

FACT: Corn Plants are Fast-Growing & Efficient “Power” Plants

LESSON 1:	Tour a Power Plant	(Science)*
LESSON 2:	Plants With Personality	(Language Arts, Music, Dance, Art)*
LESSON 3:	You Can Count On Corn	(Math)*
LESSON 4:	Listen to A-Maizing Stories	(Social Studies)*

** All Lesson Plans are adaptable for ALL ages!*

CLAIRE PLAYS BASKETBALL

The basketball hoop was brand new and Claire was practicing her shooting. She could jump, turn and sink it every time. She could move from a dribble to the basket in a single motion. She could hit a freethrow three out of four times.

Her sixth grade class was coming to her farm the next day, and she needed to be ready. It was her chance to play the boys on her home turf. They didn't have a prayer. She just hoped there would be time for a game.

Her mom wanted to teach her classmates about corn. She was planning to take them into the field and talk about soil, insects and stuff like that.

Claire wondered if she should ask some of the kids to bring their own basketballs.

She practiced her vertical jump. “Not bad,” she thought. She'd had her mom measure her the night before. She'd been recording her height on a wall in the kitchen for 10 years. Once she'd grown an inch in three months. She was five feet five inches now, and she was only 12. That was already taller than her mom.

By the end of the year she hoped she'd be even taller. She didn't want to be as tall as some of the girls who played basketball on TV. She'd hit her head on doors and have a hard time finding clothes she liked. But she did want to play professionally. She was fast. She could jump high. She had a good eye and an accurate arm.

She wasn't very interested in agriculture. Her mom loved it though, so when her class studied Minnesota agriculture, Claire arranged a tour to her farm. She thought her friends would like the computer part of her mom's business. And the microscope part.

But when it was time to walk to the cornfield, Claire was going to nudge them towards the basketball hoop.

The next day Claire woke up feeling strong, limber and eager to beat the boys. She knew that hoop, and she was ready.

The school bus pulled into the yard, and 30 sixth graders jumped out. They looked at a worm under a microscope. They found their houses in satellite photos on the computer. They drank pop sweetened by corn syrup. Then they went out to the field.

This was her chance. She made sure they all saw the basketball hoop as they walked by. Excitement pumped in her blood.



They walked to a row of corn. The plants were four inches tall.

They used tape measures to count how many corn plants were in 1/1000 of an acre. They figured there were 1,200,000 plants in the field where they stood.

They each had a small trowel to dig up one plant. They saw the seed, the root, the new leaves.

“Okay, it’s time to play basketball,” said Claire. The kids started to run after her. “Wait,” said her mom. “I want each of you to learn at least three things about corn before you go.”

Claire didn’t want to be there. Instead, she could imagine her feet running across the court. She could feel the bounce in her arch, the soft pads cushioning her jump, her toes stretching as she reached for the sky.

“Let’s look at the roots. The first one that comes out of the seed only feeds the plant for a few days. Then the nodal roots take over. They find water and food. They go deeper and deeper. By the end of the summer, every plant can have 378 miles of roots in the soil.

Claire wanted to stretch her arms, and reach for the basket.

“The corn plant has 16-18 leaves when it’s mature. Those leaves unfurl from the center of the plant.” Claire’s mom showed them a small green spear rolled deep inside the very center of the stem. “This is called the growing point. All the rest of the leaves start here. Why do you think it’s so protected in the middle of the plant?”

Claire caught a pass and pulled it tight into her chest, guarding it until she could twist away into a run.

“If the weather turns cold early in the season, it’s warmer deep inside the plant. If there’s a hail storm, the outside leaves will be shredded, but the growing point will be safer.”

Claire could feel her heart beating faster. Her ribs were moving up and down as she breathed deeply into her lungs.

“As the weather warms up, the leaves unroll, and reach for the sun. The leaves angle upwards so plants can be side by side, very close to each other, and the sun can still reach their surface. They absorb sunlight and help the plant manufacture sugars.”

Claire’s stomach began to growl. She was impatient.

“Does anyone know that a corn plant can grow over six feet six inches tall?”

Claire stared at her mom. Six feet six inches. That’s Michael Jordan’s height. What was her mom talking about?

“The corn is only four inches tall today. By the middle of July, 70 days from now, it could be seven feet tall. Corn can grow more than an inch a day.”

Claire looked at the little plants around her. There were more than a million plants, and in a couple of months they’d be as tall as Michael Jordan. In 70 days she might be one inch taller, if she was lucky.

She couldn’t believe her ears.



“When the plant stops growing taller, it starts putting all its energy into production of an ear. The ear gets food from the leaves and the roots. It grows kernels. There is always an even number of rows of kernels around the ear, usually 14-16. The ears average 40-50 kernels long.”

Claire kept score. A million plants, and each one with more than 560 kernels. She had held those ripe ears of corn. Some had bright orange kernels, some were more yellow. She loved to play a game shelling one kernel off at a time. One. Two. Three. Four.

Time was going fast. She looked at her mom. She looked at the field. Five. Six. Seven. Eight. She could imagine these small plants growing before her eyes. Taller. Taller. Taller. Reaching the top of the hoop.

Her mom winked at her. “Come on,” shouted Claire. “Let’s play basketball!”



LESSON 1: TOUR A POWER PLANT

SUBJECT: Science

OBJECTIVE: Students will learn the parts of the corn plant, and will be introduced to photosynthesis.

EVALUATION: Students will know that corn is a fast-growing, efficient “power” plant!

BACKGROUND FOR TEACHERS:

The corn plant is one of nature’s most amazing energy-storing machines, a true “power” plant! It begins as a tiny seed weighing about one-hundredth of an ounce. In less than 10 weeks it grows into a plant seven to 10 feet tall! Then, in the next two months, it produces 500 to 1000 seeds similar to the one from which it started.

It does this by building a large, efficient energy “factory,” a factory built of roots, leaves, stalks, and flowering parts. Think of a cornfield as a manufacturing community, with up to 35,000 factories per acre!

The raw materials are water, minerals from the soil, and carbon dioxide from the air. The power is sunlight. It runs the machinery that turns these raw materials into useful products. The process is called photosynthesis. It is a chemical reaction in which water + light + organic compounds (such as carbon dioxide) = organic compounds (such as sugar) + oxygen.

The products are kernels of stored energy. They consist of combinations of carbohydrates, proteins, oils and minerals. See [Units 6, 7, and 9](#) for more information on the diversity of products!

STUDENT ACTIVITIES:

1. Ask students to read the story [Claire Plays Basketball](#), then ask them to share at least three things they have learned about corn plants. (For example: The corn plant has 16-18 leaves when it is mature. The growing point is protected inside the whorl of leaves when the plant is young. The leaves angle upwards so they can absorb sunlight and help the plant manufacture sugar. Corn plants can grow taller than six feet, six inches. The ear always has an even number of rows, usually 14-16. There are usually 40-50 kernels in every row.)
2. Identify the parts of the corn plant in the worksheets. (Worksheet 1, 2, 3)
3. Encourage older students to dissect actual corn plants, as illustrated. (Worksheet 4)
4. This handout has detailed information on photosynthesis. Younger students will enjoy coloring the picture. Use the arrows to point out which factors go into corn (carbon dioxide + water + sunlight) and which products (oxygen + sugars or cellulose) are made by corn. (Worksheet 5)
 - Older students can begin to appreciate the fact that, through the process of photosynthesis, corn is able to remove carbon dioxide, a pollutant, from the air, and replace it with oxygen, which we need to live. More information on this, particularly on ethanol, is available in [Unit 7, Lessons 1, 2, and 3](#).



5. Encourage students to complete other activities related to corn anatomy! Corn roots are diagramed and studied in Unit 2, Lesson 2. Corn kernels are dissected and studied in Unit 9, Lesson 2.



Can you identify the parts of a full size corn plant?

Draw a line from each named part of the corn plant listed below to the appropriate part of the corn plant pictured at right.

- Ear
- Leaf
- Brace Roots
- Silk
- Soil Level
- Tassel
- Nodal Roots
- Stalk



Can you identify the parts of a corn seedling (ankle high)?

Radicle

Coleoptile sheath

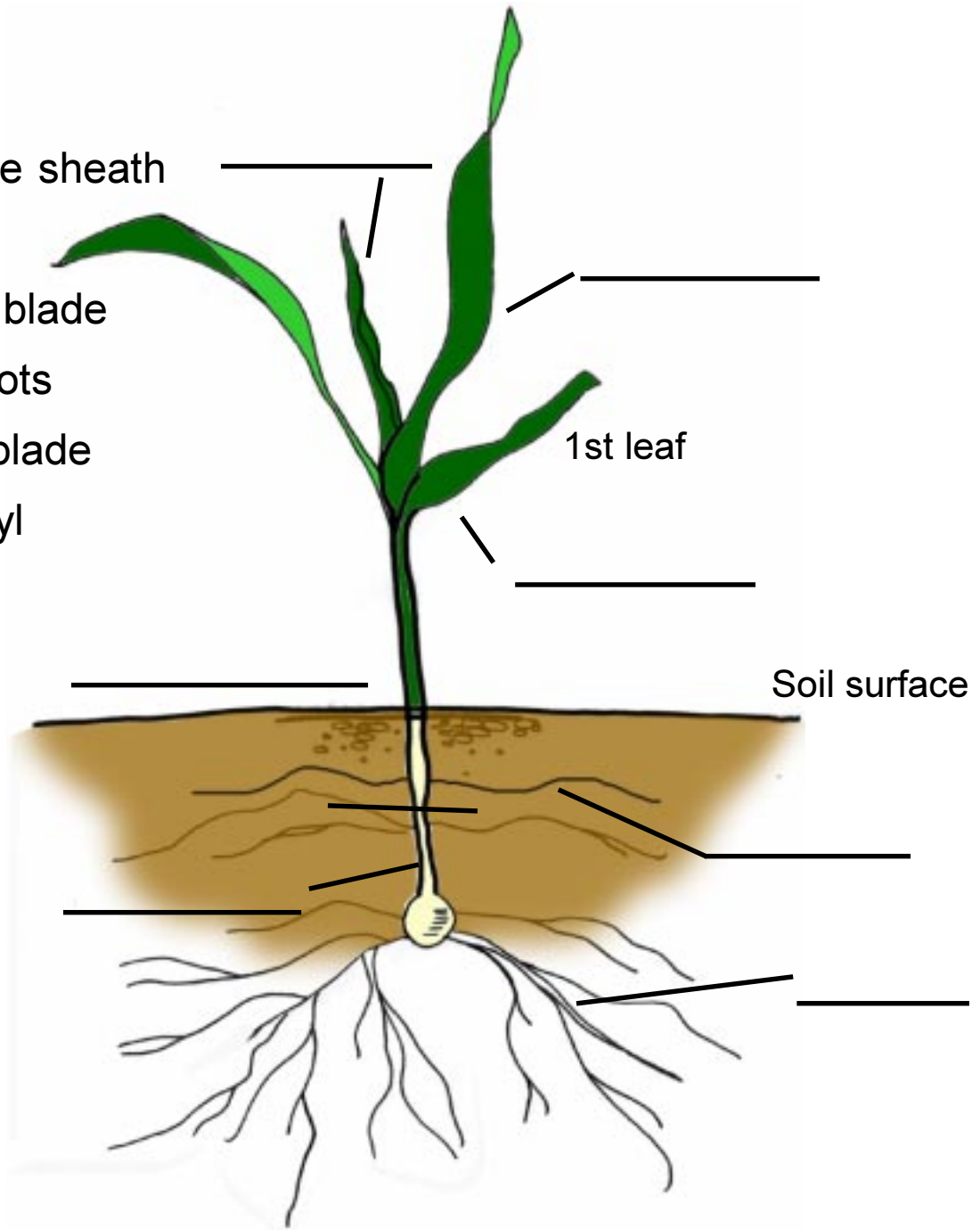
Whorl

2nd leaf blade

Nodal roots

1st leaf blade

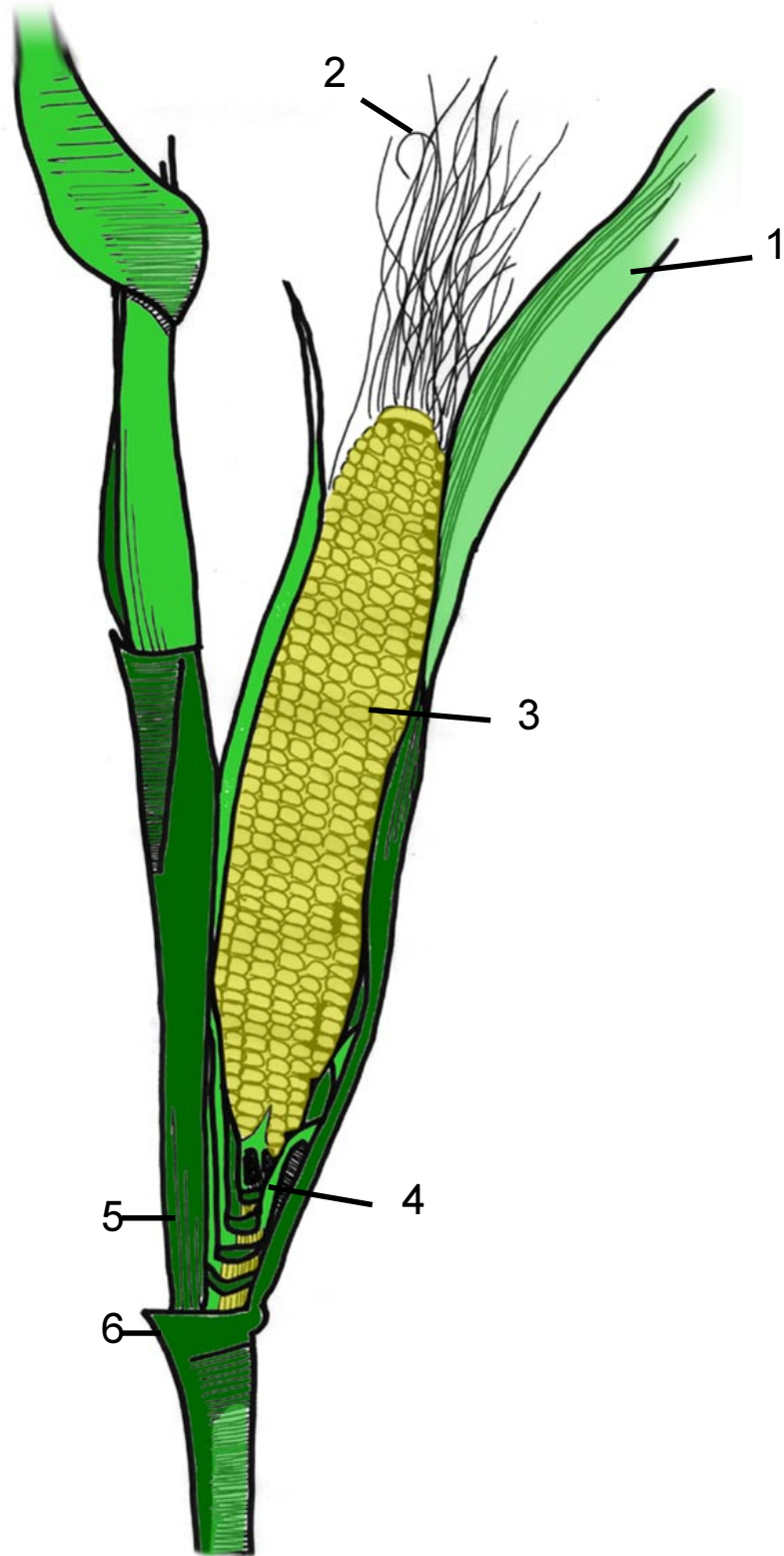
Mesocotyl



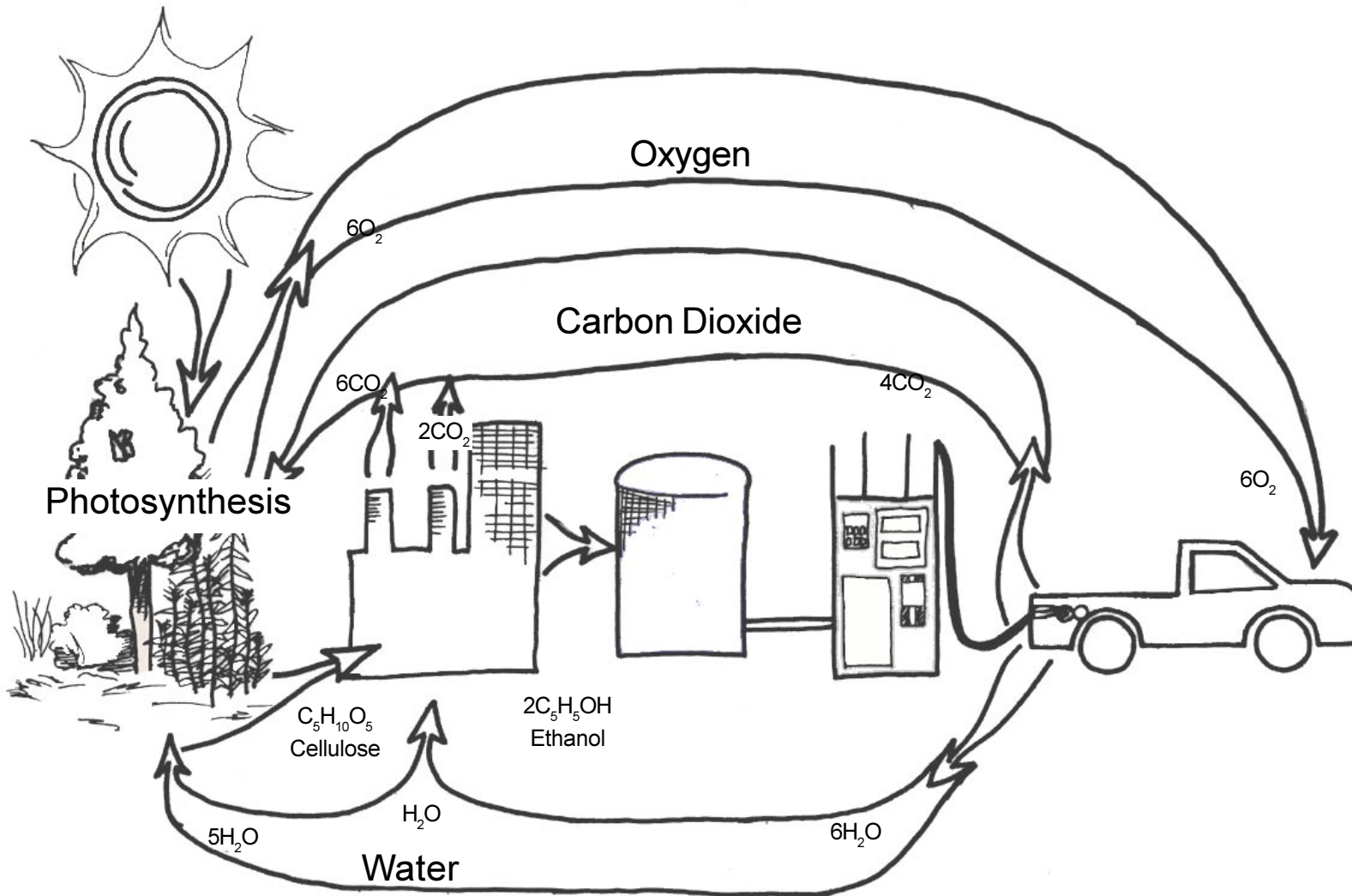
Can you identify the parts of a corn ear?

- Silks
- Ear leaf
- Stem
- Kernels
- Ear node
- Husks

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____
- 6. _____



Carbon Dioxide Recycled With Ethanol Fuel



LESSON 2: CORN WITH A PERSONALITY

- SUBJECT:** Language Arts, Music, Dance, Art
- OBJECTIVE:** Students will appreciate the beauty, strength and complexity of corn plants, and their own bodies.
- EVALUATION:** Students will be able to imagine, and express, new connections between themselves and corn plants. The way they see a corn plant will be changed forever, and they will be able to express it.

BACKGROUND FOR TEACHERS:

In this excerpt from “Hiawatha’s Fasting” in The Song of Hiawatha, by Henry Wadsworth Longfellow, a corn plant (maize) is given “robes” and “soft, yellow tresses.”

“Till at length a small green feather
 From the earth shot slowly upward,
 Then another and another
 And before the Summer ended
 Stood the maize in all its beauty,
 With its shining robes about it,
 And its long, soft yellow tresses;
 And in rapture Hiawatha
 Cried aloud, “It is Mondamin!
 Yes, the friend of man, Mondamin!”

In the story Claire Plays Basketball, Claire makes connections between corn leaves and her arms reaching to the sky, between corn roots and her feet racing across a basketball court. As she learned about the growing point of corn deep inside the whorl of leaves, she thought of her own heart protected by her ribs. Her stomach growled when she thought about the plant manufacturing sugar. Her ears perked up at the discussion of corn ears.

STUDENT ACTIVITIES:

1. Ask students to read the story, Claire Plays Basketball then read the poem from the Song of Hiawatha. See if they can point out the connections that Claire makes between the corn plants and her own body. (See examples listed above.)
2. Show students photographs of corn that illustrate the plant’s beauty, strength or complexity. (Example 1) Use these pictures or make an activity for students to search out pictures of corn in magazines or other sources. Then ask students to complete one or more of the following activities.

- Create a song or dance illustrating the emergence of a seed, and that seed growing into a tall plant.
 - Draw or paint a corn plant—personified. (For example, they could draw an ear of corn as a girl with “soft-yellow tresses” or a corn plant as a basketball player with roots instead of feet...)
 - Write a poem in which they compare their body to a corn plant.
 - Write a story in which they ARE the growing point, or the root, or the leaf, and ask them to describe how the air feels, the soil feels, what sounds they hear, if they feel safe or frightened, whatever they are experiencing. This could be acted out, or danced as well.
 - Imagine how it feels to live inches away from the same corn plants your entire life, then write a play about the experience. Draw your “neighborhood.”
 - Create a cartoon character, in which a corn plant becomes a person.
3. If possible, take students to a cornfield, and let their imaginations run wild! If that’s not possible, bring a corn plant to the classroom. Or grow one! Anything that students can touch and feel will enhance this lesson.



The Beauty of Corn



LESSON 3: YOU CAN COUNT ON CORN

SUBJECT: Math

OBJECTIVE: Students will practice mathematical concepts using corn kernels, plants, and fields by:

- Counting the numbers of rows on an ear.
- Counting the number of kernels in a row.
- Comparing the sizes of fields by number of acres.
- Learning the dimensions of acres in feet.
- Converting miles into feet and vice versa.
- Calculating the number of square feet in an acre.
- Calculating the number of kernels in an acre.
- Learning how to count the number of ears in 1/1000 of an acre.
- Learning to use a yield-calculation formula.
- Estimating corn yields in several hypothetical fields.

EVALUATION: Students understand the mathematical concepts taught on these worksheets. Using these real-life examples make the concepts more understandable.

BACKGROUND FOR TEACHERS:

The amount of corn produced in a field is called its “yield.” The number of kernels determines the yield. A high yield results from many kernels on every ear AND many ears in a field. There can be many ears, but if the weather was bad during pollination there won’t be many kernels on each ear, resulting in a poor yield.

Ears can be very big, with many kernels. But if there aren’t enough plants (a corn plant normally produces one ear per plant) yields will still be low. Planter problems, seed problems, insects, diseases or poor weather can all cause low yields by reducing the number of plants or ears in an acre.

If you know the number of kernels on an ear, and the number of ears, it’s easy to calculate the number of kernels in an acre. If you know the number of kernels in a bushel, it’s easy to calculate the number of bushels in an acre.

Corn prices are set on a per bushel basis. Therefore, the number of bushels produced affects a farmer’s profitability. He or she can measure the yield during harvest by using a yield monitor connected to a GPS unit (see [Unit 5](#)), or can wait to measure it after storing the corn in a grain elevator, or after selling it.

But because the best prices are often before harvest, a farmer might want to predict or ESTIMATE how much corn is in a field before harvest begins. Then they use a yield calculation formula that calculates the number of kernels per acre, then divides by the average number of kernels in a bushel of corn (source: DeKalb Genetics Company):

1. Walk into the field a set number of paces. Establishing a predetermined pattern eliminates the natural tendency to stop where the crop appears to be better than average.



- Measure 1/1000 acre and count the number of ears. The length of the row to measure for 1/1000 acre depends on your row spacing, as shown below. Do not count ears that have only a few scattered kernels because these won't contribute to yield.

Row Width	15	20	22	30	36	38
Row Length	34'10"	26'2"	23'8"	17'5"	14'6"	13'9"

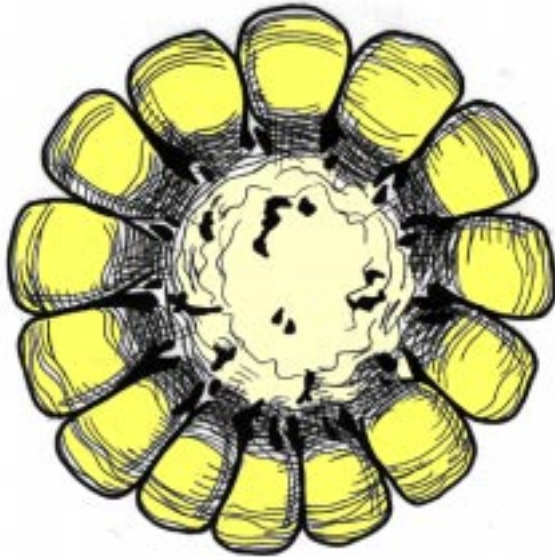
- Sample three ears from the measured row length. To avoid any sampling bias, take the third, sixth and tenth ears. Do not sample ears that were not included in the ear count.
- Count the kernel rows and average number of kernels/row on each ear. Do not count tip kernels less than half size. Multiply the number of kernel rows by the kernels/row to get kernels/ear.
- Estimate bushel per acre yield by: $(\text{number of ears} \times \text{average number of kernels per ear}) \div 90$
- The 90 in this formula comes from the fact that a bushel of corn roughly contains about 90,000 kernels. We drop the 1,000s because we've counted the ears in 1/1,000 of an acre. If kernel size is unusually large or small, adjust the 90 to reflect this.
- You will get a more reliable estimate of yield if you repeat steps 1 to 5 for each 10 acres in the field. You have to sample representative ears to get a reasonable estimate of yield. Selective sampling of ears or kernel sizes that vary markedly from normal will cause these yield estimates to significantly differ from actual yield.

STUDENT ACTIVITIES:

- Ask students to read the story [Claire Plays Basketball](#). Tell them to pay close attention to the paragraph in which Claire and her friends use tape measures to count the number of corn plants, and also the paragraph in which they learn how many rows and kernels of corn there are in an average ear.
- Then ask students to complete Worksheet 1, 2 and 3.



Count the kernels on a cob



Count the number of rows
(kernels around the cob)

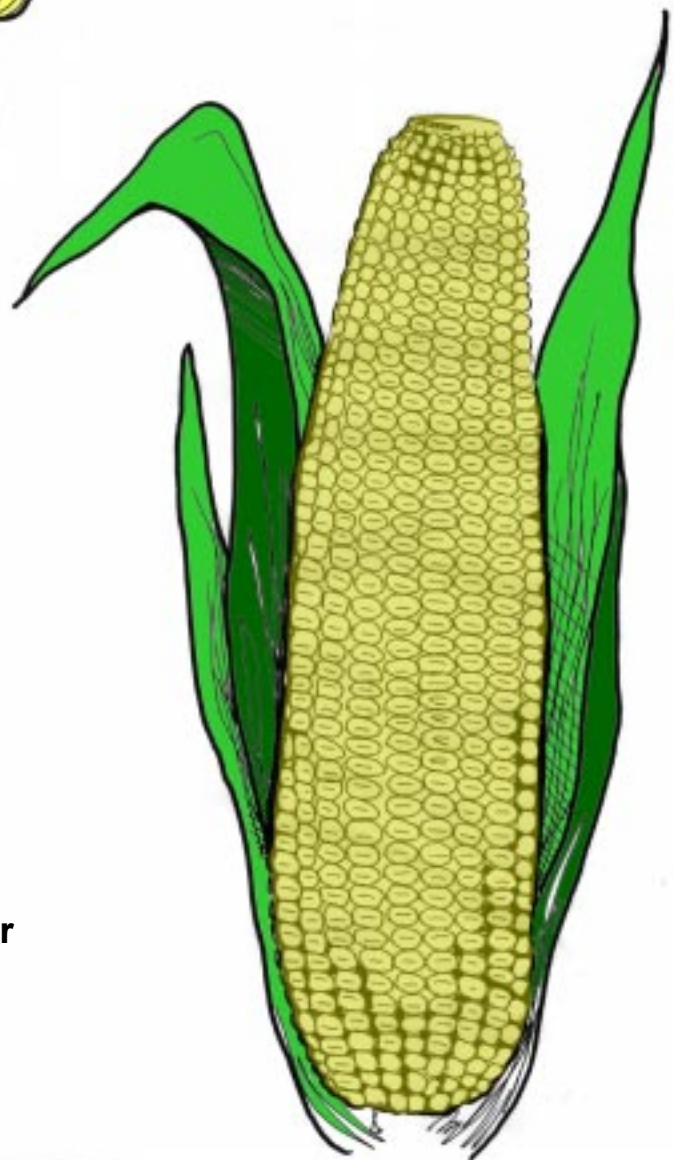
answer: _____

Count the number of kernels
per row

answer: _____

Older students: Total number
of kernels on the cob

answer: _____



You can count on corn!

1. You're a farmer using the yield calculation formula. You counted 30,000 ears over an entire acre. On the three ears you counted there were an average of 14 rows, with an average of 48 kernels per row. How many kernels per acre are there? _____

2. You tried narrow-row corn on your best farm. The rows were spaced 20" apart. How many feet should you measure when you're trying to count the number of ears in 1/1000 of an acre? _____

3. On that farm you took several counts to determine the average number of ears. Those results were 26, 32, 30, 25, 34, 28 and 29 ears per 1/1000 of an acre. What was the average number of ears? _____

4. This time you measured 1/1000 of an acre in five locations, and counted an average of 30 ears in each location. As in the first question, the ear size averaged 14 rows, with 48 kernels per row. How many bushels per acre do you estimate?

5. The field you rent by town was very dry during corn pollination, so you're not expecting the yields to be high. When you count ears in 1/1000 of an acre you get the following numbers: 22, 28, 25. The average ear size was small: 38 kernels per row, with 12 rows. What is your estimate of the yield? _____

6. It was rainy early in the season, and you weren't able to get enough nitrogen applied to one of your fields. The populations and number of ears were very good (30 + 32 + 34) but the ears were small (40 + 36 + 38 kernels long and 14 + 10 + 12 rows around). What is your estimate of the yield? _____

7. You used the yield calculation formula every 10 acres in a 40 acre field. Your yield estimates were 190 bushels/acre, 182 bushels/acre, 168 bushels/acre, and 176 bushels/acre. What do you estimate the yield for the entire field to be? _____



How many acres?

Diagram shows 320 Acres

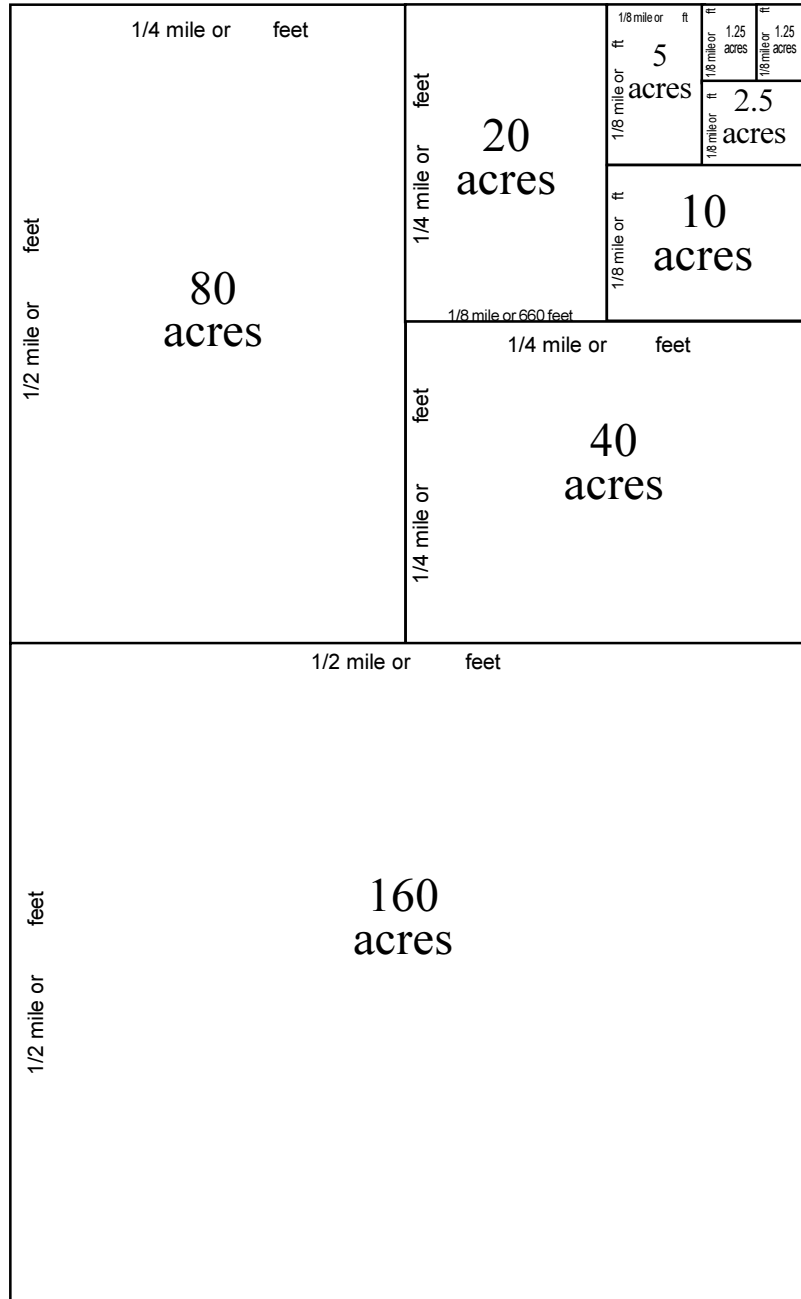
1. Compare the sizes of the fields. Draw what you think is one acre. Then, complete the acreage or dimension questions.

2. 10 acres = _____ feet
 x _____ feet
 = _____ square ft.

3. 1 acre = _____ sq. ft.
 (660 ft long x 66 feet wide)

4. EXTRA CREDIT:
 Measure the school grounds or football field in feet and calculate what part of an acre, or how many acres it is.

5. Bonus question: How far did a farmer walk behind his horse in one day 70 years ago in order to plow two acres?
 (2 acres = 87,120 feet = 16.5 miles)



LESSON 4: LISTEN TO A-MAIZING STORIES

- SUBJECT:** Social Studies
- OBJECTIVE:** Students will gain insights about corn, and about the people who raise it.
- EVALUATION:** Students appreciate this amazing plant even more, because they have seen or heard some first-hand stories.

BACKGROUND FOR TEACHERS:

No two corn farmers are alike. The way they raise corn depends on their location in the country. That location affects the average temperature and precipitation. It affects the soil type, as well the insect and disease pressures. It affects the uses and profitability of corn.

Within a region, philosophies and management styles also differ greatly. But all farmers have a solid appreciation for what an “a-maizing” plant corn is, and they ALL have stories to tell about it!

STUDENT ACTIVITIES:

1. Ask students to read the story Claire Plays Basketball, then invite one or more corn farmers to visit your class. Ask them to bring some corn plants or kernels, and to tell stories that can “a-maize the students. If they’re unable to visit the classroom, maybe they will write some memories in a letter:
 - *Stories of storms, insects, or other stresses on corn plants and how the plants survived, or didn’t.*
 - *Stories about the size and quick growth of corn plants, or about high and low yields.*
 - *Stories about how corn plants have changed since they first started farming.*
 - *Stories of what jobs they need to do when corn is at certain sizes, and how they know what to do.*

2. Or read about several farm families on the Internet, and discuss what they might tell you if they were in your classroom.