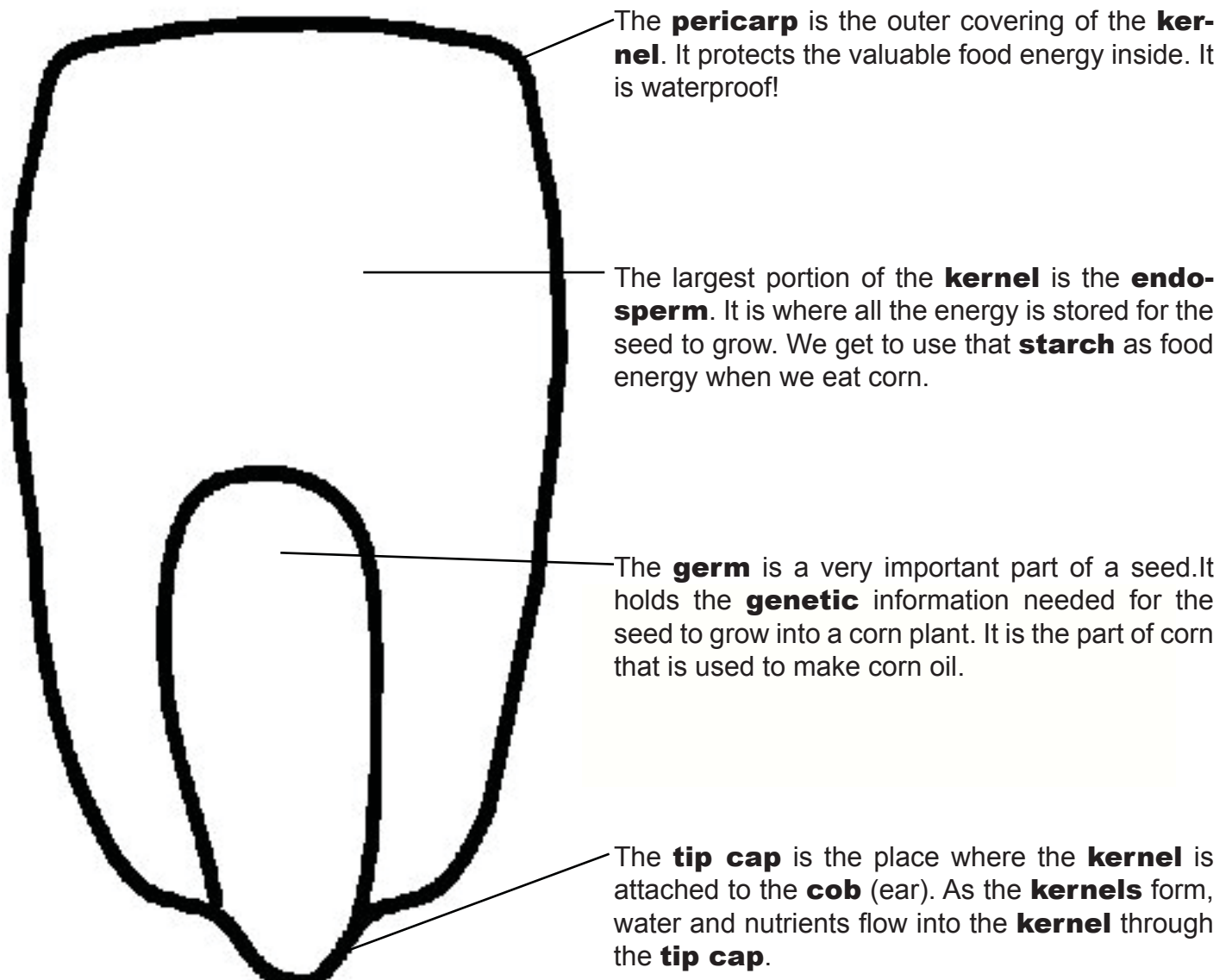
Iowa is the largest producer of  
corn.  
Color it solid yellow.

Illinois also grows a lot of corn.  
Color it green

name \_\_\_\_\_

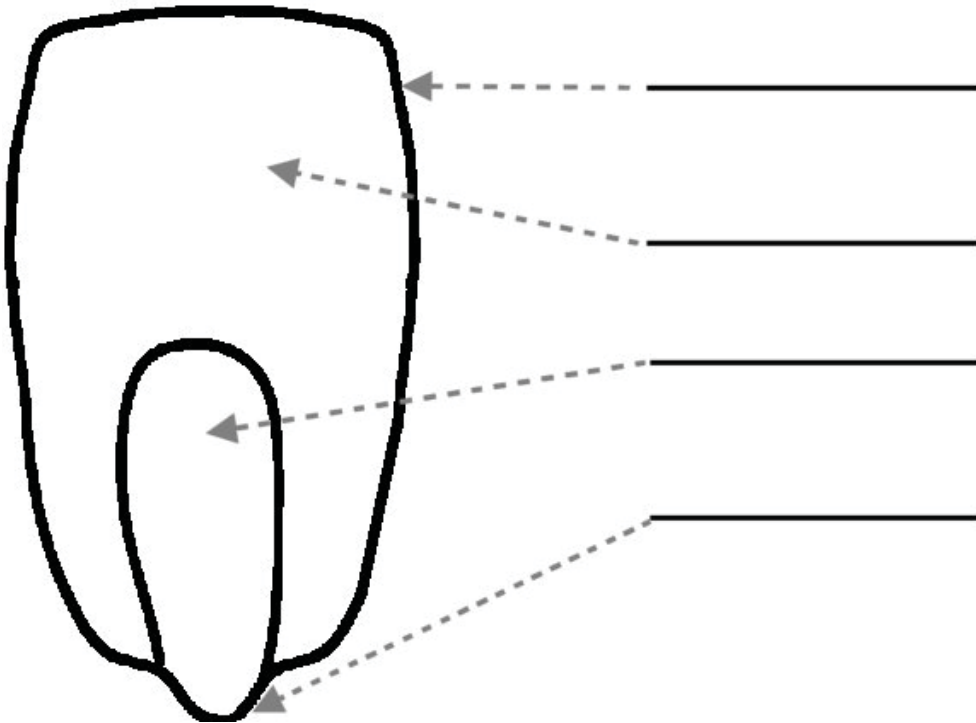
## Student Lesson: Corn You Believe it? What is a **kernel**?

**Kernel** is the name we use for the corn seeds which grow on an ear of corn. The **kernel** is a real powerhouse! It has four parts.



name \_\_\_\_\_

Student Lesson: Corn You Believe It?  
Label the **kernel**!



Food Energy

**Starch**

Sugar

**Carbohydrates**

You have probably heard of all three. But what are they?

**Carbohydrates** are an energy source for plants and animals. When we eat a plant that has **carbohydrates** in it, we get the energy. For example, when we use wheat to make bread, and then eat that bread, we are getting the **carbohydrates** in wheat and using them as fuel for our bodies.

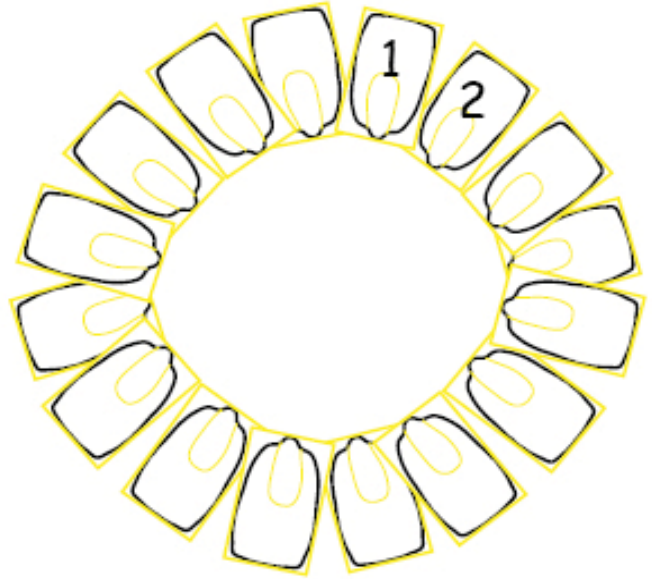
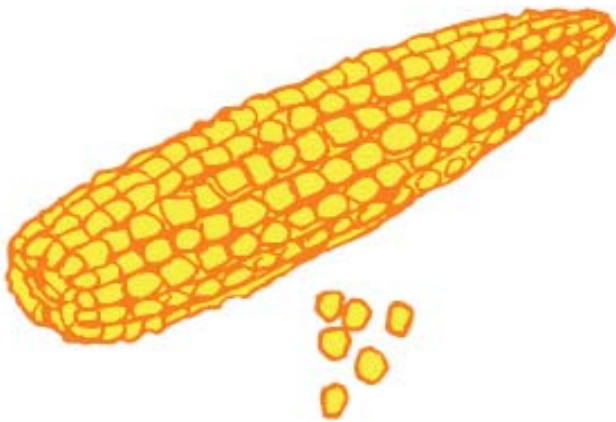
**Carbohydrates** change when they are digested. They become **starches** and sugars. **Starch** changes slowly, giving energy over a longer period of time. It is called a **complex carbohydrate**. Sugar changes quickly, giving a quick burst of energy. The **carbohydrates** in corn are mostly **starches**, but can be processed into sugars, too.

name \_\_\_\_\_

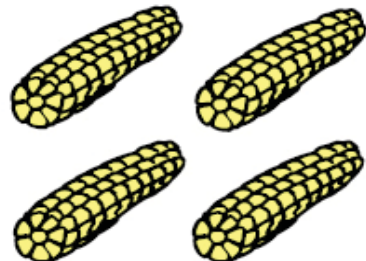
## Student Lesson: Corn You Believe It? Corn Math!

This ear of corn shows how the rows are attached. There is always an even number of rows. Imagine that each row on this **cob** has 50 **kernels**.

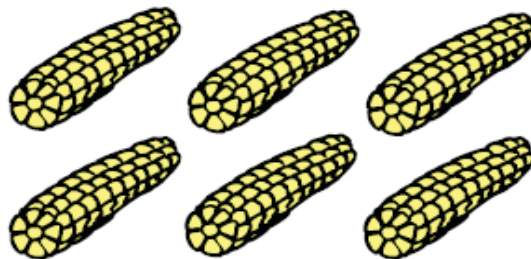
How many **kernels** are on this **cob**? \_\_\_\_\_



circle one half  $\frac{1}{2}$



circle one quarter  $\frac{1}{4}$



circle one third  $\frac{1}{3}$



circle one half  $\frac{1}{2}$



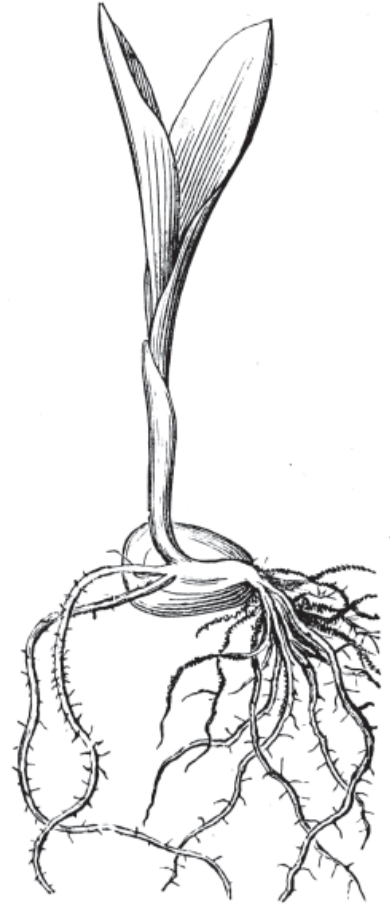
circle one third  $\frac{1}{3}$

## Student Lesson: Corn You Believe It?

How does corn grow?

Corn is planted in the spring, when the ground has warmed up. The seeds need sun and water to **germinate** and put down a small root. They get the energy to do this from the **carbohydrate (starch)** stored inside the seed. Then it sends up its first leaf. The tiny corn plants will grow fast if the weather is warm.

In about two months a corn plant can grow to be seven feet tall or more. It can grow an inch a day! Leaves help the plant make energy from the sun. This process is called **photosynthesis**.



When the plant is done growing tall, it puts its energy into producing seeds. At the top of the plant, corn produces tassels. Below, the ears produce silk. Pollen from the tassels drops down and pollinates the silks. A seed will develop for every silk strand pollinated. We call these seeds **kernels**. An ear usually has 12-16 rows and 30-50 **kernels** in each row.

A few weeks later, when the silk is starting to dry, the corn is probably ready to be picked. If the corn is going to become feed for animals, it is left much longer. Sweet corn can be picked by hand, but a lot of corn is picked by machine.



name \_\_\_\_\_

## Student Lesson: Corn You Believe It?

What do we get from corn?

Corn and corn **by-products** are in many things we use everyday. It is used as a sweetener in a lot of products. Find some of the products corn is used to make!

D M Y R T U S G M Q S S N S C S W K  
Y L W J E K H A A R P O D A R T A N  
I H D T C P R S E D I A R L A R L I  
R E P A P G A N E T B P C L Y U L A  
W O N A A U A P A Y E S Z I O G B F  
S S N R N E H L L T D O W T N O O K  
P L I D L X U H S L E A Q R S Y A Z  
R N A C Z S P M G X A M O O Z F R K  
E U P E N I C P A S Q W M T V Z D M  
G Y A I R E N L X Y P A I N T O U Q  
H S C I T E M S O C O Z L D P G S N  
K R E L Z D C L A C S N O I T O L S  
Z Y V J V F A C C S A J N U I X N U  
T O O T H P A S T E P N A A E F P C  
K E D U R L Y D R V A I D F I W Y Y  
S R A H A R A H Y C T N R Y L S J D  
C T M S U S X K G O H Q T I U R E S  
D Z E P A K E T C H U P V G N R U S

ASPIRIN  
CANDY  
CARPETS  
CEREALS  
CLEANERS  
COSMETICS  
CRAYONS  
DYES  
GUM

INK  
INSULATION  
KETCHUP  
LOTIONS  
MARGARINE  
MAYONNAISE  
PAINT  
PAPER  
SNACKS

SOAPS  
SYRUP  
TOOTHPASTE  
TORTILLAS  
WALLBOARD  
WALLPAPER  
YOGURT



## Student Lesson: Corn You Believe It?

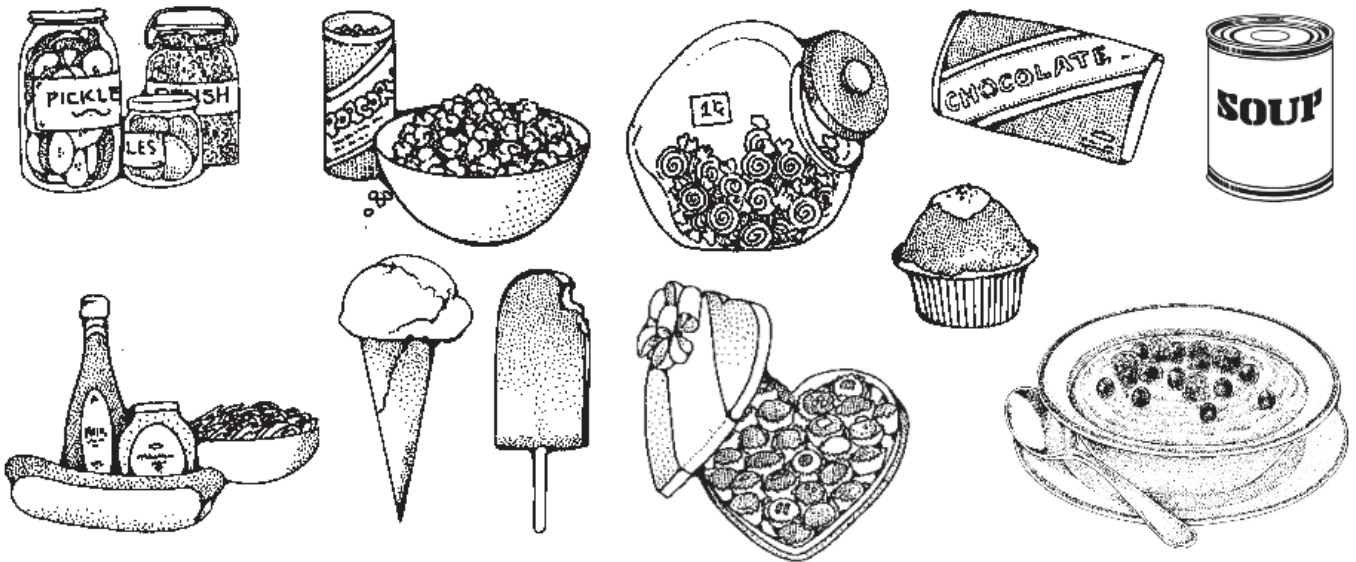
What do we get from corn?

### Looking for corn!

When you are at home or at the store, look at the labels of food items you eat. On a separate sheet of paper, list five food products that you found which have corn in them! Ask an adult to help you.

Look for these words: corn **starch**, dextrose, corn syrup, or corn gluten.

Nearly 60% of all corn grown in the U.S. is fed to livestock, but one out of every four food products in our grocery stores has corn in it!



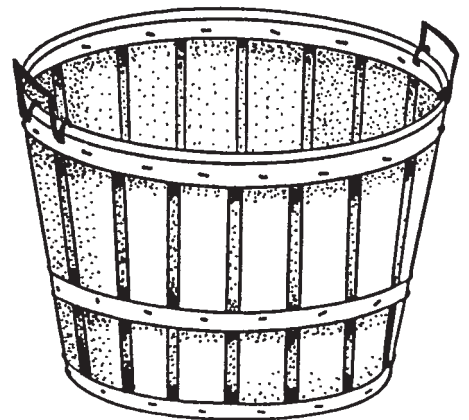
What is a **bushel**?

A **bushel** is the way farmers and producers measure corn, the same way quarts and gallons are used to measure milk.

The United States produces over eleven billion **bushels** of corn each year.

An average **bushel** weighs 56 pounds.

Sometimes the word "**bushel**" is used to describe a basket that hold a **bushel** of something.



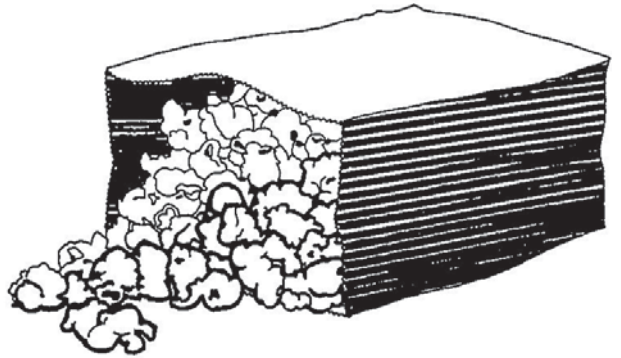
name \_\_\_\_\_

## Student Lesson: Corn You Believe It?

### Why does popcorn pop?

Each corn **kernel** has a tiny bit of water in it. We're already learned that the outer covering, the **peri-carp** is waterproof, Popcorn pops because the water inside the **kernel** can't get out and it expands (gets bigger) when heat changes the water into steam. Steam is a form of water that takes up more space than water does inside the **kernel**.

Have you ever eaten or made popcorn? Have you seen or heard it pop from a **kernel** into a fluffy snack?



Popcorn is a snack that's been around for a very long time. Popcorn is a different type of corn than the sweet corn you cook and eat for dinner. Some Native Americans popped corn by placing it near the fire. Today we use the microwave, a hot air popper, or a pan on the stove top.

The best way to complete this activity is to make popcorn! Describe, with a lot of details, what you see, hear, smell, taste and feel when you make popcorn and eat it. Use a separate sheet of paper if you need to.

I see \_\_\_\_\_

\_\_\_\_\_

I hear \_\_\_\_\_

\_\_\_\_\_

I smell \_\_\_\_\_

\_\_\_\_\_

I taste \_\_\_\_\_

\_\_\_\_\_

I feel \_\_\_\_\_

\_\_\_\_\_



## Student Lesson: Corn You Believe It?

**Ethanol**

What is **Ethanol**?

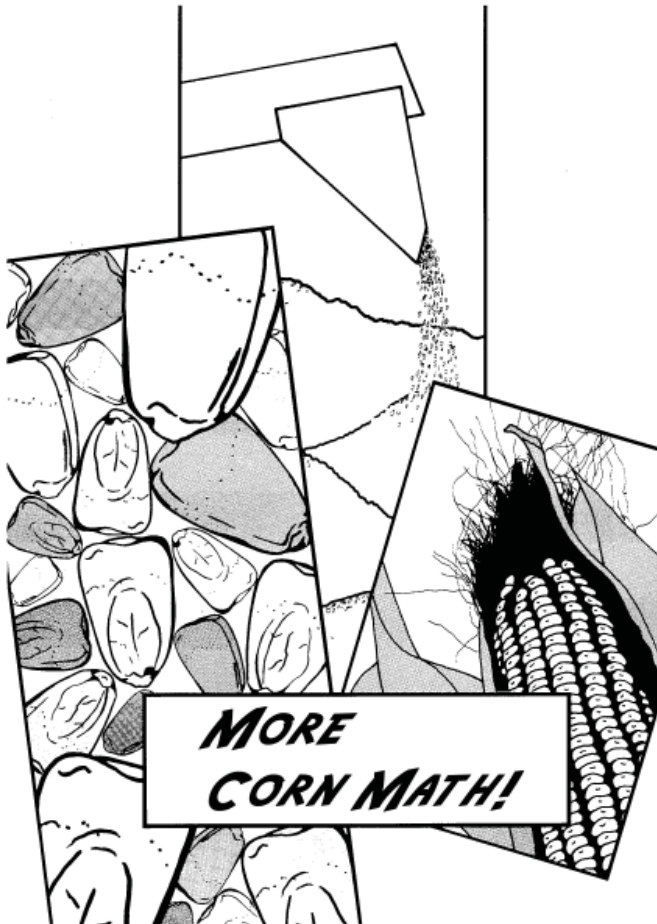
**Ethanol** is a kind of alcohol made from **grains** and **by-products** of the forestry industry. It is not the kind of alcohol used to clean cuts or to drink. It can be mixed with other fuels to make a new fuel for vehicles. **Ethanol** is said to be better for the air than fuels made from **petroleum**.

Some corn farmers are using their corn crop to make **ethanol**. It may be very good for our environment and reduce the use of **petroleum** products.

What do you think about using corn to make your family car run?

One **bushel** of corn (56 lbs) can make either:

- 31 lbs of corn **starch**
- 33 lbs of sweetener
- 2.8 gallons of **ethanol**



Iowa, Illinois and Nebraska grow a lot of corn. If you counted up all the **acres** of land used in each state you might be amazed. Remember, an **acre** is about the same size as a football field.

In one year:

Iowa grew corn on 12, 800,000 **acres**  
Illinois grew corn on 12,100,000 **acres**  
Nebraska grew corn on 8,500,000 **acres**  
New York grew corn on 990,000 **acres**.

1. How many more **acres** were grown in Illinois than in Nebraska?

\_\_\_\_\_

2. If New York grew 10 times as many **acres** next time, which state would it **surpass** (grow more than)?

\_\_\_\_\_

## Student Lesson: Corn You Believe It?

### How do farmers protect their corn crops?

Corn, like other vegetables, **grains** and fruits, is vulnerable to pests like diseases and insects. Plants can tolerate some pests if they are healthy and have good growing conditions. Farmers like to see both rainy days and sunny days during the summer.

Why might that be?

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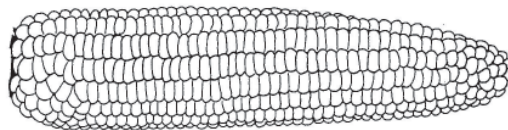
Corn plants can be attacked by insects such as corn borers, corn earworm, armyworms, corn rootworms, and black cutworms. Some insects eat the stalk, some chew on the leaves, and others prefer to feed on or live in the ear of corn.

Corn plants can also get diseases. Most of them are fungal disease. Fungus likes damp environments, so it is worse in cool, rainy weather.

Weeds compete with corn plants for soil nutrients. Weeds can also make insect and disease problems worse. They can interfere with harvesting.

Farmers use IPM (Integrated Pest Management) because it means thinking carefully about how to treat pest problems. The word **integrated** means using a combination of methods. Here are some ways farmers can reduce risks to their corn crops.

1. They can encourage beneficial insects that eat pests but not corn plants.
2. They can rotate their crops (use different fields every year or so) and clean up plant residue that might have pests and diseases on it.
3. They can use traps that collect or confuse insects, or use other physical barriers for diseases and weeds.
4. They can use pesticides, very carefully and only when necessary.
5. They can plant varieties of corn that are resistant to pests.



name \_\_\_\_\_

## Student Lesson: Corn You Believe it?

### Test Your Knowledge

True or False? (circle one)

1. Corn is a major crop in the **Midwest**. T      F
2. Corn is used to feed people and animals and is used in many products we buy. T      F
3. A corn **kernel** is not the same thing as a corn seed. T      F
4. Plants use **photosynthesis** to make their own food energy from the sun. T      F
5. Corn can be made into **ethanol** to fuel cars. T      F
6. The largest part of a corn **kernel** is the **endosperm**. It is where the E \_\_\_\_ Y is stored for the seed to use when it grows.
7. The number of rows on an ear of corn is always (circle one):  
  
    A. Odd  
  
    B. Even
8. Name two food items you might have at home that contain corn **by-products**.  
  
    A. \_\_\_\_\_  
  
    B. \_\_\_\_\_
9. On a separate sheet of paper:  
  
    A. Finish this sentence: "I learned that corn..."  
  
    B. Describe one way farmers use IPM to protect their corn crop.

## Student Lesson: Corn You Believe it?

### Vocabulary

**Acre** - a unit of land measurement (43,650 square feet) about the size of a football field

**Artifact** - a very old item, usually created by human hands, that tells us something about the past

**Bushel** - a unit of measurement for crops such as corn and wheat, or a basket that holds a **bushel** of something

**By-product** - a secondary product made from what is left over after the original use

**Carbohydrate** - an energy source made by plants, that can also become food energy for people and animals

**Cob** - another word for an ear of corn; the **cob** is where the corn seeds (**kernels**) form

**Complex** - not easy or **simple**, having many parts

**Endosperm** - the largest portion of the corn **kernel**; it is where the food energy is stored.

**Estimate** - to guess what something is or what will happen based on what you know

**Ethanol** - a chemical in the alcohol family, created from plant materials and used as a fuel

**Gene** - the basic unit, inherited from parents, that tells a cell or organism how to be, grow, or act

**Genetic** - having to do with **genes**

**Germ** - the part of a seed which directs how the seed grows (not the same as a **germ** that causes illness)

**Germinate** - the action of the seed **germ** starting to grow into a plant

**Grains** - the seeds of certain grass-like plants which provide food for animals and people

**Kernel** - another name for a seed; it is usually within a husk or shell.

**Maize** - a name for corn used by some Native American peoples

**Midwest** - the area in the center of the United States which is **generally** flat land and used for farming

**Pericarp** - the outer covering of the corn **kernel**

**Petroleum** - liquids, solids and gasses beneath the earth's crust, formed from ancient dead plants. Examples: gasoline, oil, and coal.

**Photosynthesis** - the process where plants use sun, water and nutrients to make their own food energy.

**Seed viability** - the ability of seeds to **germinate**

**Simple** - not difficult or not having a lot of details

**Starch** - a form of **carbohydrates** that provide long-term energy

**Surpass** - to go beyond what is expected or to exceed; to do better than something else or someone else

**Tip cap** - where the corn **kernel** is attached to the ear

*Integrated Pest Management is a specialized form of environmental management wherein scientific research and real world application work together to reduce pests such as insects, diseases or weeds.*

1. Proper identification of pests
2. Learn the pest/ host biology
3. Sample the environment for pests

4. Determine an action threshold
5. Choose the best tactic
6. Evaluate results

# Teacher Information for Student Worksheets

## Student Worksheet 1

How much do you know about corn?

Corn is a popular vegetable with students, but we still expect they'll learn something new about it. Discuss these questions in a group setting, so students may volunteer their answers.

## Student Worksheet 2

Corn is cool!

Corn, wheat and rice feed most of the world. The United States is a major producer of corn and wheat. Students may be surprised to find out that most corn becomes animal feed. After that, much of the corn crop becomes corn and corn **by-products**. Very little of the U.S. corn crop is the fresh, canned or frozen corn we see on our dinner tables.

Reinforce to students that corn, like other plants, begins as a seed. Most students do not think of grass as a plant with seeds, but corn is in the grass family. All seeds have the job of growing into a plant, and must have stored energy to do so. After all, plants cannot produce food through **photosynthesis** until they have some established leaves.

## Student Worksheet 3

Where does corn come from?

Corn has been a **grain** crop for indigenous peoples of the Americas for as long as we can tell. It can tolerate heat and drought, provides a good source of **carbohydrates** and stores well. The **Midwest** is the largest provider of corn in the world, and much of their crop is exported. Most corn becomes animal feed. You know your corn cereal is a corn product, but did you realize that your steak, eggs or bacon have also come to your table courtesy of corn?

## Student Worksheet 4

What is a **kernel**?

One little seed, lots of power! Discuss the parts of the corn **kernel** with students and ask them to look at a **kernel** of corn closer the next time they eat corn. They may think the **germ** is a funny name for part of a seed. Ask them if they have heard of the word **germinate**. What does that mean? If possible, supply students with a few **kernels** of corn, soft or dry. (Corn seeds are often treated with chemicals, to prevent fungus when planted - make sure any seed **kernels** you bring to the class are *untreated*).

## Student Worksheet 5

Label the **kernel**!

Students can review the names of the parts of a corn **kernel** by labeling the drawing.

The largest part of the **kernel** is the **endosperm**. This is the area where the corn seed stores its energy for the work of becoming a plant, in the form of **carbohydrates**. When we eat corn, we also get the use of that stored energy. Corn is considered a **starch**. When it is processed it can be made into a **starch** or a **sugar**. Much of corn's **carbohydrates** is made into corn sweeteners.

Answers (from top down)

**Pericarp**

**Endosperm**

**Germ**

**Tin Cap**

### Student Worksheet 6

#### Corny Math

Students can practice their multiplication skills and their fractions using corn **cobs**!

Answers:

16 rows x 50 **Kernels** = 800 **Kernels**

Fractions:  $1/2 = 3$  **cobs**,  $1/4 = 1$  **cob**,  $1/3 = 2$  **cobs**,  $1/2 = 2$  **cobs**,  $1/3 = 1$  **cob**

### Student Worksheet 7

How does corn grow?

Sweet corn and field corn are different varieties. There are over a hundred varieties of sweet corn alone! Ask students if they have ever helped to husk corn. Note that there is one silk for each **kernel** inside the ear. Why?

### Student Worksheet 8-A

What do we get from corn?

We have given you a link to an online list of corn products. This word puzzle contains a few of those items. Students may be able to do some research into how corn is used in these products. Corn **starch** is used in making tires. It is dusted onto the molds before the rubber is poured! Corn is used as a sweetener as much as or even more than cane sugar in modern food production.

### Student Worksheet 8-B

What do we get from corn: Looking for corn!

You can use this activity in class by bringing in multiple products and having students look at the labels. It is also a good homework assignment which can involve parents or other adult guardians. You may expand this activity by asking students to list as many products containing corn as they can find at home or at the store. Discuss the lists in class and ask students what they think is the most surprising use of a corn product they found.

### Student Worksheet 1

Why does popcorn pop?

We hope you can pop corn in your classroom for this activity. Perhaps you can arrange a trip to the school cafeteria or teachers' lounge. Another option is to have students imagine what they would experience when popping corn.

### Student Worksheet 11

#### **Ethanol**

This worksheet explains what **ethanol** is and how it can be used in our everyday lives. Students will be asked to complete a few math problems having to do with the amount of space allotted to corn in the country's biggest corn states.

Answers:

1.  $12,100 - 8,500 = 3,600,000$

2. It would be 10 x's NY production ( $10 \times 990,000 = 9,900,000$ ) to be more than Nebraska (8,500,000)

### Student Worksheet 12

How do farmers protect their corn crops?

Here is a review of what integrated pest management means. It is the process of thinking carefully about how we treat pests. When farmers, homeowners, gardeners and landscapers use a combination of tactics, they may be able to reduce the amount of pesticides they use to treat pests. Discuss with students the options available. There is a question in the review section relating to this section.

### Student Workseet 13

Test Your Knowlege

Answers:

1. T
2. T
3. F
4. T
5. T
6. ENERGY
7. Even
8. Answers may include cereal, cake mix, candy, granola bars, cookies, cola, corn chips, yogurt, ice cream, syrup, marshmallows, frosting, ketchup, fruit juices, cookies, gelatin
9. Answers will vary

### Student Worksheet 14

Vocabulary

Provided for student reference





