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# Kansas Corn: Explore Corn

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This lab is made possible with the support and content contributions of the Kansas Corn Commission.



# Kansas Corn: Explore Corn

## Grade Level: Middle School and High School

### Overview

Corn is a vital part of the Kansas economy and landscape. Understanding how corn is planted, grown, and harvested helps students comprehend the importance of this crop to the Midwest. As cities grow, many people move away from an agricultural understanding, even though it is essential to their lives. In this activity, students will get a background in the origins of corn, as well as the growth process for a single corn plant. Students will also get the chance to dissect a corn plant.

### Kansas College and Career Ready Standards

#### Science

- **LS1-5.** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
- **LS 3-2.** Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
- **ESS3-2.** Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

#### Language Arts

- **RI.3.1.** Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
- **RI.3.7.** Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).
- **W.3.2.** Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
- **SL.3.1.** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on Grade 3 topics and texts, building on others' ideas and expressing their own clearly.

### Learning Objectives

- Students will understand and be able to identify corn in various stages of growth.
- Students will identify different types of corn.
- Students will understand how corn goes from the vegetative to reproductive stage.

### Materials

- Explore Corn PowerPoint (available online at [kansascornstem.com](http://kansascornstem.com))
- Computer and internet access
- Student copies of *Explore Corn* article (pg. S1, or at [kansascornstem.com](http://kansascornstem.com))
- Corn Staging Student Worksheet (pg. S2-S4, or at [kansascornstem.com](http://kansascornstem.com))
- The Many Uses of Corn poster (optional; available at [kansascornstem.com](http://kansascornstem.com))

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### *Materials for Explore an Ear of Corn:*

- Explore an Ear of Corn Student Worksheet (pg. S5-S6, or at [kansascornstem.com](http://kansascornstem.com))
- Explore an Ear of Corn Labeling Answer Key (pg. T9)
- Ear of dried corn
- Corn plant pulled from field, including ear
- Bushel of corn
- Electronic scale
- Cutting board

### *Materials for Leaf Collar Method:*

- Leaf Collar Method Student Worksheet (pg. S7-S9, or at [kansascornstem.com](http://kansascornstem.com))
- 5 knives (such as a box knife or razor blade)
- 5 cutting boards
- 5 ears of dried corn
- 5 fully developed corn plants (grown in a greenhouse if not available from a field)
- 5 electronic scales

### **Safety Considerations**

Students will be using a cutting utensil with a sharp edge to cut the corn. Show proper handling of the cutting utensil.

### **Procedures for Instruction**

Length of Time for Preparation: 30 minutes

Length of Time for Classroom Teaching: 1.5 hours

### *Preparation Procedure/Instructions:*

Students will be doing three lessons, all centered around the background knowledge below.

Complete this unit's lessons in the following order:

- Lesson 1: Explore Corn: Corn Staging
  - Researching corn growth stages and corn history
- Lesson 2: Explore an Ear of Corn
  - Corn plant dissection
- Lesson 3: Leaf Collar Method

# Kansas Corn: Explore Corn

## Grade Level: Middle School and High School

### Background Information

Why is corn a valuable crop? How does corn grow, pollinate, and produce kernels? What farming techniques are important to increase corn yield?

Corn is a grass, native to the Americas. Evidence in central Mexico suggests corn was used there about 7,000 years ago. Various Native American tribes shared their knowledge of corn, also known as maize, with early European settlers, saving many from starvation. Early American colonists ground dried corn as meal for flour to use in porridge, cake, and bread. Sweet corn, served as “corn on the cob,” was not developed until the 1700s.

Along with wheat and rice, corn is one of the world’s major grain crops. It is the largest grain crop grown in the United States. About 9% of all the corn is used to produce food for humans: corn meal, cooking oils, margarine, corn syrups, and sweeteners (fructose). About 64% of all corn is used as feed for livestock. Corn is harvested for either grain or silage, with most of the grain going to dairies, animal feeding operations, and poultry operations. Corncobs have been used in the manufacturing of nylon fibers, as well as being a source for producing degradable plastics. Ethanol, made from corn, is a renewable fuel used in today’s cars.

Corn is pollinated by wind and is typically planted in 30-inch rows. A single seed, or kernel, of corn may produce a plant that yields more than 600 kernels of corn per ear. Approximately 22,000 to 35,000 individual plants may be grown on an acre of land. Hybrid corn is developed to produce from one to two ears per plant. More than 80 million acres of the heartland are planted in corn each year. That’s almost as big as 60 million football fields! After the corn is harvested, the farmer begins to prepare the soil for the next season by mixing in nutrients, such as potassium and phosphorus, with some form of tillage (breaking up soil) to incorporate them. In the spring, the farmer will do a light tillage pass to create smooth bedding for planting. When the ground temperature is ready (50°F and expected to rise), the farmer will plant the corn seeds. The farmer will then add fertilizer, two inches deep and two inches to the side of the kernels, to help the seeds get a healthy start. After the seed is planted, most farmers will spray a pre-emergent herbicide to prohibit weed growth. When seedlings emerge and grow, the farmer will inject the soil with some form of nitrogen fertilizer before the V8 (eighth leaf development) stage. This spring fertilizer will allow for the plant to “green-up” and establish good photosynthetic activity through harvest. The farmer will continue to scout the crop through maturity for any additional pests. The farmer will harvest the crop when it is ripe in the fall.

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### Classroom Discussion

Begin by using these classroom discussion questions to find out what students already know (or think they know) about corn and where it is grown. This discussion can be done with the entire class, small groups, or as “bellwork”.

- Where is corn grown? Why is it grown there?
- How is corn grown?
- What are the stages of corn growth?
- When can you harvest corn?
- How many ears of corn are there on one stalk?
- What types of corn are there?

Once the discussion is finished, hand each student the *Explore Corn* article (pg. S1, or at [kansascornstem.com](http://kansascornstem.com)), and read it. Encourage students to highlight important portions they would like to explore more. By the end of the article, students should be able to answer the following:

- What are three uses for corn?
  - Possible answers: human consumption, livestock feed, ethanol, nylon fibers, and plastics. Can use *The Uses of Corn* poster to help with discussion.
- How long has corn been around?
  - Possible answers: 7,000 years from Central Mexico or sweet corn developed in 1700s.
- How many kernels are on a corn ear? How many plants can grow on one acre?
  - Answers: 600 kernels on one ear and 22,000 to 35,000 plants per acre.
- Teacher could have students summarize what they learned about the history and origin of corn.
- Student could research the differences between corn, such as dent, sweet, flint/popcorn, and flour/soft.

### Lesson 1: Explore Corn – Corn Staging (30 minutes)

#### Procedure for Lesson

- Pass out a copy of the Corn Staging Student Worksheet (pg. S2-S4, or at [kansascornstem.com](http://kansascornstem.com)).
  - Students will need internet access to visit the DuPont Pioneer websites. The websites will be used as a resource to complete the Corn Staging Student Worksheet. Students will read about and explore the different stages of corn growth while completing the worksheet.
  - Think of this as a pre-lab so students understand different stage of life of corn.

### Lesson 2: Explore an Ear of Corn (30 minutes)

- Students will break into five groups. Students should closely follow the instructions on the Explore an Ear of Corn Student Worksheet (pg. S5-S6, or at [kansascornstem.com](http://kansascornstem.com)).
- At the end of this activity, regrouping the class to review can be helpful.

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### Lesson 2 (continued)

#### *Procedure for Lesson*

1. Hand out an ear of corn and corn plant. Identify the following terms on the blank corn diagram on the *Explore an Ear of Corn Student Worksheet*: roots, stalk, ear, kernel, silks, tassels, husk, and shank.
  - Use the following website to identify the parts of a corn plant: [http://www.nebraskacorn.org/wp-content/uploads/2010/07/unit1\\_TeachersKey.pdf](http://www.nebraskacorn.org/wp-content/uploads/2010/07/unit1_TeachersKey.pdf)
2. What growth stage is it in? V (vegetative), VT (tasseling), or R (reproductive)?
3. If there are kernels on the cob, what reproductive stage is it in?
4. Lift the bushel, how much does it weigh?
5. Pop off kernels. How much does a kernel weigh?
6. How many kernels are there in a bushel?

#### *Questions*

- What are some things that may have altered these ears (pests, drought, water)?
- What stage are they in (vegetative or reproductive)? Can you go into more detail about the stage?
- Explore your ear – how many rows, how many kernels per row, how many kernels per ear?

### Lesson 3: Leaf Collar Method (30 minutes)

- Students will break back out into five groups for the Leaf Collar Method activity. Students will be working with cutting utensils for this portion. Have students closely follow the instructions on their Leaf Collar Method Student Worksheet (pg. S7-S9, or at [kansascornstem.com](http://kansascornstem.com)).
- Regroup the class at the end of this activity to talk through answers to questions.

#### *Procedure for Lesson*

1. Hand out the Leaf Collar Method Student Worksheet. Have student follow the instructions on the sheet.
2. Use a knife and cutting board to carefully split the stalk of a corn plant in half, vertically, down to the roots.
3. Remembering that the first four nodes are often indistinguishable within the crown, count the number of nodes to determine the vegetative stage that the corn plant is in.
4. Compare the nodes counted within the stalk to the number of leaf collars found on the outside of the plant.

#### *Reflection*

1. Why is it necessary to split the stalk to accurately determine what vegetative stage the corn plant is in?
2. How do the internal nodes compare to the external leaf collars found in/on the plant?
3. How can determining the vegetative stage of the corn plant help the farmer determine when to input fertilizers and predict the ear length?

# Kansas Corn: Explore Corn

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### Reflection and Conclusion

Students should be able to identify the nodes on the plant and be able to talk about what growing stage the plant is in. Use this to talk about the advantage of understanding what is needed to bring this plant to full growth and when we can apply different nutrients and pesticides/herbicides/fungicides.

### Assessments

Before leaving class, one way to evaluate content knowledge is to create an “Exit Ticket”. Students respond to these questions before leaving class (answers are listed in bullet points):

1. What are four major stages of growth for a corn plant?
  - VE, VT, R1, R3
2. What are two uses for corn?
  - Livestock feed, ethanol
3. How long is it thought corn has been around?
  - 7,000 years
4. How many kernels are on a corn ear? How many plants can grow on one acre?
  - 600 kernels per ear, 22,000 to 35,000 plants per acre
5. What can the Leaf Collar Method tell us about a corn plant? What stage of life it is currently in?
  - Answers will vary depending on stage of corn plant
6. What are some things that can impact corn growth?
  - Pests, drought, water

### Science and Agriculture Careers

- Climatologist
- Agronomist
- Biologist
- Geneticist

To learn more about agriculture careers visit [agexplorer.com](http://agexplorer.com). You can also find career profiles at [kansascornstem.com](http://kansascornstem.com).

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### Sources

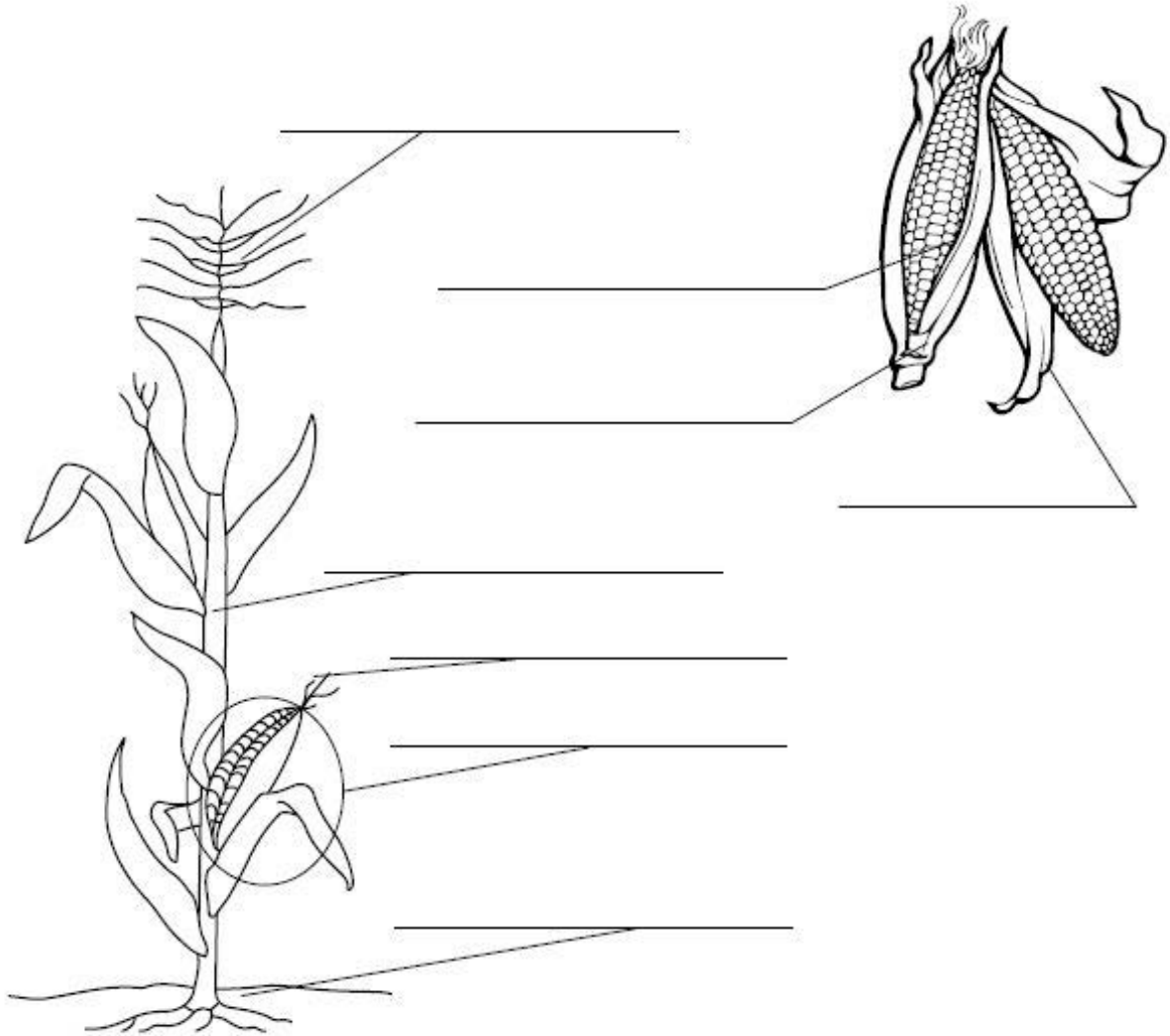
- Resources adapted with permission from Ohio Corn and Wheat – <http://ohiocorneducation.org/>
- Growing Kansas Article – <http://ohiocorneducation.org/curriculum/growing-ohio>
- Explore Ear of Corn Diagram and Key – [http://www.nebraskacorn.org/wp-content/uploads/2010/07/unit1\\_TeachersKey.pdf](http://www.nebraskacorn.org/wp-content/uploads/2010/07/unit1_TeachersKey.pdf)
- Dupont Pioneer Overview of Stages of Corn Growth – [Tinyurl.com/cornstages](http://Tinyurl.com/cornstages)
- Dupont Pioneer Vegetative Stages of Corn Growth – [Tinyurl.com/vegetativestages](http://Tinyurl.com/vegetativestages)
- Dupont Pioneer Reproductive Stages of Corn Growth – [Tinyurl.com/reproductivestages](http://Tinyurl.com/reproductivestages)

Any educator electing to perform demonstrations is expected to follow *NSTA Minimum Safety Practices and Regulations for Demonstrations, Experiments, and Workshops*, which are available at <http://static.nsta.org/pdfs/MinimumSafetyPracticesAndRegulations.pdf>, as well as all school policies and rules and all state and federal laws, regulations, codes and professional standards. Educators are under a duty of care to make laboratories and demonstrations in and out of the classroom as safe as possible. If in doubt, do not perform the demonstrations.



## Explore an Ear of Corn Labeling Answer Key

Label the images below:



### Reflection

1. Name the parts of a corn plant.
2. What new knowledge do you have about the corn plant? List at least five things.

### Answer key

Answers, from top to bottom:  
tassels, kernel, shank, husk, stalk,  
silks, ear, root

## Explore Corn

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## Corn Staging Student Worksheet

Name: \_\_\_\_\_

Group: \_\_\_\_\_

How does corn go from the vegetative to reproductive stage?

- From under the ground (germination) to the first stage (VE), as shown in the picture below.

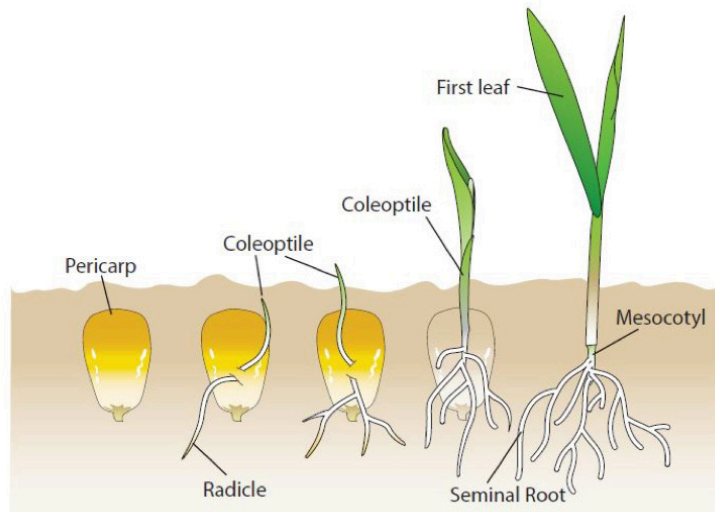


Photo provided by Dr. Ciampitti, KSUCROPS Team, K-State Agronomy and Bob Holcombe, K-State Communications

### Corn Staging:

Visit the DuPont Pioneer website ([tinyurl.com/cornstages](http://tinyurl.com/cornstages)). Fill in the grid describing the vegetative and reproductive stages. If link does not work visit [kansascornstem.com](http://kansascornstem.com) for updated link.

<b>VE</b>		<b>R1</b>	
<b>V1</b>		<b>R2</b>	
<b>V2</b>		<b>R3</b>	
<b>V3</b>		<b>R4</b>	
<b>V(n)</b>		<b>R5</b>	
<b>VT</b>		<b>R6</b>	

### Corn Staging Student Worksheet (Continued)

*Stages of Development (Vegetative):*

Visit the Dekalb Asgrow Deltapine website ([tinyurl.com/dekalbvegetativestages](http://tinyurl.com/dekalbvegetativestages)). Write why each stage is important (significance) and draw a picture showing how the plant would look in that stage. If link does not work visit [kansascornstem.com](http://kansascornstem.com) for updated link.

Stage	Significance	Picture
VE-V1		
V3		
V6		
V9		
VT		

## Corn Staging Student Worksheet (Continued)

### Stages of Development (Reproductive):

Visit the K-State Agronomy website ([tinyurl.com/ksu](http://tinyurl.com/ksu)). Write why each stage is important (significance) and draw a picture showing how the plant would look in that stage. If link does not work visit [kansascornstem.com](http://kansascornstem.com) for updated link.

Stage	Significance	Picture	GDUs
R1			
R2			
R3			
R4			
R5			
R6			

## Explore an Ear of Corn Student Worksheet

Name: \_\_\_\_\_

Group: \_\_\_\_\_

### What do you know about this familiar plant?

#### Procedure for Lesson:

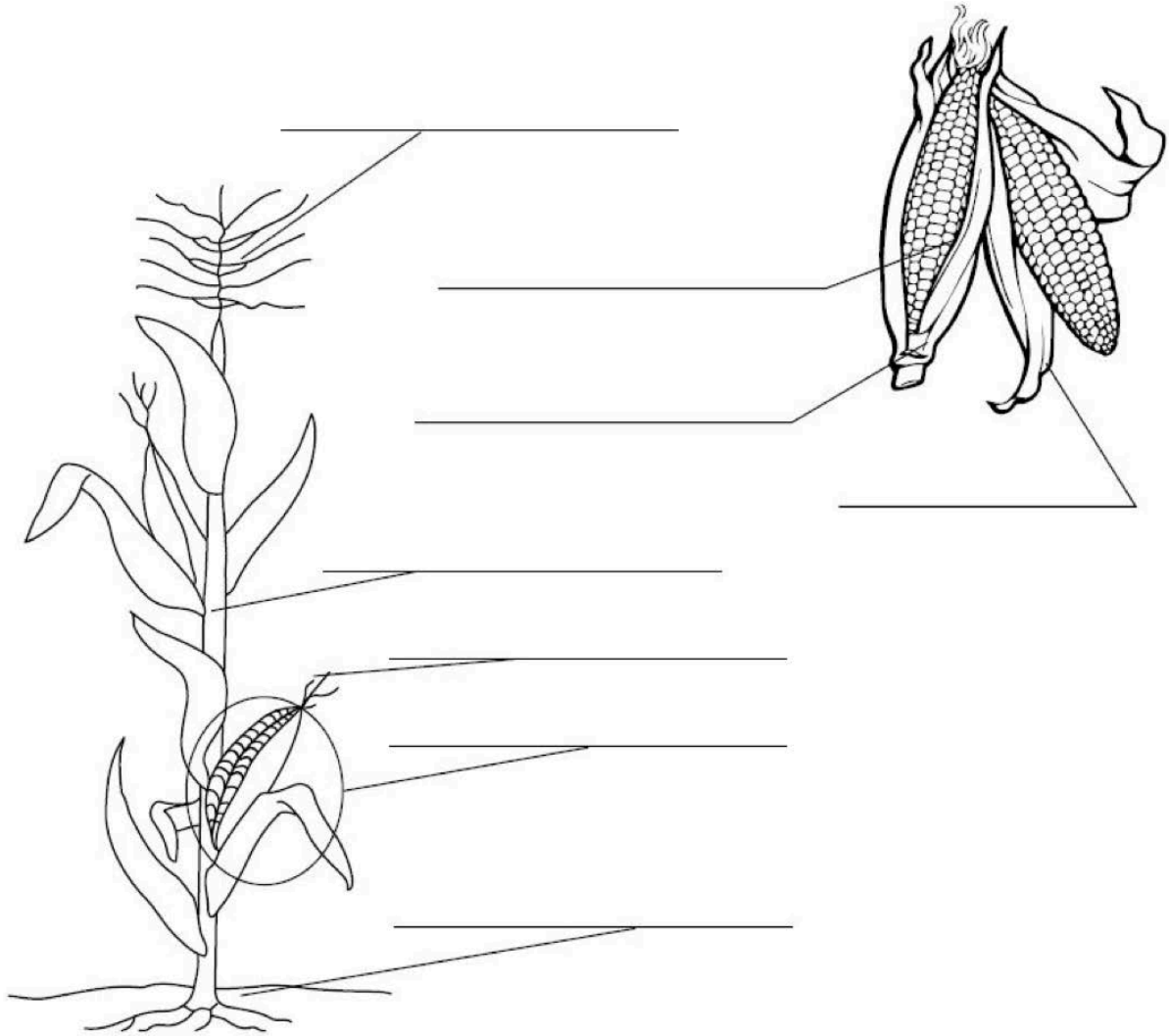
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2. What growth stage is it in? V (vegetative), VT (tasseling), or R (reproductive)?
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4. Lift the bushel, how much does it weigh?
5. Pop off kernels. How much does a kernel weigh?
6. How many kernels are there in a bushel?

#### Questions:

- What are some things that may have altered these ears (pests, drought, water)?
- What stage are they in (vegetative or reproductive)? Can you go into more detail about the stage?
- Explore your ear – how many rows, how many kernels per row, how many kernels per ear?

## Explore an Ear of Corn Student Worksheet (Continued)

Label the images below:



## Leaf Collar Method Student Worksheet

Name: \_\_\_\_\_

Group: \_\_\_\_\_

### What can the corn plant tell the farmer?

#### Background:

Vegetative (V) stages are determined by the total number of leaves with visible collars (e.g., a plant with three visible leaf collars is at V3). A collar is the off white band at the base of the leaf blade where it extends away from the stalk. A new leaf appears every three to four days with good growing conditions until tasseling. As the plant grows, lower leaves are lost. These leaves must be counted; otherwise, the development stage will be misidentified. Split stalks to accurately determine the leaf stage. Each leaf is attached to a single node, and nodes are visible as lines across the split stalk. The first four nodes are usually indistinguishable within the crown. The 5th node is about 1/2 inch above the area that contains the first nodes. The node corresponding with the uppermost leaf, with a visible collar, defines the vegetative stage. This knowledge is important because it helps the farmer determine any inputs that might be necessary to add to his crop, as well as the crop's potential yield. Corn needs little fertilizer boost until V5, but requires a large nitrogen intake to promote yield from V8 until VT (tasseling). It is important to side dress (inject between corn rows) nitrogen before the V8 stage. This allows the plant to maximize its photosynthetic potential. Ear length is determined between the V12 and VT vegetative stages. Tassel emergence occurs from V17 to V22, depending upon the corn variety.

#### Procedure for Lesson:

1. Use a knife and cutting board to carefully split the stalk of a corn plant in half, vertically, down to the roots.
2. Remembering that the first four nodes are often indistinguishable within the crown, count the number of nodes to determine the vegetative stage that the corn plant is in.
3. Compare the nodes counted within the stalk to the number of leaf collars found on the outside of the plant.



