KANSAS CORN STEM

Kansas Corn: How does it grow?

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KANSAS CORN COMMISSION

Kansas Corn: How Does it Grow?
Grade Level: 2

Unit Overview
Students work like scientists to test their ideas about what plants need to grow and live by using corn plants as model organisms. Students test growing conditions, such as amounts of water and sunlight. Consider whether you want to have students grow corn from seeds, or if you want to have seedlings already sprouted. If you choose the latter, you will need to plant and grow the corn about 2 weeks in advance.

Kansas College and Career Ready Standards
Science

- **2-LS2-1.** Plan and conduct an investigation to determine if plants need sunlight and water to grow.

Mathematics

- **2.MD.D.10.** Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.

Learning Objectives
- Students will identify characteristics of different types of plants.
- Students will propose answers to the question, "What do plants need to live and grow?"
- Students will plan and conduct an investigation to test environmental effects on corn seeds (e.g., light availability, water availability, etc.).
- Students will find patterns in their findings, and identify what corn needs to live and grow, forming explanations based on their observations (evidence).
- Students will record survival rates and represent these on a bar graph.
- Students will conclude from observations that plants depend on water and light to grow in their environments.

Materials
- Science journals
- Corn seeds or plants (Note: If using already sprouted plants, these need to be prepared in advance.)
- Planting pots
- Soil
- Grow light (if available) or basin to set pots by a window
- Spray bottles
- Sand, rocks (optional)
- Live samples of different types of plants, OR pictures of different types of plants available (available in web version at kansascornstem.com)
- Crayons – blue and black

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- Planning and Recording Sheet
- Labels or markers
- Slideshow (optional - available in web version at kansascornstem.com)

Safety Considerations
Be aware of student allergies to corn, or seeds treated with chemicals.

Lesson 1: Thinking About Plants
(30 minutes)

Key question
What do you think plants need to live and grow?

Learning Objectives
- Students will contribute examples of different types of plants based on previous knowledge.
- Students will identify characteristics of different types of plants.
- Students will propose answers to the question, "What do plants need to live and grow?"

Materials
- Live samples of different types of plants, OR pictures of different types of plants – See Slideshow (available in web version at kansascornstem.com)
- Science journals
- Crayons – blue and black

Procedures for Instruction
1. Introduce the topic and assess students for prior understanding:
   - Ask students to quietly draw or write down different types of plants they know about.
   - Pair the students together, and have them compare drawings – did they have similar and/or different types of plants?
   - Ask students what characteristics they think plants have? "What do plants have? What makes a plant a plant?" (Guide the discussion, but do not correct or explain to them. This discussion is to get them thinking and comparing ideas.)
   - Instruct students to circle the indoor plants they drew with a black crayon, and the outdoor plants with a blue crayon (if unsure, circle with both black and blue).

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2. Lead further discussion so students explore ideas of what plants need, whether indoors or outdoors, by asking questions such as:
    - "Why do you think some plants are grown indoors?"
    - "Can the outdoors be too dry or too cold for some plants, but not others?" "Too hot?" (Note: Most houseplants originated in tropical or subtropical climates, similar to indoor conditions.)
    - "What do indoor plants and outdoor plants have in common?"
    - "What do all plants need to live and grow?" (Create a list on board or anchor chart)

3. Guide the discussion toward questions about what plants need to live and grow, whether they're indoor or outdoor plants. Encourage wonderings and leave questions open for investigation, such as:
    - "Do plants need light?"
    - "Do plants need water?"
    - "Do plants need soil?" (see note below for your own reference, though allow students to ponder this for investigation)
    - "Do plants need air?"
    - "Do plants need other plants?"
    - "Do plants need food like we need food?" (see note below)
    - "Do you think plants need the same things that we need as humans? Or do they have different needs?"
    - "Do plants need the same things when they're just sprouting from the seed versus once they've grown leaves?"

4. Close the lesson in anticipation of the investigation coming up:
    - "Hmmmm ... I wonder. You have some very interesting ideas and thoughts about what plants need. I want you to think about how we can investigate these ideas using tests with plants."
    - If using slideshow (available online), use the slide with Farmer Ken asking "What does corn need to grow?"
    - Formative Assessment: "Write down one variable you would like to investigate as a scientist to determine what corn needs to live and grow."

NOTE: Not all plants need soil. In fact, while soil provides micronutrients or minerals, soil is not the main source of the matter that plants take in. Rather, water and carbon dioxide (from air) combine through the processes of photosynthesis in plants, to create the simplest building block of plant matter: glucose. Light, water, and air are the most important needs of plants since they provide the elements that form most of the plant's mass (even when dried). This may seem counter-intuitive, but it is true. Soil mainly provides support for roots and water, as well as a source for micronutrients. See this website for further information on Misconceptions about Plants: https://tinyurl.com/Misconceptions-about-Plants

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Lesson 2: Testing Our Ideas
(45 minutes, then 2-4 weeks of growing and observing)

Key question
What does corn need to live and grow?

Learning Objectives
- Students will plan and conduct an investigation to test environmental factors on corn (e.g., water availability, light availability, etc.).

Materials
- Science journals
- Corn seeds or plants (Note: If using already sprouted plants, these need to be prepared in advance.)
- Soil wafers, sand, rocks
- Grow light (if available) or basin to set pots by a window
- Spray bottles
- Plastic planting pots
- Planning and Recording Sheet
- Labels or markers
- Slideshow (optional)

NOTE: Find optimum planting instructions in Procedures for Instruction.

Procedures for Instruction
1. Introduce the topic and elicit prior learning with questions such as:
   - "What did we think that plants need to live and grow?"
   - "Can we help Farmer Ken determine what his corn needs to live and grow?"
   - Farmers need to consider such needs, and they need to provide the best conditions for their plants to live and grow.
   - "How can we investigate the needs of corn plants?" (For instance, if we want to test whether plants need light, how would we do that? We would have to test plants growing in the light, and plants growing in the dark.)

2. Small groups plan an investigation: What do corn plants need to live and grow?
   - Hand out the Planning and Recording Sheet to help students plan.
   - Split students into small groups and have each group test one variable (e.g. water, light, soil or no-soil).

- Show them the materials they have to plan an investigation (planting pots, soil, spray bottles for water, possible grow light, items to block light, etc.), and tell them how much time they will have (consider 2 – 4 weeks if working with seeds)
- Have each group plan the conditions to test the one variable. (For instance, if students are testing the factor of light, they need to grow plants in light and in dark to compare them. "Light" and "dark" would be the conditions.)
- How many plants will they test in each condition?
- What is the total number of plants they will need?
- It's good to have replicates in each treatment. Discuss this with your students in terms of, "If a plant doesn't grow, how can you tell whether it was due to the condition, or if it was just a bad seed? What if you planted a few seeds in the same condition to be sure?" (a "fair test")

3. Start the investigation:
   - Following the students' plans, have them plant corn seeds in each of the different conditions they identified. OR have already sprouted plants, instruct them to create different conditions for them.
   - Be sure to label each container to identify the group and the conditions. (Example: "Group A, no light")
   - Water the appropriate containers with a spray bottle.
   - Note: Optimum planting depth of corn kernel is 1-2 inches deep. Emergence of leaf above the soil will take approximately 5-7 days. Consider planting all seeds
   - 2 weeks in advance and providing students seedlings that have been grown in the same conditions up to that point.

4. Develop an investigation as a whole class or in small groups based on the question, "How does a seed germinate?" Hand out corn seeds and baggies, letting students figure out that they will be placing a few seeds in each baggie, and seeing if they will germinate in different conditions. Have a variety of liquids setting out. Guide the development of the investigation with such questions as:
   - "What does a seed need to germinate?" (Based on the introductory activity, they should realize it needs water. If not, guide them to reflect on the introductory activity to understand this.)
   - "Does it have to be water, or can it be any liquid? Does it have to be a liquid?"
   - "Which liquid will work best? Why?"
   - "Should the bag be opened or closed? Why?"

5. Document their thinking / make predictions: In their science journals or handout, have students draw a picture of what their plant looks like now (or the planted seed), and what they think it will look like at the end of the investigation. Have them show the different conditions they are testing.

6. Observe and record results over 7-28 days:
    - Have students water the soil as appropriate with spray bottles over the next 7-28 days.
    - Provide brief (3-5 minute) observation times during those days / weeks for students to observe (draw) and record (describe) in their science journals the progress (or lack thereof) of their plants.

Lesson 3: Analyze Findings

(30-40 minutes)

Key Questions

What do plants need to live and grow?

Learning Objectives

- Students will find patterns in their findings, and identify what corn needs to live and grow (evidence).
- Students will record survival rates and represent these on a bar graph.
- Students will conclude from observations that plants depend on water and light to grow in their environments.

Materials

- Science journals
- Planning and Recording Sheets
- Plants

Procedures for Instruction

1. Analyze findings and discuss after 7-28 days:
   In their small groups, have students assemble: their plants, their science journals, and their planning and recording sheets.
    - Take a look: How did the plants in each of their conditions do? What did they look like at the end of the investigation?
    - Do the math: How many plants started in each condition? How many survived in each condition?
    - Record the survival rate (example: 3 out of 4 or 3:4) for each condition. Create a bar graph, with the number of surviving plants on the y-axis, and the condition on the x-axis.
    - Discuss and explain: "What were the best growing conditions? How do you know that? How did the plants tell you that? What is your evidence?"
    - Record: In their science journal, show by drawing and text the best growing condition their group tested.
    - Report out and record class findings: Have each group report out and make note of their findings about each variable on an anchor chart or white board.
    - Discuss ALL the findings together: water conditions, light conditions, soil conditions.

- Form conclusion: Discuss what corn plants need to live and grow. They need water, light, and air. (see note below about plant needs)
- "What will we tell Farmer Ken about what his corn needs to grow?" "What if he doesn't have enough water?" "Can he get his plants started in a building without light?"

2. What did we do and learn as scientists?
   - Compare with predictions: How do your findings compare with what you predicted? Were they similar? Different? (Refrain from using the terms "right/wrong" or "correct incorrect" – this is not how scientists compare predictions to findings. Scientists simply consider whether predictions were similar or different to findings and try to explain why and what they learned.)
   - Discuss: Was anything surprising? Did your results turn out differently than what you originally thought? Scientists use investigations to learn based on evidence.
   - Reflective writing: In their science journals, use this prompt: "I used to think _____, and now I think _____."

Assessments

- Formative assessments: Assess students' abilities to plan and conduct investigations, and observe and draw conclusions based on their results. Are they able to consider the elements of a fair test with prompting? Can they make predictions by imagining what their corn plants will look like in the future? Can they make and record accurate observations? Can they use their evidence to support their conclusions? Adjust instruction and prompts accordingly.
- Summative assessments:
  - Science journal in planning and conducting an investigation: Plans, Observations, Conclusions. Show survival rates and graphing of findings. Explanations based on evidence. Recommendations to Farmer Ken about needs of corn plants.
  - Informal: verbal responses in final discussions
  - Do students conclude that corn plants need water and light to grow?
  - Are they able to identify what they learned?

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Planning and Recording Sheet

Name _____ **Group** _____

What are you testing? (circle one): **Water** **Light** **Soil**

How many days will we run this test?

How many plants in each condition? **1** **2** **3**

Condition #1	Condition #2	Condition # (optional)
Describe or draw the condition.	Describe or draw the condition.	Describe or draw the condition.
Number of plants =	Number of plants =	Number of plants =

Number of total plants = _____

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Planning and Recording Sheet

Let's make some predictions!

What your seed looks like now...		
Condition #1 at the end	Condition #2 at the end....	Condition #3 at the end...