



CORN: Staying Alive!

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



Kansas Corn: Staying Alive!

Grade Level: 3

Unit Overview

Students propose ideas about what they think plants need to grow, and specifically what corn plants need to germinate and grow. They tackle the challenge their teacher sets before them to prove their ideas with evidence, coming up with ideas themselves about how to do that. They use their imaginations to think clearly in planning their investigations and making predictions, and they carry out the investigations over the course of several days or a few weeks. During that time, they observe carefully and record their data accurately by drawing and writing. Afterward, they examine their findings, and are able explain to their teacher and peers what corn plants need to germinate and grow based on their evidence. They reflect on whether their ideas have changed based on their evidence, and how scientists often have to change their ideas based on evidence, too.

Kansas College and Career Ready Standards

Science

- **3-LS4-3.** Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

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.

Math

- **3.MD.A.2.** Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.

Art

- **Cr2.3.3.** Individually or collaboratively construct representations, diagrams, or maps of places that are a part of everyday life.
- **Cn10.1.3.** Develop a work of art based on observations of surroundings.

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Learning Objectives

- Students will propose and justify answers to the question, “What does corn need to grow and survive?”
- Students will propose and justify answers to the question, “How can we find out?”
- Students will plan and conduct an investigation to understand what corn needs in its habitat to survive well.
- Students will make observations and record their findings to construct an evidence-based account that corn needs water and sunlight to germinate and grow.
- Students will construct an explanation based on evidence that corn seeds need water to germinate and grow, and need sunlight to grow beyond a few days.
- Students will be able to argue based on evidence that corn needs an environment that provides it with water and sunlight in order to grow and survive well.

Materials

- Corn seeds
- Document camera/projector
- Whiteboard (or easel pad of paper) and marker
- Science Journal, Journal page inserts (pg.S1-6 and more options available for print online)
- Glue sticks
- Scissors
- Pencils
- Planting pots
- Planting sticks
- Soil (and other materials such as sand, rocks)
- Balance scale and gram pieces to measure soil/other material amounts
- Water (and possibly other liquids)
- Liquid measuring tool such as beaker, graduated cylinder, syringe
- Grow light (if available) or basin to set pots by a window

Safety Considerations

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

Lesson 1: Sprouting Ideas

(20-30 minutes)

Key question

What does corn need to grow and survive? How can we find out?”

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Learning Objectives

- Students will propose and justify answers to the question, “What does corn need to grow and survive?”
- Students will propose and justify answers to the question, “How can we find out?”

Materials

- Corn seeds
- Document camera/projector

Procedures for Instruction

1. Introduce the topic and assess students for prior understanding:
 - Begin by holding up a corn seed and/or placing it under a document camera to project, and ask students: “What does this corn seed need to grow and survive?”
 - Provide students with think time and then share their responses (use Kagan Strategies of Rally Robin, Round Robin, or simply raising hands).
 - Listen to students’ responses and ask them to justify all responses, but do not indicate any judgement.
2. Go deeper to explore the effects that different environmental conditions have on plant growth, either in small or large group, by asking the following questions:
 - “Can plants germinate / grow in materials other than soil?”
 - “Can plants germinate / grow without sunlight?”
 - “Can plants germinate / grow with liquids other than water?”
 - “What are the ideal conditions for a plant to grow?”
3. Do not signal right or wrong answers. Just let them discuss their ideas, and guide the flow with such prompts as:
 - “Can you say more about that?”
 - “Why do you think that?”
 - “Who agrees/disagrees with this idea and why?”
 - “Does anyone have a different idea?”
 - “Is that true all the time?”
4. Have them come up with the idea of investigating with real plants. Once students have answered and justified their answers above, pose the next question:
 - “You mentioned that a corn seed HAS TO HAVE soil, water, and sunlight to grow. How do you KNOW that it has to have these materials? What is your evidence?”
 - Listen to students’ responses and guide them toward the realization that in order to KNOW something, one must collect data to prove it.

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- Pose the next question: “How could we PROVE that the corn seed HAS TO HAVE soil, sunlight, and water to germinate and grow?”
- Record student ideas.

5. Reflect and conclude: “You have come up with some very interesting ideas about how we could prove that corn seeds HAVE TO HAVE soil, water, and sunlight to grow! I want you to think about these ideas tonight. I keep wondering if a corn seed HAS TO HAVE these to grow. How can we prove that it does or does not need these in its environment? Think on your own and we will pick this up again next time.”

Assessments

- Formative assessments: Assess contributions in discussions for prior understanding and adjust instruction if needed. Do students have experience with growing plants? Do they have a sense of conducting an investigation with actual plants to find evidence for their ideas?

Lesson 2: Planting Seeds

(30-40 minutes, with follow-up observations for 7-28 days)

Key question

“How can we prove that a corn seed does or does not need soil, water, and sunlight to germinate and grow?”

Learning Objectives

- Students will plan and conduct an investigation to understand what corn needs in its habitat to survive well.
- Students will make observations and record their findings to construct an evidence-based account that corn needs water and sunlight to germinate and grow.

Materials

- Science Journal, Journal page inserts (pg. S1-6 and more options available online)
- Glue sticks
- Scissors
- Pencils
- Corn seeds
- Planting pots
- Planting sticks
- Soil (and other materials such as sand, rocks)

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- Balance scale and gram pieces to measure soil/other material amounts
- Water (and possibly other liquids)
- Liquid measuring tool such as beaker, graduated cylinder, syringe
- Grow light (if available) or basin to set pots by a window

Procedures for Instruction

Pre-lesson preparation: If your students utilize science notebooks, print out the notebook pages and have students cut and paste the pages into their notebooks. If your class does not use specific science notebooks, consider copying and stapling together the science notebook pages and hand out to your students. Different versions of these are available online at kansascornstem.com to meet the needs of diverse classrooms.

1. Introduce the topic and activate prior learning: Begin with the question posed during the conclusion of the previous lesson:
 - “How can we prove that a corn seed does or does not need soil, water, and sunlight to germinate and grow?”
 - Post this question in the classroom for reference throughout the investigation.
2. Once students realize they need to develop an investigation, proceed to get out science journals. Work together as a class to develop answers to the following questions. Using the Teacher Science Journal, and projecting it through the document camera, develop the ideas, and model what they should record in their journals.
 - “What steps can we take to create and plan an investigation to test our ideas?” Have students record this in their journals, and number each step.
 - “What conditions will we be testing?” (growing plants in dark vs. light; with water vs. no water or another liquid; in soil vs. a damp paper towel; etc.)
 - “What materials do we need to conduct this investigation?” Have students record this in their journals. Display the actual items (planting pots, soil, corn seeds, etc.). Showing the students will help them if they do not have any background knowledge. Draw and label the materials.
 - “How long will we need to grow?”

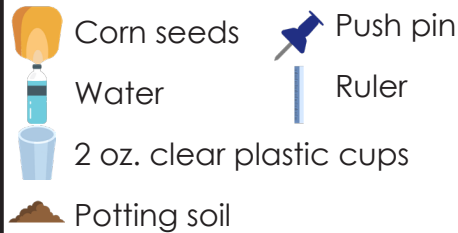
Note: Optimum planting depth of corn kernel in soil is 1-2 inches deep. Emergence of leaf above the soil will take approximately 5-7 days. Additional days or weeks may be desirable.

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Instructions for planting corn seeds in soil:

MATERIALS:

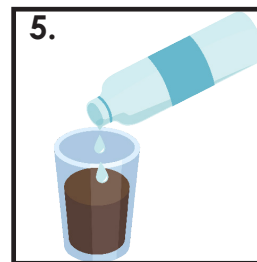
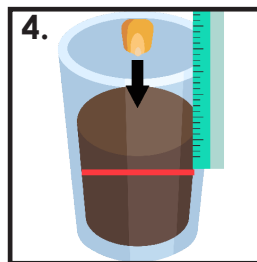
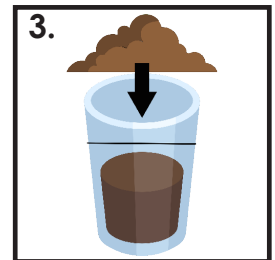
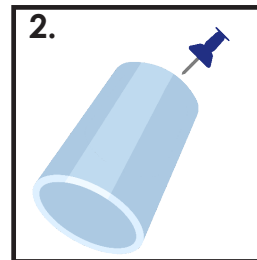
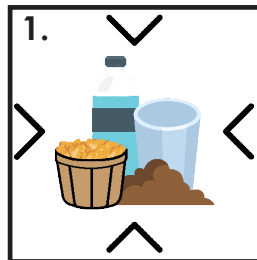


Planting Corn Seeds to drive student-led inquiry!



INSTRUCTIONS:

1. Gather materials.
2. Use a push pin to make 4 drainage holes in the bottom of the cup.
3. Fill the container $\frac{3}{4}$ full with potting soil.
4. Place the seed 1 inch down from the soil's surface.
5. Water seed until soil is damp, approx. 2 tablespoons. Monitor dampness daily; water as needed.
6. Observe growth each day.



Note: These are just our normal planting instructions. Please adapt them to your classroom, lesson materials and variables as you see fit. For example, if you use planting pots instead of cups then you don't need to make the drainage holes.

3. Small group planning and investigating:

- Place students in teams of 4-5 for conducting the investigations.
- Instruct students to decide among themselves their investigative roles:
 - What conditions will each student plant their seeds in? (One student will plant seeds that will grow in dark, one that will grow in light, one that will be given water, another a different liquid, etc.)
 - Have students follow their own steps to start their investigations, which might include planting seeds, or placing young plants in different growing conditions (See "Corn Plant Growth Set Up" sheet).

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- Using the label sticks be sure to label planting containers with student names. If students have more than one planting container, they should number them so they know which plant goes in which growing condition, and record this in their journal. (This may seem unnecessary, but when they observe the pots to record data, the containers may get switched.)
- Guide students in how to use measurement tools correctly, and emphasize the importance of keeping amounts constant so they can conduct a fair test among the conditions.

4. Planning and conducting observations as a whole class:

- Add data collection recording pages to the students' journals.
- Discuss what makes good quality data collection (See "Science is ALL about" sheet):
 - Observing details (What do they see? What can they measure? What has changed? Anything surprising?)
 - Record accurate details
 - Draw and describe with words
- Observe and record what they did today (See "Corn Plant Growth Data" sheet).
- Set up a schedule for the duration of the investigation (7-28 days) for students to make and record observations (collect data). Observations can be made every few days in the "Corn Plant Growth Data" sheets of student science journals.

NOTE: Determine how many times you want students to observe their plants and be sure to provide enough data sheets in their journals.

5. Observe and record results over 7-28 days:

- Have students water the soil as appropriate 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.

6. Conclude

- Prompt students to collect data, make accurate observations, and record the data in their journals. Keep wonder alive by showing deep interest in their observations, asking them what they have found, what data they are collecting, and if they have any preliminary thoughts based on their evidence? Refer back to the investigation question posted in the classroom: "How can we prove that a corn seed does or does not need soil, water, and sunlight to germinate and grow?" Ask if they think they are gathering evidence to answer this question.

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Assessments

- Formative assessments: Assess students' understanding of plant needs based on their propositions of how to plan and conduct an investigation. Adjust instruction and prompts accordingly. Refer to Background Information for Teachers below.
- Summative assessments: Assess student plans and observations as recorded in their Science Journals. Are the plans and data collection clear and detailed? Do the plans provide fair tests for the conditions they are testing?

Background Information for Teachers

Seeds do not need soil to germinate. Soil is a substrate that holds water that the seed needs to germinate. Once the plant reaches sunlight, it will start photosynthesizing, creating glucose and plant matter which results in growth. The soil is necessary only to hold the water it needs, to provide tiny amounts of micronutrients it needs, and to provide structure to support a standing plant. It technically does not need soil to survive and grow. A seed also does not need sunlight to germinate. The seedling can grow quite substantially as it tries to reach sunlight, but ultimately it will not be able to photosynthesize without light, and so will not survive long if it does not find light.

Lesson 3: Reaping the Harvest

(30-40 minutes)

Key question

“What does a corn seed need to germinate and grow?”

Learning Objectives

- Students will construct an explanation based on evidence that corn seeds need water to germinate and grow, and need sunlight to grow beyond a few days.
- Students will be able to argue based on evidence that corn needs an environment that provides it with water and sunlight in order to grow and survive well.

Materials

- Science Journals with data recorded based on observations from Lesson 2
- Plants from the investigation

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Procedures for Instruction

1. Introduce the topic and activate prior learning:
 - “What did we set out to do? What question were we trying to answer in our investigation?”
 - “How did we go about trying to prove that plants need soil, water, and sunlight?”
2. Small group discussion and exploration:
 - Have students gather with their team.
 - Instruct them to look at their science journals, and based on their data, answer the question, “What does a corn seed need to germinate and grow?”
 - Have them write a statement to answer this question, and describe the evidence they found to support their statement.
3. Sharing and discussion:
 - Have groups share their conclusions and their supporting evidence to the class (use their journals as data and evidence, along with the actual plants – dead or alive – from their investigation). You can do this as a whole class, or jigsaw the class so that new groups are formed with one student from each investigation team.
4. Discuss findings and conclusions in the whole class by asking questions such as the following:
 - “Can plants germinate and grow in materials other than soil?”
 - “Can plants germinate and grow without sunlight?”
 - “Can plants germinate and grow with liquids other than water?”
 - “Can plants grow in all conditions well?”
 - “What are the ideal conditions for a corn plant to grow?”
 - “If conditions in a plant’s environment changed (less water, less light), how would that impact the plant’s growth?”
 - “Are there conditions in which some plants can grow, but not others?”
5. Be sure to have students support their statements with evidence.
 - “Why do you think that?”
 - “What’s your evidence?”
 - “How did you arrive at that conclusion?”
 - “Can you give an example?”
 - “Can you say more about that?”
 - “I’m not sure I’m convinced. Your conclusion and your observations seem to be saying different things.”
 - “Does anyone have a different conclusion based on this evidence?”
 - “What new questions do you have based on this investigation?”
 - “How could we get evidence to answer this new question?”

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(Note: students might be surprised to have discovered that soil is not necessary for a plant to germinate and grow, or that light is not necessary for a seed to germinate. They may be resistant to believing their evidence. Be sure to have them think deeply about this if the evidence seems to conflict with their ideas, but refrain from “correcting” them. Studies show students will tell a teacher what s/he wants to hear, even if they don’t believe it to be true. The point here is to have students really examine their own conclusions based on evidence.)

6. Conclude:

- “You planned and conducted an investigation to determine what a corn plant needs to germinate and grow, and you have formed conclusions based on very convincing evidence! You are budding scientists!”
- “Some of you changed your ideas about what plants need based on the data you collected. How many of you changed your ideas? You are certainly budding scientists, because that’s what scientists do – they often have to change their ideas based on the evidence they find!”
- “We have new questions, and I can see that we could continue to investigate many of these new questions. That is what scientists do – they conduct investigations to find evidence to answer questions!”
- “Scientists also need to keep their lab clean and stay organized, so let’s clean up!”

7. Clean-up: Be sure to get student help in cleaning up the investigation.

Assessments

- Formative assessments:
 - Assess students’ understanding of scientific observation and data collection by their science journals. Guide them to observe carefully and record accurately.
 - Assess students’ conceptual development as their assumptions may be challenged by the data they collect.
- Summative assessments:
 - Assess student observations and conclusions as recorded in their Science Journals. Are their data clear and accurate? Collected regularly? Are their conclusions clear? Are they based on evidence?

Corn Plant Growth

Focus Question: *I wonder if a seed has to have soil to grow?*

How can we create an experiment to test our focus question? (Steps)

What science tools and materials will we need? (List)

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Draw a picture below of what you think this experiment will look like once it is set up.

Science is ALL about wondering, experimenting, and making observations!

How do I OBSERVE ...

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*

*

*

*

How do I make QUALITY observations?

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*

Corn Plant Growth Data





*My corn seed was planted in _____ (g) of _____. (material)

*My corn seed was given __ hours of light during the school day with the _____ . (light source)





*My corn seed was given _____ ml of water to drink.

Date of Observation 	Illustration of Growth 	Description of Growth 	Is the plant healthy? Yes/No How do you know? 





Corn Plant Growth Data

Date of Observation 	Illustration of Growth 	Description of Growth 	Is the plant healthy? Yes/No How do you know? 

Corn Plant Growth Data

<p>Date of Observation</p> 	<p>Illustration of Growth</p> 	<p>Description of Growth</p> 	<p>Is the plant healthy? Yes/No How do you know?</p> 

Corn Plant Growth Data

Date of Observation 	Illustration of Growth 	Description of Growth 	Is the plant healthy? Yes/No How do you know? 
Final Day			

My Conclusions

The seed planted in _____ (material) grew the best/was the most healthy because _____

_____.

The seed planted in _____ (material) grew the worst/was the least healthy because _____

_____.

Healthy Corn Plants

