GROWING AMERICA LESSON 2

Corn dissection

| Focus question | What can the corn plant tell us? How can we tell what stage of growth the corn plant is in? |
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| Learning target | To identify what stage of corn development the corn plant is in. |
| Vocabulary | Vegetative (V) stages, reproductive (R) stages, node, sidedress |

MS-LS1: From Molecules to Organisms: Structures and Processes

| Performance expectation | Classroom connection: This activity is an introduction to | | |
|-------------------------|---|--|--|
| MS-LS1-5 | growth and developmental stages of the corn plant. | | |

Science and engineering practices

| Constructing Explanations | Classroom connection: Students begin to construct an | | |
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| and Designing Solutions | explanation for the growth developmental stage of corn. | | |
| | Classroom connection: Students design a management | | |
| | plan to maximize plant growth. | | |

Disciplinary core ideas

| LS1.B: Growth and Development | Classroom connection: Students will compare different | | |
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| of Organisms | plants to determine if either genetic or environmental | | |
| | factors have had an impact on corn development | | |
| | and growth. | | |

Cross-cutting concepts

| Cause and Effect | Classroom connection: Students will observe | | |
|------------------|---|--|--|
| | developmental stages of corn growth. Students will look for cause and effect relationships to explain the growth stage and impact of development. | | |

This lesson focuses on Constructing Explanations and Designing Solutions as a means to determine the growth stage of a corn crop in order to design a management solution to maximize crop yield. Students will dissect a corn plant to determine its growth stage by identifying the number of nodes and leaf collars present. Students will then determine the needs of the crop as it continues to develop and create a management plan to meet its nutritional needs.



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Background

Corn is an integral component to the success of agriculture. Throughout the growing season, the corn plant undergoes a series of developmental stages as it grows from a seed at planting to a tall plant with an ear at harvest. The development of the corn plant is determined by different **Vegetative (V)** and **Reproductive (R) stages.** Please see the attached Corn growth and development poster: **bookstore.ksre.ksu.edu/pubs/MF3305.pdf** for details on the Vegetative and Reproductive Stages a corn plant undergoes throughout its development. V stages are determined by the total number of leaves with visible collars (e.g., a plant with 3 visible leaf collars is at V3). A collar is the offwhite band at the base of the leaf blade where it extends away from the stalk. A new leaf appears every 3 to 4 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.

Corn needs little fertilizer boost until V5, but requires a large nitrogen intake to increase yield from V8 until VT (tasseling). Farmers **sidedress** (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.

The growth rate of a corn plant is slow at the beginning of the season, but increases with the presence of each new leaf. Under non-stressful conditions, the time between new leaves will decrease as the season progresses. The plant is most vulnerable to stress during silking, when important pollination events are occurring. As the reproductive stages progress, the effect of stress on seed weight will decrease, while the effect on seed number will be minimal after R2. Highest yields will be achieved in areas where environmental conditions are favorable for these growth stages, especially R1. Unfavorable conditions early in the season will limit leaf size, which will decrease photosynthesis, while stress later in the season can affect pollination in the form of kernel size and number.

Materials

- Student handout
- · Heavy-duty scissors (dissecting/kitchen shears) or utility knife
- · Cutting boards/table protector
- Corn plants (1 or 2 per group)

Student handout

Constructing explanations

4. Why is it necessary to dissect the stalk to accurately determine the growth stage of the corn plant? What does the growth stage tell us?

Answers may include:

- You can determine the exact node that the leaf sheaf/leaf collar/and leaf have grown from.
- The growth stage determines the amount of remaining growth until maturity is reached.
- The growth stage helps us to determine the amount of inputs (nutrients, growing degree units, energy input, water) that is necessary to reach maturity.
- The growth stage helps us to predict yield based upon the environmental factors that occur up until maturity is reached.

Design a management plan

5. Create a management plan to maximize your crop growth as it reaches maturity. Research corn growth and describe the remaining growth stages that your corn plant will go through as it develops. What does the plant still need to remain healthy and grow? What inputs are necessary as it develops to create a healthy ear of corn? Be sure to correlate the necessary inputs with the proper developmental stage.

Answers may include:

- The current growth stage of the corn plant
- The growth stages that the developing corn plant has left to become a mature crop
- The inputs that are necessary (at the right time) to develop a robust ear of corn for high yield possibility.

Teacher preparation

- 1. Get plants from an agricultural field or your school greenhouse the night before or morning of the dissection. Dig out the entire plant, including the roots. Wash the roots of the plant for student observation and dissection. Place plants in a bucket of water until the dissection.
- 2. Determine if you want the students to dissect the corn plants with or without developmental background information. Split the corn stalk of a growing corn plant to accurately determine the leaf stage. Note: Each leaf is attached to a single node, and nodes are visible as lines across the split stalk. The first 4 nodes are usually indistinguishable within the crown (just above the root. 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 a farmer, or agronomist determine any inputs that might be necessary to add to the developing crop, as well as the crop's potential yield. *Options:* Students can carefully describe what they find in the interior of the corn plant and explain their findings to determine a growth stage. Or, the students can use the information in the student handout and the Corn Growth and Development poster to help lead their investigation. Encourage the students to dissect each part of the plant and lay them out to the side following the developmental stages described on the poster.
- 3. Demonstrate how to dissect/cut the corn plant in half carefully so as to not cause harm. Alternatively, pre-cut the corn plant in half for each student group to examine.
- 4. Have the students clean up their dissection by placing the corn parts in a trash bag which can be placed in the school dumpster upon completion.

Differentiation

Other ways to connect with students with various needs:

- Local community: Students connect with a local agricultural expert or famer to discuss corn production and management. Students may take a field trip to a local corn field to better understand modern agriculture.
- Students with special needs (language/reading/auditory/visual): Allow students to see the growth and development of corn in relationship to a blog post, Odell's World, Corn Growth: odells.typepad.com/blog/corn-growth-stages.html. Students can plant corn to watch the growth stages as they occur in the classroom.
- Extra support: Kansas State University Corn Growth & Development: agronomy.k-state. edu/extension/crop-production/corn/corn-growth-development/index.html Corn Growth & Development Poster: bookstore.ksre.ksu.edu/pubs/MF3305.pdf Odell's World: odells.typepad.com/blog/corn-growth-stages.html
- **Extensions:** Students design a research project to test genetic variations of corn hybrids with environmental differences. For example, students can compare drought guard tolerant corn hybrids with non-drought guard tolerant corn hybrids in varying precipitation experiments.

Assessments

Rubric for assessment

| Skill | Developing | Satisfactory | Exemplary |
|--------------------------------|---|--|---|
| Constructing Explanations | Student can identify the developmental and growth stage of a corn plant. | Students can explain identify and explain the development and growth stages of the corn plant. | Student can explain the growth stage of the corn plant and describe the beginning and remaining stages of growth that for the corn plant. |
| Designing a Management Plan | Students can identify the growth stage of the corn plant and determine the remaining growth needed to reach maturity. | Student can identify the growth stage of the corn plant and determine the remaining growth needed to reach maturity. Students can explain the nutrient inputs needed for their corn to reach maximum yield. | Student can identify the growth stage of the corn plant and determine the remaining growth needed to reach maturity. Student can explain the nutrient inputs needed for their corn to reach maximum yield. Student can create a management plan that includes the time and inputs needed at each remaining developmental stage for the corn to reach maximum yield. |

Rubric for self-assessment

| Skill | Yes | No | Unsure |
|--|-----|----|--------|
| I can identify the developmental stage of the corn plant. | | | |
| I can describe the remaining stages of growth the corn plant must undergo to reach maturity. | | | |
| I can outline the necessary inputs needed for corn to reach maximum yield. | | | |