Farming in a Glove

Suggested Grade Level: 3-5 (can be adapted for K-2)

Time: 1 hour + (Two 20-minute activities, then 5-minute observations for 7-15 days to document germination)

Subject: science, plant growth & development, growth cycle, energy, environmental influence, germination study (with state standard connection to ELA/Literacy)

Overview: Students will plant seeds in a transparent glove to observe and document how five different kinds of seeds germinate and start to grow.

Learning Objectives:

1. Identify parts of a seed.
2. Create the conditions necessary for germination to occur.
3. Describe the environment and energy needed for plant growth.
4. Document changes in plant growth.
5. Compare and contrast the germination and growth rates of 5 types of seeds grown on Kansas farms.
6. List careers related to farming and ranching.

Background:

Seeds are vital to our survival. Without seeds, the plants that provide our food, fuel, fiber, oxygen, and many other essential products would not exist. Seeds are the method by which some plants reproduce.

Each seed has a seed coat, an embryo (baby plant), and a food source in either an endosperm or cotyledon. A seed needs warmth, moisture, and air (all natural resources) to germinate. Seeds remain dormant and will not germinate until the proper conditions are present. For example, in some climates, the winter soil temperature may dip below 32°F. Seeds will not sprout in these conditions. Once the ground thaws in the spring and the temperature rises to approximately 65°F, most seeds will sprout if moisture and air are also available. Most seeds germinate when the temperature is between 65-85°F.

In germination, the seed must undergo imbibition (a rapid uptake of moisture causing swelling and softening) to activate root growth. Moisture softens the seed's outer protective covering, called the seed coat. The embryo pushes through the softened seed coat, and the new plant begins to grow. The roots push further into the soil, and a shoot, containing the new plant's stems and leaves, reaches up toward the surface. The germination process can be somewhat mysterious because it typically

occurs underground, where it cannot be observed. The clear plastic glove and cotton balls used in this activity provide an opportunity to view the germination process and the plant's beginning growth and root system. Learning about seeds and the germination process offers various possibilities for scientific investigations and experiments. Working with moisture, light, air, and temperature as variables, students can design experiments to discover optimal conditions for germination.

Kansas Connections:

Soybean Facts

Kansas ranks 10th in the nation for soybean production. Soybeans are the 2nd-most produced crop in the U.S.

- Most (97%) U.S. soybean meal feeds pigs, poultry, and cattle.
- Soy foods like edamame, tofu, soymilk, soy nuts, and other versatile ingredients give food flavor, texture, nutrition, and health benefits.
- Other soy-based products include wood stains, concrete sealants, caulking, paint, insulation, foam, crayons, candles, beauty supplies, and more.

Wheat Facts

On average, Kansas is the largest wheat-producing state in the United States. Nearly one-fifth of all wheat grown in the United States is grown in Kansas, which is why Kansas is called the "Wheat State" and the "Breadbasket of the World."

- Wheat is typically milled into flour and used in various foods for human consumption. Examples include bread, muffins, noodles, pasta, biscuits, cakes, pastries, cereal bars, snack foods, crackers, etc. Each American consumes about 134 pounds of wheat flour per year.
- By-products of wheat are used in animal feed.

Sunflower Facts

Kansas ranks fourth in the nation for sunflower production.

- The state of Kansas has been known by several different nicknames, with the most popular being the Sunflower State. The sunflower is the state flower of Kansas.
- In central Kansas, sunflowers are mainly grown for birdseed and oils, while in western Kansas, they are also grown for seed for human consumption.
- Sunflower oil is a healthy vegetable oil. Sunflower seeds are a healthy, tasty snack and a nutritious ingredient in many foods. Many sunflower seeds are grown for birdseed.
- When sunflowers can't be harvested, they are often used to make silage for feeding cattle.

Sorghum Facts

Kansas ranks as the No. 1 grain sorghum-producing state in the nation, representing nearly half of U.S. sorghum production in 2019.

- Grain Sorghum is also called milo.
- Its primary use is for livestock feed (poultry, beef, and pork).

- In addition, sorghum is used to produce many products, including ethanol, packing peanuts, building material, fencing, floral arrangements, pet food, and brooms. It is growing in popularity as a food for humans, primarily because of its use in gluten-free food products.

Corn Facts

Corn is the most-produced crop in the U.S. Kansas is the 6th leading producer of corn in the United States.

- About a third of the corn crop is used for feeding cattle, hogs, and poultry in the U.S.
- Another third of the corn crop makes ethanol, a fuel additive to gasoline for vehicles.
- The rest of the corn is used for human food or in products used daily, such as breakfast cereal, tortilla chips, grits, soda, cooking oil, and biodegradable packaging materials. It's the key ingredient in the growing medium for medicines, including penicillin.

Kansas Grain Usage

What about feeding Kansas livestock? Kansas grains are essential to Kansas livestock production. On the nearly 27,000 Kansas farms and ranches raising cattle and calves in 2017, almost 8 million head were sold. This accounted for over 11 percent of all cattle and calves sold in the United States. Just over 5.4 million hogs were sold off Kansas farms in 2017"…Overall, the nearly 59,000 Kansas farms and ranches, encompassing almost 46 million acres, accounted for roughly $19 billion worth of agricultural products sold in 2017"(Bounds). Livestock convert plant products into more human-digestible amino acids and proteins. Cattle especially can "...transform fibrous material inedible to humans such as roughage [or crop residue] and by-products from the food industry, into milk and meat which justifies their role in food production" (Patel). Livestock also consume distillers' grains or the products left over from breweries and ethanol plants, which is waste to people but a good source of energy and protein for livestock. Millions of pounds of distiller's grains that have zero nutritional value to people are upcycled into protein products that people can consume ("What").

Materials in the Kit:

Food service gloves (one per student)
Cotton balls
Soybean, wheat, corn, sorghum, sunflower seeds
Pipe cleaners
Food, Plant, and Seed Cards
Seed Properties Chart
Physical Properties Chart

Materials the Teacher will need to provide:
Water
Hand lenses (optional but preferred)

Instructional Format:

1. Share background and Kansas industry information with students.
2. Conduct an engagement exercise.
3. Conduct activity 1: students will complete a seed physical properties chart with instructional support of plant part posters.
4. Conduct activity 2: students will build a farm in the glove by following the steps to plant a different seed in each finger of the glove.
5. Conduct activity 3: students will record daily observations of their farm in a glove until the sprouts are outgrowing the glove.
6. (optional activity) transplant sprouts into the soil and continue observations.

Engagement
Organize the students into five groups, and give each group set of Food Cards. Ask the students to identify each item on the cards. Explain that all of these items are food for humans or animals. Tell the students that all of these foods come from plants grown on farms. Give each group a set of Plant Cards, and ask them to match the plant cards with the food pictures. Review the correct matches. Explain to the students that every plant begins as a seed. Give each group a set of Seed Cards. Ask the students to try to match the seed, plant, and food pictures together. Review the correct matches. Tell the students they will learn more about these seeds and how they grow into plants.

Supporting Video: (3:47 min): **How Does A Seed Become A Plant?**

Procedures:
Activity 1: Seed Properties

1. Provide each group with soybean, corn, sorghum, wheat, sunflower seeds, and hand lenses. Instruct the students to match the seeds with the seed cards. Review the correct matches.
2. Allow time for the students to observe the seeds with the hand lenses. Discuss their observations.
3. Pass out the Seed Properties Chart to each student. Explain to the students that a physical property describes how an object looks, feels, or acts. By describing the size, shape, color, texture, and mass of each seed, they will describe the seeds' properties.
4. Project the Physical Properties Anchor Chart on a large screen if possible. Discuss the adjectives on the chart that could be used to describe the properties of the seeds. Have the students work together as a group to complete their Seed Properties Charts.

5. Discuss the properties of the seeds the students listed on their charts. Ask the students, “How are these seeds alike and different?”
6. Ask the students what they think the seeds look like inside. Project the Soybean and Corn Dissection Images onto a large screen if possible, or have copies for each student group (from our Kids Connection Magazines). Point to the embryo inside each seed. Explain that inside every seed is an embryo, a baby plant. The embryo has the potential to grow into a new plant.
7. Point to the cotyledon inside the soybean seed and the endosperm inside the corn seed. Explain that seeds also contain food that the embryo uses for energy as it sprouts. Depending on the type of seed, the nutrients are absorbed or stored in either the cotyledon or endosperm of the seed.

Activity 2: Seed Germination

1. Have the students look at their group’s matched Food, Plant, and Seed Cards. Ask the students to imagine that they are farmers that want to grow one of these crops. Ask, “How would you begin the growing process?” (plant the seeds)
2. Ask the students, “What do farmers need to provide in order to help the seeds grow into the plants that provide humans and animals with food?” (water, air, and warmth; Once the germinating seed sprouts, the new plant will also need nutrients and light.)
3. Tell the students that they are going to provide their seeds with everything they need to germinate. Germinate is a scientific word for sprout. Explain that they will be germinating seeds in a very small farm—a farm in a glove.
4. Demonstrate the process of making a farm in a glove: a. Use a permanent marker to write the name of a different seed—soybean, corn, wheat, sorghum, and sunflower—on each finger and thumb of the glove. Have students write their names in the center of the glove. b. Dip five cotton balls into the water. Squeeze any excess water out of the cotton balls so that they are saturated but not dripping. (Note: If you are sprouting large seeds like corn, squash, peas, or beans, use two moistened cotton balls). c. In each finger of the glove, place one seed until you have five cotton balls, each with a different type of seed on it. d. Place the “seeded” cotton balls into the correctly labeled fingers of the glove. e. Fold down the opening of the glove and secure it with tape.
5. Distribute the gloves, permanent markers, cotton balls, water bowls, seeds, and tape to each group. Assist students in creating their farm in a glove.
6. Display the gloves by hanging them (fingers facing downward) on a classroom bulletin board or another designated area. Because the cotton balls contain enough water to germinate the seeds, there is no need to water. Most seeds will sprout within a week.

Activity 3: Observation and Documentation

1. Have the students check their farms daily and record observations of their germinating seeds. Instruct them to trace their hand on a page of their science

journal for each day of observance. They can draw a picture of each seed or seedling on the appropriate finger of their tracing and note measurements and changes in the margins of the page.

2. Sprouts can be transplanted into the soil to continue observations after plants have sprouted. Cut the bottom off of each finger of the glove and remove the cotton balls with the sprouts. The entire cotton ball can be transplanted along with the seedling into the soil.

Vocabulary:
embryo: a human, animal, or plant in the early stages of development before it is born, hatched, sprouted, etc.
cotyledon: a type of leaf that is part of the developing plant inside a seed that either stores food or grows from the seed to produce food
endosperm: the part of a seed that provides food for the developing plant embryo
germinate: to begin to grow
dormant: not active but able to become active
seed coat: the protective outer covering of a seed
germination: The process of a plant emerging from seed and beginning to grow.
imbibition: the absorption of one substance by another, in particular, the uptake of water by a plant or seed.
physical properties: Properties are used to describe how an object looks, feels, or acts.
crop residue: waste materials left after a crop is harvested, which are often used for livestock feed.

Related Careers:
There are many ways to earn a living or to work in agriculture. Some of the jobs connected to the seed crops used in this activity are animal nutrition, truck driving, milling, and baking.

Crops produced from the seed you planted can be used for animal feed. Much of the grain produced in Kansas is used for livestock feed. An *animal nutritionist* studies the food requirements for animals and the quality of different feeds and helps animal owners make good decisions about what to feed their animals. They also use science to improve the quality of animal food. *Animal nutritionists* may work for feed companies or universities.

Truck drivers haul goods from one location to another. Some truck drivers have their own trucks, while others work for transportation companies. Driving large trucks does require a Commercial Driver's License, also known as a CDL. Truck drivers can deliver grain to mills for processing.

Much of the grain used for human consumption goes through a mill. Milling is a process of cleaning and working the grain to be used for products such as flour to make breads and pastries. The milling process requires continuous monitoring by of the incoming wheat and outgoing flour by a *mill operator* to obtain high-quality finished products. Milling uses science to improve their processes and products and offers a variety of job opportunitites.

A *Baker* uses products produced by the mill to make cakes, cupcakes, pastries, and items for human consumption. Baker's also experiment with recipes and different ingredients to improve the quality of the items they bake. Some bakers own their own bakeries, while others work for companies.

Assessment:
Answer the following questions in your journal:
1. Use your documented observations to compare the growth of your plants. Which plant grew the largest?
2. What natural resources did your seed need to grow?
3. List a career that involves working with plants.

Kansas Academic Science Standards:
3-LS1-1. Develop models to describe that organisms have unique and diverse life cycles, but all have in common birth, growth, reproduction, and death.
Disciplinary Core Idea
- LS1.B: Growth and Development of Organisms - Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (3-LS1-1)

3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.
Disciplinary Core Idea
- LS3.B: Variation of Traits - Different organisms vary in how they look and function because they have different inherited information. (3-LS3-1)
- The environment also affects the traits that an organism develops. (3-LS3-2)

Common Core State Standard Connection to ELA/Literacy:
- RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-LS3-1),(3-LS3-2),(3-LS4-2)

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
Disciplinary Core Idea:
- LS1.A: Structure and Function Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1)

Common Core State Standard Connection to ELA/Literacy:

- W.4.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (4-LS1-1)

5-PS3-1. Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.
5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water.
5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
Disciplinary Core Idea:

- LS1.C: Organization for Matter and Energy Flow in Organisms Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. (secondary to 5-PS3-1) Plants acquire their material for growth chiefly from air and water. (5-LS1-1)

Common Core State Standard Connection to ELA/Literacy:

- W.5.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-LS1-1)

National Agriculture Literacy Outcomes

T1.3-5 Agriculture and the Environment

b. Explain how the interaction of the sun, soil, water, and weather in plant and animal growth impacts agricultural production.

E. Recognize the natural resources used in agriculture practices to produce food, feed, clothing, landscaping plants, and fuel (e.g., soil, water, air, plants, plants, animals, and minerals).

T2.3-5 Plants and Animals for Food, Fiber & Energy

B. Distinguish between renewable and non-renewable resources used in the production of food, feed, fuel, fiber (fabric or clothing), and shelter.

Companion Resources

Found on the Kansas Foundation for Agriculture in the Classroom Website
Growth Cycle Posters
Plant Parts Posters
Kansas Kids Connection Magazines

References:

Kansas Department of Agriculture.
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https://nationalfestivalofbreads.com/nutrition-education.

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Kansas State University.
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“What Do Cattle Eat in the Winter.” Kansas Beef Council. 2023.
https://www.kansasbeef.org/on-the-farm/what-do-cattle-eat-in-the-winter

NAITCO lesson adapted to include seeds grown in Kansas from the lesson Farming in a Glove, Authors: Sue Knott, Debra Spielmaker, Lynn Wallin
Contributor: Patricia Wolfe, 2020 KFAC Teacher of the Year

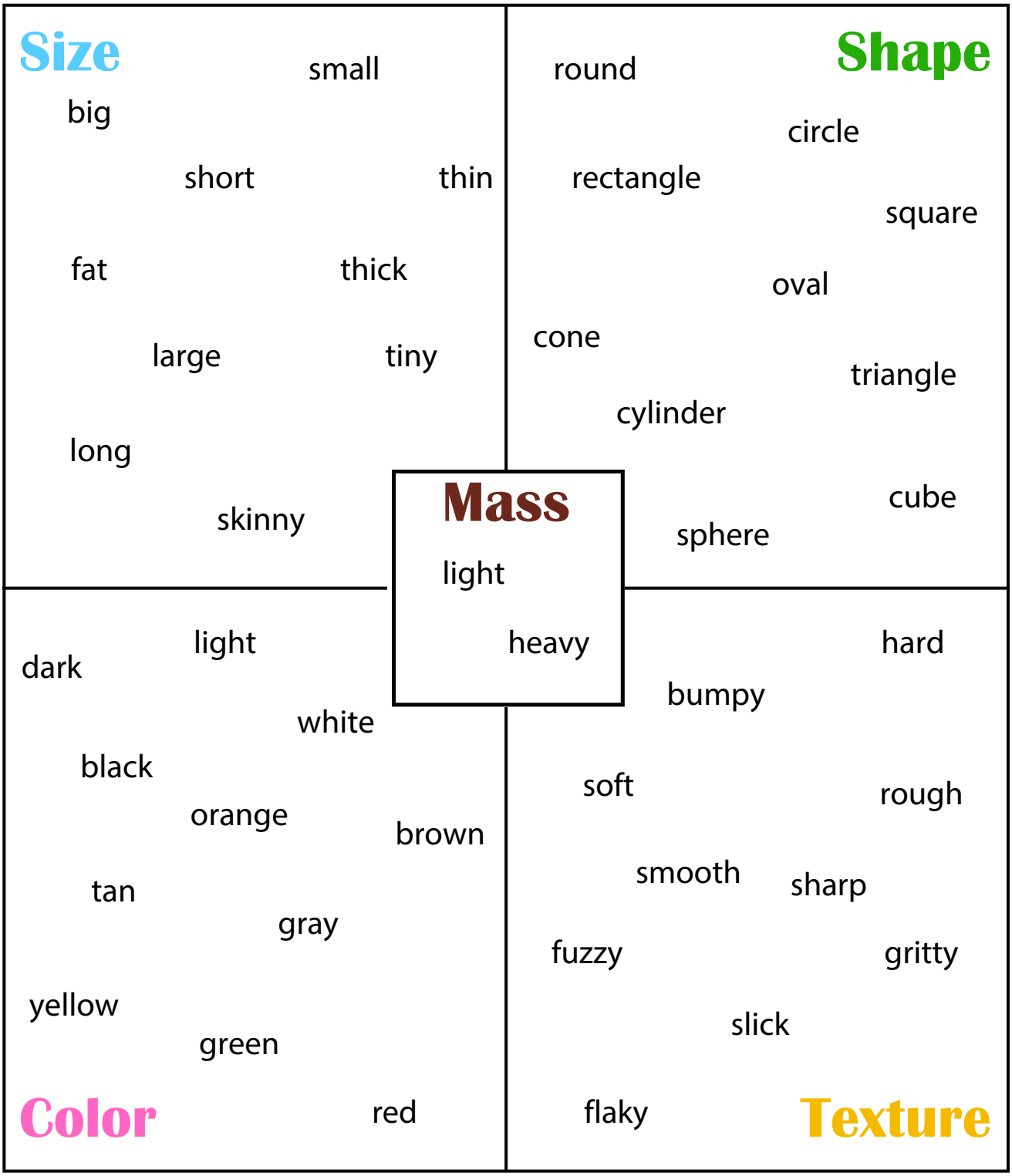
Name:_____

Seed Properties Chart

Seed	size	shape	color	texture	mass
corn					
sorghum					
soybean					
sunflower					
wheat					

Name:_____

Physical Properties



Food Cards

Plant Cards

Seed Cards