## Lesson Plans for 2011-12 School Year

### Grade 2

#### Planting a Healthy Garden

**Lesson five:** Where do seeds come from?

“Sunflower House” and “Germination” from GROWING IN THE GARDEN, Iowa State University Extension and Outreach

Where do seeds come from? What does one seed grow? How does a seed grow? Students make sunflower seed to seed models with some simple supplies and use them to explore the seed to seed cycles of other food plants. They also conduct two science experiments to see how a seed starts to grow. Students will taste seeds that are healthy vegetables. A lengthy list of children’s books about seeds comes with this lesson.

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| Life skill objectives: | Learning to learn, Critical thinking, Problem solving, Decision making, Healthy living |

**Core and STEM concepts and skills:**

- **Science**
  - Life science, Earth and space, Science as inquiry

- **Math**
  - Operations and algebraic thinking, Measurement and data, Connections

- **Language Arts**
  - Reading, Vocabulary, Sequencing, Inferring, Interpreting, Viewing, Speaking, Listening

| Healthy snack: | Seed snacks |

**Additional and supporting resources:**

* A Seed is Sleepy by Diana Hutts, Sunflower House by Eve Bunting, From Seed to Plant by Gail Gibbons, Pumpkin Circle by George Levenson, From Seed to Sunflower by Dr. Gerald Legg (check if available from library or purchase online)
BEFORE THE LESSON

1. Grade 2, Lesson 5:
This document contains all the curriculum items and resources you
need for this lesson. All lesson downloads are located on the
www.peoplesgarden.wsu.edu Educational Toolkit.

2. Check materials list for complete description of items needed.

3. Check your library for the books associated with this lesson: *A Seed is Sleepy* by Diana Hutts, *Sunflower House* by Eve Bunting, *From Seed to Plant* by Gail Gibbons, *Pumpkin Circle* by George Levenson, *From Seed to Sunflower* by Dr. Gerald Legg
(or purchase online).

4. Assemble necessary ingredients and materials for the Seed Snack.

THE LESSON

1. **Sunflower** and **Germination** are meant to be taught over several days.
   Students will check the growth of seeds they plant.

AFTER THE LESSON

Optional activities are included in the lesson plan include reading *A Seed is a Promise* by Claire Merrill. Consider doing “Banking on Seeds” the lesson from Project Food Land and People, available for purchase and digital download from http://www.foodlandpeople.org/ordering/gardenwise/

Have students keep their bean seed growth chart in their garden journal.

RECIPE

**Seed Snack** A variety of seed choices can be used as a snack: sunflower seeds, corn kernels or seeds, soy nuts, pumpkin seeds or dried peas. Or select fruits or vegetables with visible seeds: cucumber, snow peas, citrus with seeds, kiwi, strawberries (seeds on the outside).
Sunflower House

Outdoor classrooms such as school gardens open up a fun new world full of discovering and learning. Outdoor classroom experiences are apply/expand activities that students can do and enjoy for the rest of their lives. School gardening helps students to:

- Learn life skills such as critical thinking, decision making, problem solving, healthy lifestyle choices, communication, cooperation, responsibility, respect, service learning, learning to learn, patience, and others;
- Gain knowledge and experience and increase interest in science, health, math, social studies, language arts, and the arts;
- Apply their learner types and challenge them to try new ones such as bodily-kinesthetic, spatial-visual, logical-mathematical, linguistic-words, intrapersonal, interpersonal, music, and natural (Howard Gardner's multiple intelligences);
- Increase vegetable and fruit consumption and physical activity;
- Grow healthy, fresh food for themselves, their families, others, or as a business;
- Identify hobbies or potential career interests;
- Set goals, plan, implement and evaluate activities;
- Identify local resources and partners to accomplish goals;
- Work as partners with caring adults to learn new skills and accomplish goals.

Corresponding lessons from Growing in the Garden:

- General Unit, Lesson 1: Project Discovery
- General Unit, Lesson 3: My Special Garden
- General Unit, Lesson 4: A Dream Garden
- Natural Resources Unit, Lesson 1: Sun, Soil, Water and Air
- Natural Resources Unit, Lesson 2: Just Right – Water and Light
- Plants Unit, Lesson 1: Start with Seeds
- Plants Unit, Lesson 2: Plant Parts Become Me
- Plants Unit, Lesson 6: Germination
- People Unit, Lesson 2: Claude Monet: Connecting Nature and Art
SUNFLOWER LIFE CYCLE

ACTIVITY 5

MATERIALS - Small yellow paper plates (one per student)
- Sunflower Life Cycle (one copy per student, found in this activity)
- Scissors (enough for everyone to share)
- Glue (enough for everyone to share)
- Tape (enough for everyone to share)
- Paint stir sticks (one per student)
- Sunflower seeds (You may want to use a small bag of bird food. You will need at least 6 seeds per student.)
- Brown crayon or marker (enough for everyone to share)
- Green dessert napkins (Cut along the fold line so two students can use a napkin. You may want to substitute green construction paper and cut out the leaves.)
- Sunflower head pictures or an actual sample (optional)

You may want to set the materials listed above in a supply station for everyone to walk by and pick up.

Hold up a yellow paper plate.
What shape is this?
Circle
What other things are circles?
Wheels, hoops, plates, pancakes, etc.

Wheels are circles that go around and around.

What is it called when a wheel or circle makes one complete rotation?
It is a cycle. You probably have a bicycle. “Bi” means two. “Cycle” means it goes around and around in complete circles. Bicycles have two circular wheels that go around and around to move you across the ground.

When something goes through a full cycle, where does it end?
Technically, a cycle never ends unless something stops it. In the case of a seed, a butterfly, or a food cycle, a cycle ends where it started and then it has the ability to start over again. We are going to make a sunflower seed to seed life cycle to show how one sunflower seed starts a cycle by producing a plant and ends by producing more seeds that can grow into more plants.

Have the students pick up their sunflower life cycle supplies or distribute one paper plate, a sunflower life cycle pattern, a paint stir stick, half a green napkin, and at least six seeds to each person. Have them use their own scissors, glue, tape, and markers or crayons.
**SUNFLOWER SEED TO SEED CYCLE**

1. Cut around the circular edge of the Sunflower Seed to Seed Cycle and glue it to the inside of the yellow paper plate.
   
   What is the picture at Step 1 of the Seed to Seed Cycle?
   
   It is a seed.
   
   What do you do with the seed to start the cycle?
   
   Plant it in the ground and water it.

2. Glue one sunflower seed to the bottom of the paint stir stick as if you were planting the seed in the ground and the stick was the stem that grew from the seed.
   
   When the seed is watered, what is the next step in the Seed to Seed Cycle?
   
   Hint: Take a look at Step 2 on the picture.
   
   The seed germinates or sprouts. The roots start first and then the leaves and stem grow up out of the ground.

3. Use a brown marker or crayon to draw roots growing out of the seed on the paint stick. The paint stick becomes the stem that grows out of the ground.
   
   While the small sprout or sunflower plant continues to be fed by the sun, soil, water and air, take a look at Step 3 and tell us what it does next.
   
   The stem and leaves continue to grow. You may begin to see a bud for the flower.
4. Take the green napkin and pinch it together in the middle to form two green leaves. Put tape across the pinched part of your leaves and tape them to the back of your stem or stir stick. **Take a look at Step 4 of the cycle and describe what happens after a sunflower grows a little taller?**
One flower starts to grow on the sunflower plant.

5. Make petals around the yellow paper plate, or sunflower blossom, by cutting slits from the outer edge of the plate to the Seed to Seed Cycle picture. You may want to bend some of the petals to make it look more like a real flower. Then put a strip of tape across the back of the paint stick to hold the flower in place. You may choose to glue the flower onto the stick. Look at your bright, colorful sunflowers. This is usually the favorite step or stage of growing a sunflower. **What happens when the sunflower begins to fade?**
When flowers fade on plants, fruits form. The dried-up flower head is the fruit of a sunflower. It is represented in Step 5 of the Seed to Seed Cycle. **After the sunflower head dries, what is forming in the middle of the flower or fruit?**
Sunflower seeds
**Why is Step 6 written next to Step 1 of the Seed to Seed Cycle?**
The sunflower plant has produced more seeds like the ones in the picture to start the Seed to Seed Cycle over again.

6. Glue several sunflower seeds in the middle of the Seed to Seed Cycle picture. You will see several rows of sunflower seeds in the center of a real sunflower. You may want to show a picture or have a real sunflower head for the students to examine.

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**SUNFLOWER SEED TO SEED CYCLE CRAFT**

We have gone through one complete Seed to Seed Cycle of a sunflower. **How many steps are there in the sunflower Seed to Seed Cycle?**
Six

The sunflower Seed to Seed Cycle also can be called a sunflower life cycle. **How can the Seed to Seed Cycle be the same as a life cycle?**
When a sunflower seed is planted and watered, it starts a sunflower sprout or small plant. The sprout needs sun, soil, water and air to grow and become a healthy larger plant. Then a flower grows on the plant. The flower produces the fruit that contains many seeds. The plant dies, but the seeds from the plant can produce new sunflower plants with more seeds.

Let’s say the steps together: seed, sprout, grow, flower, fruit, seed. **Try this in the stomp, chant and clap activity below. Go through it once slowly, then speed up.**

**STOMP footprint, CHANT “seed,” and CLAP at the same time**
**STOMP foot, CHANT “sprout,” and CLAP at the same time**
**STOMP foot, CHANT “grow,” and CLAP at the same time**
**STOMP foot, CHANT “flower,” and CLAP at the same time**
**STOMP foot, CHANT “fruit,” and CLAP at the same time**
**STOMP foot, CHANT “seed,” and CLAP at the same time**
Germination

Lesson 5

CONTENT OBJECTIVES
Identify simple parts of a seed, Describe how seeds grow, List reasons seed germination is important to the students and others

LIFE SKILL OBJECTIVES
Learning to learn through observing, experimenting, and recording; Responsibility; Critical thinking; Problem solving; Decision making; Communicating with yourself and others

INDICATORS
Accurate completion of the Germination Record activity sheet, Promise statement about what they would do to germinate a seed or grow a plant, Oral and written responses to questions, Completion of paper chain characteristics of seeds, Use of germination tests to decide what seeds to grow

EVALUATIONS

SUBJECT STANDARDS
Science: Life (characteristics of organisms, life cycles of organisms, organisms and environments)
Social Studies: Individual development and identity
Language Arts: Vocabulary, Reading, Factual understanding, Main idea, Interpreting, Inferring, Sequencing, Summarizing, Writing
Math: Number and operations, Measurement, Data analysis and probability, Connections, Communication

LEARNER TYPES
Linguistic-words, Logical-mathematical, Spatial-visual, Bodily-kinesthetic, Interpersonal, Intrapersonal, Natural

MATERIALS
A Seed is a Promise by Claire Merrill (optional or use the summary in the Optional Activity Ideas found at the end of this lesson, see the Introduction section)
Dry lima beans (from grocery store, two per student; see the Do/Reflect Part 1 section)
Container or zip-closure bag (to soak the lima beans, see the Do/Reflect Part 1 section)
A Seed is Sleepy by Dianna Hutts Ashton
Strips of colored paper (at least six per student to write one word and to form into a paper chain, see the Do/Reflect Part 1 and Apply sections)
Germination Record activity sheet (copy one per student and one transparency, found at the end of the lesson)
MATERIALS LIST continued on next page
MATERIALS continued
Overhead projector
Egg cartons (one per group of three students)
Potting soil (enough to fill egg cartons)
Scoop (something to scoop soil into the egg cartons)
Plastic spoons (one per group of three students)
Disposable plastic plates (one per group of three students plus three more)
Garden bean seeds (from garden store, approximately ninety; see the Do/Reflect Part 2 section)
Three different varieties of green bean seeds (from garden store, see the Apply section)
Pencils or pens
Rulers
Tape or staples and stapler (to complete paper chain)
Absorbent paper towels
3 clear plastic gallon-sized bags

INTRODUCTION

ENGAGE
SET THE STAGE
5 TO 10 MINUTES

Social Studies:
Individual development
and identity
Life Science:
Characteristics of organisms,
Life cycles of organisms,
Organisms and environments
Language Arts:
Reading, Vocabulary,
Factual understanding,
Main idea, Interpreting,
Inferring, Sequencing,
Summarizing

TEACHER’S NOTES: You may want to start this section by reading A Seed is a Promise by Claire Merrill. If you are unable to find the book, there is a short summary in the Optional Activity Ideas found at the end of this lesson.

Raise your hand if you ever promised someone something.

What are some of the promises you made?
What did you have to do or not do after you made the promise?
Could you keep your promise?
Why not?

What is a definition of a promise?
According to Webster’s New World Student’s Dictionary, Revised Edition, 2006, a promise is “an agreement to do or not to do something.”

How is a seed a promise?
If seeds are given the right conditions of sun, water, soil and air, they promise to try to grow into the plant that they came from. Seeds assure us that the species of that plant will continue on.

What kind of promises can seeds make to farmers or gardeners?
Their promises are that they will grow and produce crops if other factors or forces don’t interfere. Farmers and gardeners can use the crops to feed their families.

Can it take a long time for a promise to be fulfilled?
Yes, it might take an oak tree a few months to germinate and nearly 20 years before it is large enough to provide much shade or produce acorns.
GERMINATION BASICS

**TEACHER’S NOTES:** Soak enough dry lima beans at least an hour in warm water so that each student can examine two bean seeds.

Besides being a promise, seeds are many other things. Together, we are going to read *A Seed is Sleepy* by Dianna Hutts Aston. I am passing a strip of paper to each of you and after you have read a section in the book, write the descriptive word about seeds on your strip of paper. I’ll show you what I mean by writing the word “promise” on my strip of paper.

Pass the book around the room and have each student read one section or description such as “A seed is sleepy.” Write the descriptive words on the board as they read them. Have the student write the word that he/she read on his/her strip of paper.

After reading the story, use the questions and answers below and have each student read the word on his/her strip of paper and discuss what the word means. Then have the students put their strips on the corner of their desks to return to later.

Let’s see if we remember why a seed is all of these things:

**Why is a seed (a) ... Promise?**  
*Every plant is a chance to grow into a plant like the one it came from.*

... Sleepy?  
*Seeds don’t germinate until conditions are just right.*

... Secretive?  
*Seeds don’t reveal themselves too early. It may take several years before some seeds germinate.*

... Fruitful?  
*Most plants are flowering plants that produce fruits that contain seeds.*

... Naked?  
*Some seeds hide in scales on cones rather than in fruit.*

... Many sizes?  
*Some seeds are very tiny, almost microscopic; others are very large.*

... Adventurous?  
*Some seeds have mechanisms that help them move with a breeze or float in water.*

... Inventive?  
*Some seeds have mechanisms that help them stick to things or survive after they have been eaten. This helps them move from one area to another.*

... Generous?  
*Seeds have a “coat” that protects the embryo, and seed leaves have the food to feed the baby plant before it emerges.*

... Ancient?  
*Seeds can live a long time and still germinate.*
Why is a seed ... Thirsty?
(Seeds need water to grow.)

... Hungry?
(At first seeds use their own nutrients or food to grow. When a plant starts growing its own leaves above the ground, it needs nutrients from the soil.)

... Clever?
(Plants make their own food through photosynthesis.)

Distribute copies of the “Germination Record” activity sheet located at the end of the lesson and give each student two soaked bean seeds. Use the transparency copy or draw an outline of a bean seed on the board and proceed with the following discussion.

Take a close look at your bean seed. The clear “skin” on the outside of the seed is called the **seed coat**. It is stuck tight to the seed when it is dry and serves as a protective covering for the baby plant. When the seed coat softens in moist soil or water, it allows water into the seed, enabling the seed to begin growing. The seed coat may be thin like on this bean seed or very thick like a coconut. Draw the seed coat on the bean seed picture. Draw a line to the seed coat and label it. (*Do the same on your transparency or drawing.*)

You may want to refer to the diagram on this page or the cross section of the bean seed in *A Seed is Sleepy* by Dianna Hutts Aston.

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**What color are the cotyledons when they are in the seed?**
They are white. When the cotyledons or seed leaves grow above the soil surface and are exposed to the sunlight, they change colors.

**What color do the seed leaves become when they are above the ground and in the sun?**
Green

**Why?**
The chlorophyll in the cotyledons starts working, causing them to turn green. We will learn more about that in a lesson about photosynthesis.
On the inside curve of the bean seed you will see a tiny plant called the **embryo**. The embryo has a root, stem and leaves. Draw the embryo on your seed picture and label the root, stem and leaves. (*Do the same on your transparency or drawing.*)

When water is present, the seed coat will soften and water will soak into the cotyledons. The embryo soaks up some of the water and starts to grow. The root is the first part of the embryo to grow. It stretches out and pushes its way through the softened seed coat. The stem and leaves of the embryo then push out of the seed coat and grow up. The cotyledons on some plants such as beans grow above the soil. They stay in the soil on other plants such as corn.

Think about the story we read and your bean seeds to answer these questions.

**Why is a seed a promise?**
Every seed is a chance to grow into a plant like the one it came from.

**What things are needed to make this promise happen?**
Water, soil, air, light

**What are some reasons that seeds might not be able to fulfill their promise to grow into plants?**
The seeds may not have developed properly or have been injured by drying out, rotting, poor soil conditions, insect damage, animals ate them, etc.

**Why are ancient seeds able to sprout after thousands of years?**
They had been stored in a cold, dry, dark place. To preserve the species of certain plants, unique and rare seeds are stored in special rooms such as at a government facility near Iowa State University and at Seed Savers in Decorah, Iowa.

Seeds are like tiny time capsules. The seed is a time capsule that opens as soon as the conditions are right. For some seeds, this can be as soon as there is moisture present. Many seeds of perennial plants, such as trees and shrubs, need a few months of cold temperatures before they will sprout and grow. This prevents these seeds from spouting in the fall and the new, young plants from being killed by freezing temperatures.

Seeds of some plants need to pass through the body of a bird or animal before they will germinate. The acid in the stomach of the animals softens the seed coat that protects the embryo. Once the seed passes through the animal, it is able to take up moisture and sprout.

Some seeds live a very long time, waiting for the right conditions before they start to grow. Seeds might be considered the “resting stage” of a plant. Seeds of lotus, a water plant, have germinated more than 200 years after falling from their mother plant. Seeds of beans and squash have been found in ancient ruins that were more than 500 years old. They were like time capsules that were opened hundreds of years later!

**If a seed coat is very hard and solid, what can you do to that seed to make it grow faster?**
Soak it in water for a while. Use a file, such as a nail file, and file a small spot through the seed coat so that water can enter.
GERMINATION EXPERIMENT

Divide the class into groups of three. Give each group an egg carton and twelve bean seeds. Have the students scoop potting soil into the cells of the egg carton and plant one bean seed 1/4 inch deep in each cell. With a pencil have them number the cells on the lid from one to six. Have them water the soil well and set the egg carts in a location that receives bright light.

Two days after planting, have the students predict what the seeds will look like. Then have the students use plastic spoons to carefully dig up the seeds in the two cells labeled “1,” put the bean seeds on a plastic plate, and look at them. The students should document the growth of their bean seeds on the “Bean Seed Growth Chart” found on their “Germination Record” sheets.

Four days after planting, have the students dig up the seeds in the two cells in row two, look at them, and record their findings on the “Bean Seed Growth Chart.”

Six days after planting, have the students dig up the seeds in the two cells in row three, look at them, and record their findings. They should measure any root growth that has occurred.

The students should continue digging, measuring and recording their findings until all the seeds have sprouted.

On the board, use the germination record from one group to plot out the growth rate of the bean plant, with number of days on the bottom (“Y” axis) and the length in centimeters or fraction of inches on the vertical (“X” axis). Plot out the root growth before plotting out the shoot growth. It should show a slow start and then more rapid growth with the root emerging first. In other words, the line curving up on the graph shows that once the seeds started to grow, they grew quickly.

Did the seeds change in size after only 2 days?
Yes.

How and why did they change?
They got larger because they absorbed water.

What was the first part of the young plant to break out of the seed coat?
Root

How many days did it take before you saw the seedlings above the ground?

What grew faster and longer on the young seedlings, the root or the stem?
Root

Why do you think the roots were the first thing to grow when the seeds germinated?
Roots absorb water and nutrients for the other parts of the plant.

Were the cotyledons above or below the soil after the young plant came out of the soil?
Above
What color were the cotyledons after they emerged from the soil?
Green

I am going to ask you a few questions and if you think the answer is “live,” raise your hand. If you think the answer is “die,” keep your hand in your lap.

**If a seed is given enough water to sprout and then it dried out, would it live or die?**
Die, because it started growing and can’t go back to “resting”

**If a seed is soaked in a glass of water for a week or two, would it live and grow or die?**
It didn’t get any oxygen so it will probably rot and die.

**If a seed is kept at a uniform temperature and in a dry location for a hundred years, would it still be alive and able to grow if given the right conditions?**
Depending on the species, yes, it would be alive.

*Have the students give you their Germination Record sheets so that you can evaluate accuracy and completion. Read them prior to doing the Apply section so that if you need to review, you can do so.*

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**PROMISE STATEMENTS**

Seeds need the right conditions to fulfill their promise to grow.

**What do you need to do to keep your promises?**
Let’s refer to the steps or actions you need to follow to keep your promises as your “action plans.” Give some examples of promises you’ve made and your action plans to keep those promises.

**What happens when a seed is unable to keep its promise?**
The plant does not grow. Farmers and gardeners won’t buy that variety of seeds because they want seeds they can depend on.

**What happens when you are unable to keep your promise?**
What you promised does not happen. The people you promised something to may think you are not responsible to keep your promises and lack of trust may break down your relationship.

**What happens when a seed is able to keep its promise?**
A plant grows and produces food, clothing, shelter, beauty, and thousands of products. Everyone is happy.

**What happens when you are able to keep your promise?**
Whatever you promised happens. People will think you are responsible and trust that you will do what you say. Everyone is happy.

*Have the students write a promise about what they would do to germinate a seed or grow a plant. Have them start with their name. Examples include: “Jessica promises to follow the seed packet directions for planting flowers.” “John promises to plant the tomato plant in a place where there is plenty of light, and he promises to keep it watered.” Underneath your promise, write an action plan or what you have to do to keep your promise. Then conclude with what you expect to happen after you have fulfilled your promise.*

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**APPLY**

**EXPAND**

**ELABORATE IN A NEW WAY**

20 MINUTES,
10 MINUTES WHEN SEEDS SPROUT

**Life Science:**
Characteristics of organisms,
Life cycles of organisms,
Organisms and environments

**Social Studies:**
Individual development and identity

**Language Arts:**
Writing, Vocabulary,
Interpreting, Inferring,
Sequencing

**Math:**
Number and operations,
Data analysis and probability,
Connections, Communication
Paper Chain Characteristics of Seeds

Distribute at least four or five more strips of paper to each student.

Do you remember what a seed needs to fulfill its promise to grow?
Think about what you plant a seed in and what you do to get it to grow. There are four natural resources that both plants and animals, including you, need in order to grow. Write one or two of the natural resources on your strips of paper. (Sun, soil, water, air)

The author of the book A Seed is Sleepy used many descriptive words to teach us about seeds. You wrote one of the words on a strip of paper.

What else do you know about seeds?
Write one thing you know about seeds on each strip of paper. Consider what we read in the book and think about the seeds you see, the ones you eat, the many uses of seeds, what seeds grow into, what seeds need to grow, how they grow, and so on. Put your initial in the corner of each strip of paper you write on.

When they are done with writing what they know about seeds, attach all their answers together into a paper chain. Put it up in the room. See how big you can make it grow by proceeding with the following discussion.

Think about what you wrote and how long our chain is and answer the question, “How important is seed germination to you?”
(Go around the room and ask the students to answer the question based on what they wrote on their pieces of paper. Possible answers include: seeds grow the plants I eat; the trees we use for shelter or paper; the plants we use for clothing; the plants that produce food for animals; seeds are used for ethanol, soy diesel, corn syrup, salad oil, and thousands of other products; seeds are essential to growing more of the same kind of plant; growing and selling seeds are ways of making an income for a family; seeds make pretty flowers; seeds make nutritious foods; and so on.)

How important are seeds to our state and country?
Seeds have a huge effect on food and energy production for the United States and the rest of the world. We feed seeds to livestock such as pigs, cattle, dairy cows, sheep, laying hens, turkeys, horses, and goats here and around the world. Seeds are ingredients in thousands of products we use. Seeds produce biofuels such as ethanol and soy diesel to run our vehicles. Internationally recognized seed companies, such as Pioneer in Johnston, Iowa; they develop seeds that can be grown in a variety of soils and climates. Seeds bring millions of dollars into our economy. (You may want to add more links or papers to your chain or line.)

Garden Decisions

Let's pretend that we want to decide what kind of green bean seeds would grow best in this year's garden.

What is the first thing we could do to help us make a decision on what green bean seeds to buy?
Read the packet to determine characteristics of the green bean plant that grows from the seeds. (Pass sample packets of green beans around and ask the students to read any descriptions and length of time from planting to harvest.)
We could also conduct a germination rate to see how many seeds keep their promise to grow in each of the three varieties of green bean seeds.

Put ten seeds of one variety of green beans on a damp, absorbent paper towel on a plastic plate. Put another damp paper towel over the seeds. Put the plate of seeds in a clear plastic bag and seal it. Tape the name of the variety and the number of seeds on the top of the bag. Repeat for the other two varieties of green beans. Set the bags in a location that receives indirect light. Have the students predict how many seeds will germinate. Write their guess on the tape label on each variety.

After 5 days, check the seeds. Depending on the variety, it may take a week or 10 days for the seeds to germinate. Count the number of seeds that sprouted. Compare the number that germinated with the students’ predictions. Calculate the fraction or percent germination.

Were there differences in the germination percentages between varieties?

Based on the germination test and what you read on the packets of seeds, which seeds would you choose to plant in your garden and why?
Have the class discuss it in small groups and share their consensus with the rest of the class.

Why is the rate of germination important to farmers?
If there isn’t a good germination rate in the field, the farmers’ yields go down. Farmers have actually used this test to decide what kind of seeds to grow in their fields.

Would the way the seeds are stored affect the germination rate? Explain your answer.
Yes. For example, the lupine seeds from A Seed is a Promise by Claire Merrill were stored in a cold, dry, dark hole in the ground where there was a constant cool temperature and no moisture to start the germination process. As long as the seeds are kept in a constantly cool, dry, dark environment, they will not germinate. Those seeds may germinate once they are placed in the right conditions of air, water and light. If seeds are stored in moist or wet places, they will not germinate; instead, they will mold and decompose.

Would having more seeds give us a better indication of the germination rate?
Yes. Farmers and scientists conduct germination tests using many seeds so that the results of the tests can be as accurate as possible.
OPTIONAL ACTIVITY IDEAS

MORE READING AND DISCUSSION

A SEED IS A PROMISE by Claire Merrill

Have the students read aloud A Seed is a Promise by Claire Merrill. If you are unable to locate A Seed is a Promise by Claire Merrill, here is a brief review, focusing on the parts that are pertinent to this lesson. You may choose to have a student(s) read the review.

A Seed is a Promise reminds us that we already know a lot about seeds. Seeds come from plants, and in every seed there is a promise that a new plant will grow, the same kind of plant that the seed came from. Seeds form in flowers of plants and travel away from the plant in a variety of ways. All seeds start with a chance to grow, but there are lots of reasons that they might not. You can find a tiny baby plant starting inside of seeds such as lima beans. As long as the tiny plant stays alive, there’s a chance that the seed can keep its promise. The author gives an example of ancient seeds found in northern Canada. A miner was digging and found some old animal burrows with bones and tiny seeds. Scientists discovered that the bones were from small burrowing lemmings that probably stored the seeds for food. The cold ground preserved the bones and seeds for thousands and thousands of years. Scientists used special wet papers to get the seeds to sprout and grow. The seeds had kept their promise.

The seeds that the miner found were thought to be between 10,000 and 15,000 years old. They grew into plants called Arctic lupine, which have tall spikes of flowers. You can buy and plant a variety of the lupine plant to grow at your home.

What did the miner find in the frozen earth in northern Canada?

Seeds and bones that were thousands of years old

Why were the seeds buried next to the lemmings’ bones?
The lemmings may have stored the seeds for food in their burrow.

What did the scientists do with the seeds?
They tested them to see if they would germinate.

What happened to the seeds they tested?
They sprouted after being underground for thousands of years.

Describe ways that seeds are like promises.

“BANKING ON SEEDS”
You may want to do the “Banking on Seeds” lesson from Project Food, Land and People: Resources for Learning. See the Resources section for more information.

REFERENCE AND RESOURCES

REFERENCE

RESOURCES


# Germination Record

## Bean Seed Diagram

![Bean Seed Diagram](image)

## Bean Seed Growth Chart

<table>
<thead>
<tr>
<th>DAYS AFTER PLANTING</th>
<th>OBSERVATION (measure root and shoot growth)</th>
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