

SOWING SEEDS: THE BEGINNING OF THE FAST PLANT LIFE CYCLE

 GRADES 3-4
 PATTY FRASER

TIME ALLOTMENT: Six 50-minute classes.

OVERVIEW:

This is the first of three lessons focusing on *Wisconsin Fast Plants™*. Students will explore, research and discover, fast plant's basic needs, the parts of a seed and observe their beginning growth patterns and life cycles. *Wisconsin Fast Plants™* are flowering plants that progress through their complete life cycle (germinate, mature and go to seed) in about 40 days, allowing the students to observe each stage of growth and development first-hand. Students gain an understanding of the characteristics of living organisms and their relationship with and dependence upon their environment.

During this lesson students will plant seeds, observe and tend plants. They will learn the major plant parts, how to germinate and troubleshoot problems with plants; and, that plants need water, light, and soil nutrients to thrive. A concept map will be created noting prior and current knowledge and a *Plant Growth Data Log* will be used to chart growth, observations, predictions, experimental variables, and personal reflections. Digital photos will be taken throughout the lesson to document the various stages of the plant's life cycle. By the end of this lesson students will have experienced the scientific processes of observing, communicating, comparing, and sequencing. Lesson 2, *Just Bee-tween Flowers!*, picks up with interdependency between bees and *Brassica* plants, while Lesson 3, *Flowers, Pods and Seeds*, brings the life cycle of fast plants full circle.

Concepts

- Many plants follow a life cycle that begins with growth from a seed and proceeds through the production of seeds.
- Plants have distinct stages in their life cycle.
- To live and grow, plants need light, water, and nutrients from the soil.

SUBJECT MATTER: Science, Mathematics,
Language Arts

LEARNING OBJECTIVES:

Students will be able to:

- Observe and describe a number of seeds.
- Plant and care for *Wisconsin Fast Plants™* (*Brassica rapa*) throughout their life cycle.
- Observe, describe and record changes in plants.
- Compare and discuss changes occurring in plants over time.
- Measure, record and chart growth of plants.
- Graph and compare growth patterns.
- Predict future growth from observations and measurements.
- Identify parts of a plant.
- Discuss major needs of plants.
- Read to learn more about plants.
- Communicate results and reflect on experiences through writing, drawing and discussion.
- Develop interest in studying the life cycle of plants.
- Develop sensitivity to the needs of plants
- Chart growth of plant in **Microsoft® Excel®** or other spreadsheet program appropriate for this age.
- Recognize how plants are a benefit to people and our planet.



STANDARDS:**Louisiana Science Content Standards:**

State Standards for Curriculum Development

<http://www.doe.state.la.us/doe/assessment/standards/SCIENCE.pdf>

SCIENCE AS INQUIRY

The students will do science by engaging in partial and full inquiries that are within their developmental capabilities.

Benchmarks K-4

The abilities necessary to do scientific inquiry

SI-E-A1: Asking appropriate questions about organisms and events in the environment;

SI-E-A2: Planning and/or designing and conducting a scientific investigation;

SI-E-A3: Communicating that observations are made with one's senses;

SI-E-A4: Employing equipment and tools to gather data and extend the sensory observations;

SI-E-A5: Using data, including numbers and graphs, to explain observations and experiments;

SI-E-A6: Communicating observations and experiments in oral and written formats;

SI-E-A7: Utilizing safety procedures during experiments.

LIFE SCIENCE

The students will become aware of the characteristics and life cycles of organisms and understand their relationships to each other and to their environment.

Benchmarks K-4

LS-E-A1: Identifying the needs of plants and animals, based on age-appropriate recorded observations;

LS-E-A2: Distinguishing between living and nonliving things;

LS-E-A3: Locating and comparing major plant and animal structures and their functions;

LS-E-A4: Recognizing that there is great diversity among organisms;

LS-E-B1: Observing and describing the life cycles of some plants and animals;

LS-E-B2: Observing, comparing, and grouping plants and animals according to likenesses and/or differences;

LS-E-B3: Observing and recording how the offspring of plants and animals are similar to their parents;

LS-E-C3: Observing animals and plants and describing interaction or interdependence.

MEDIA COMPONENT:**Video:**

- **TEAMS Life Science: *Fast Plants, Episode 1 - Planting Fast Plants™***
- ***Debbie Greenthumb: How Plants Grow***

Audio:

- ***Roots, Stems, Leaves*** by Banana Slug String Band
- ***Sun, Soil, Water & Air*** by Banana Slug String Band
- ***Everything Grows*** by Raffi

Web sites:

unitedstreaming™ (for teacher) <http://www.unitedstreaming.com> A wealth of free video clips for educational use can be found here. It is recommended that clips be downloaded to a CD.

Wisconsin Fast Plants (for teacher) http://www.fastplants.org/home_flash.html University of Wisconsin offers information on ordering, planting and developing knowledge about *Wisconsin Fast Plants™*

Wisconsin Fast Plants: Life Cycle of Fast Plants http://www.fastplants.org/resources/life_cycle.html Click here to view a diagram of the Fast Plant life cycle and read about the steps and what is expected at each.

Carolina Biological Supply Company (for teacher) <http://www.carolina.com/fastplants/default.asp> Carolina Biological Supply Company supports the study of Fast Plants with its many resources. You can find an overview of the STC Plant and Development Kit, ordering information and miscellaneous articles.

The Great Plant Escape - Case 3; Is it Dust, Dirt, Dandruff or a Seed? & Facts of the Case, All About Seeds <http://www.urbanext.uiuc.edu/gpe/index.html> An award winning site developed by the University of Illinois Extension offers a hands-on tutorial about plants, complete with quizzes.

Teams Electronic Classroom (for teacher)

<http://teams.lacoe.edu/documentation/classrooms/classrooms.html> Click on Judi's classroom sign to learn about Life Cycles or Gary's classroom sign to learn about Fast Plants. Both sites have additional resources and links to join a Fast Plant TEAMS Science Project.

Cool Science for Curious Kids - Meet the Plant Parts

<http://www.hhmi.org/coolscience/vegquiz/plantparts.html> Build a virtual salad using roots, stems, leaves and flowers

Science is Cool – Plants Unit

http://www.somers.k12.ny.us/SIS/MAIN/sis/research/gr4links/plants_gr4/plantinfo.html Somer's Intermediate School educators developed this attractive and easy to read plant unit. Information about the parts of a seed, plant, flower and plant classification can be found here.

Hardware:

- TV
- Computer(s)
- Printer
- Digital camera
- Disks
- Internet connection

Software:

- Concept mapping program (**Kidspiration**®, **Inspiration**®)
- Graphing program (**GraphClub**®, **GraphMaster**™, or **Microsoft**® **Excel**®)
- **Microsoft**® **Office Suite** (**Microsoft**® **Word**®, **Microsoft**® **PowerPoint**®, **Microsoft**® **Excel**®)

MATERIALS:

Non-consumables:

- 1 squeeze bottle (to water plants)
- 1 pkg (500) snap-together centimeter cubes
- 15 centimeter rulers
- 15 forceps (tweezers)
- 15 magnifying lens
- 1 lighting system
- 30 styrofoam meat trays
- 3 water mats (or other watering system)
- 3 water tanks w/lids

Consumables:

- 15 paper/plastic cups
- 15 plastic droppers
- 3 pcs. felt, copper sulfate squares (optional to control algae growth)
- 1 pkg. slow release fertilizer pellets
- 1 pkg. lima beans
- planter quads (1 per student + 4 extra)
- 50 popsicle sticks or plant labels
- 1 bag potting soil
- 15 plastic spoons
- 60 stirrers
- 1 pkg. toothpicks
- 120 wicks
- 1 pkg. Wisconsin Fast Plant™ seeds (100)
- graph paper (optional)
- Art supplies: drawing paper, crayons, glue, scissors
- Sentence strips
- Paper towels
- Sponges
- Whisk broom/pan
- Trash can/plastic bag liners

MATERIALS:*Per Class:*

- 1 container of water
- 30+ extra bean seeds
(extra for students and for experimentation)
- Digital camera, disks
- Extra plant quads or planting containers
- 6-8 sponges
- 2 dishpans of water
- 1 plastic-lined trash can
- 1 dustpan and whisk broom

Per Each Pair or Group of Students:

- 1 hand lens
- 1 pair scissors
- 1 pair of forceps
- 1 cup water and dropper

Per Student:

- *Scientific Notebook (small binder or booklet)*
- *Plant Growth Data Log*
- *Seed Observation Chart*
- Science Journal
- Pocket or accordion folder (to keep notebook, journal, photos together)
- *Planting Wisconsin Fast Plant™ Seeds*
- 2 toothpicks
- 1 dry lima bean seed
- 2-3 soaked bean seeds
- 1 supply tray
- 1 planter quad
- 1 3-ounce cup potting mix
- 12 fertilizer pellets
- 1 spoon
- 4 wicks
- 8 Wisconsin Fast Plants™ seeds
- 1 planter label

CENTER MATERIALS (SUGGESTIONS):

- **Science/Social Studies:** Miscellaneous plants/seeds, pictures of plants, seeds, magnifying lens; local maps, globe, almanac
 - **Math:** Rulers, manipulatives, calculators, scales
 - **Language Arts/Writing:** Writing utensils, paper, crayons
- Note:** Add vocabulary words to word wall as lesson progresses. Suggested words are listed in student materials.
- **Reading/Library:** Variety of books on plants and seeds, pocket chart, poems, etc.

A Seed is a Promise by Susan Swan
A Tree is Nice by Janice May Udry
A Weed is a Seed by Feida Wolff
Anna in the Garden by Diane Hearn
First Comes Spring by Anne Rockwell
Flowers, Fruits, Seeds by Jerome Wexler
From Seed to Plant by Gail Gibbons
Growing Vegetable Soup by Lois Ehlert
Honey Bees by Takeshi Otani
Jack's Garden by Henry Cole
Life of the Honeybee by Heiderose Fischer-Nagel
Planting a Rainbow by Lois Ehlert
Plants and Flowers by Joyce Pope
Seeds and More Seeds by Millicent E. Selsam
The Tiny Seed by Eric Carle
The Carrot Seed by Ruth Krauss
The Giving Tree by Shel Silverstein
The Flower Alphabet by Jerry Pallota
The Honeybee and the Robber by Eric Carle
The Magic School Bus: Plants Seeds by Joanna Cole
The Popcorn Book by Tomie dePoala
The Reason for a Flower by Ruth Heller
The Secret Garden by Frances Hodgson Burnet
Will Spring Be Early? by Anne Rockwell
Wind's Garden by Bethany Roberts

- **Listening/Music:** tape players, headphones, books, tapes
- **Art/Cooking:** scissors, crayons, markers, string, tape, glue, miscellaneous items for art projects; recipe cards, cooking utensils, big old shirts for smocks

VOCABULARY:

plants	seeds
grow	life cycle
Wisconsin Fast Plants™	Brassica rapa
thin	transplant
sprout	germinate
seed coat	seed scar
leaves	embryo
cotyledon	roots
stem	flower
leaf	fertilizer

PREP FOR TEACHERS:

1. Order or collect planting supplies (STC Plant Growth and Development Science kit) either through the local school district, [Carolina Biological Supply Company](#) or [Wisconsin Fast Plants™](#). Additional fast plant information can be found at the [Teams Electronic Classroom](#). Set up a distribution station for supplies and train students to pick up and return to this area.
2. Set up the light house or adequate lighting system for plants. Fast Plants™ are selectively bred to grow under continuous cool white fluorescent lights 24 hours a day. Once seeds are planted, lights **must** stay on. Tape a note by the light “Please do not turn off the lights” as a reminder to the custodial staff about this. Plant tips should always be about 2-3 inches from light bulbs. Set the light at about 16-18 inches high and plants initially 14-16 high. Lower plants as they grow.
3. Prepare and label learning centers. Add activities/items throughout the lesson to keep interest high, children motivated and change accordingly. Following are suggestions.
 - a. *Science/Social Studies*: miscellaneous plants/seeds, pictures of plants, seeds, magnifying lens.
 - b. *Math*: rulers, manipulatives, calculators.
 - c. *Language Arts/Writing*: writing utensils, paper, crayons.
Note: Add vocabulary words to word wall as lesson(s) progress.
 - d. *Reading*: variety of books on plants and seeds, pocket chart (see list).
 - e. *Listening/Music*: tape players, headphones, books, tapes, CDs.
 - f. *Art/Cooking*: scissors, crayons, markers, string, tape, glue, miscellaneous items for art projects; cooking recipe cards, utensils, big old shirts for smocks .
 - g. *Technology*: have Web sites bookmarked on computer(s) so that students do not stray; open desired site prior to lesson.
4. Make and copy all lesson activity sheets for each student. Design and load on all computers the **Kidspiration® Concept Map** template and the **Microsoft® Excel® Plant Growth Data Log**.
5. Bookmark Web sites on each computer. These could also be set up as a Knowledge Hunt, Hotlist or further developed in Trackstar.
6. Set up the materials distribution center.
7. Set up TV, VCR and TV-computer display. **CUE** video(s)/CD to the segment to be viewed for the lesson (copy video clips to CD).
8. When using media, provide students with a **FOCUS FOR MEDIA INTERACTION**, a specific task to complete and/or information to identify during or after viewing of video segments, Web sites, or other multimedia elements.

INTRODUCTORY ACTIVITY:**(Setting the stage)**

1. Display a basket with fresh fruits and vegetables such as apples, avocados, kiwi, pears, peanuts, oranges, jalapeño peppers, tomatoes, an ear of corn, green beans, lima beans and any other fresh seasonal crops. Ask the students: Do you know what each one is? Where did it come from? Can anyone share anything else about the item(s)?
2. After a short discussion, tell the students that today they will begin a study of plants and seeds. During the next few weeks they will be observing the growth and development of special plants. Tell them that Dr. Paul Williams of the University of Wisconsin spent 15 years developing these rapid growing plants. These plants (*Brassica rapa*) are part of the mustard and cabbage family, Cruciferae, and complete their life cycle, from seed to seed, in about 40 days. This is 10 times faster than its ancestors. As a result, these plants are now known as *Wisconsin Fast Plants™*.
3. Tell students that the Crucifer plants have flowers with four petals in the form of a cross or crucifix. Ask them if they can think of any other forms of *Brassica rapa*. Correct answers would be turnips, Chinese cabbage, collards, mustard, broccoli, cauliflower, brussel sprouts and radishes.

4. Have each student silently think about all the plants and seeds around them. Ask them what they *know* about seeds/plants and what else they *would like to know*.
5. Open up a concept-mapping program such as **Kidspiration®/Inspiration®** and begin brainstorming with the children. An example of this is in *Student Materials*. Ask them to tell you what they know; and, as each one answers, you type the response in the area *What I Know*. Continue until a majority has contributed.
6. Then ask the class to tell you what they would like to know about seeds and plants. What questions do they have? Continue as before by typing their responses in the area *What I Would Like to Know*. Save the map to a disk/network. This will be expanded throughout the lesson as students answer additional essential questions. Print a copy and display it in the *Science Center*.

LEARNING ACTIVITIES:

Step 1: What Is a Seed?

Procedure:

1. Provide the students with a **FOCUS FOR MEDIA INTERACTION**. Tell students they are going to watch part of a video about plants and they should listen carefully to what is said about seeds and what they need to grow. (Seeds are living things that go through the following stages of development: growth and development, reproduction and death. Starting as seeds, they sprout and develop into adult plants capable of reproducing and spreading new seeds. Seeds need soil, water, air, light, warmth and nutrients to grow.)
2. **INSERT** the CD, *Debbie Greenthumb, How Plants Grow*. **CUE** CD to the beginning. **PLAY** the CD. **STOP** the sequence when Debbie says, "Remember, the two large cotyledons provide the food until the plant is large enough to make its own food."
3. Check for comprehension by asking questions such as, "What do you think caused the bean to sprout? What are some reasons a seed might not sprout? What happens to seeds that don't sprout?"
4. Discuss with students how scientists use their five senses to study and observe as well as use equipment such as hand lenses or microscopes to enhance their senses. Tell students they will explore as scientists do by using their eyes, nose and fingers to observe dry bean seeds and that tasting is not permitted in this unit.

NOTE: At some time you need to show students the distribution station and explain that they will be responsible for picking up and returning supplies to this area. You might want to also tour the learning centers and show the students the new items, books, displays and activities.

5. Ask student helpers to pass out the materials.
6. Ask students to observe the seed and record their findings on the *Seed Observation Chart*. Demonstrate how to use the hand lens, and encourage each to *touch* and *smell*, but not *taste* the seeds. Tell them that this is how scientists investigate and explore. Instruct them to identify the senses that helped them, such as touch, smell, feel. Ask them to *touch* the seed. Is it dry, smooth? *Smell* the seed. Does it have an odor? Explain to them that they are going to record their observations of the *dry* seed and compare it to one that has been *soaked* in water. As they record their observations, instruct them to think and identify the different senses that contributed to the answer. Record their observation using descriptive words in the proper space. Some observations may require measuring the seed. How can you do this? Answer: with a centimeter ruler, cubes or trace around the seed.
7. Demonstrate to class how to use a *digital camera* and how/where to save their files. I suggest that each child have a personal folder on a shared network and files kept there. Explain to the students that the camera is to be used throughout the lessons to document the stages/timeline of plant growth and lesson activities. Photos will be used later in a culminating project in the lesson, *Flowers, Pods & Seeds*. Instruct the students to take photos throughout the lesson and return the camera to the distribution station.
8. Students return lens to distribution table and put the *Seed Observation Chart* in their pocket folder and keep the *Plant Growth Data Log* in their *Scientific Notebook*. Each is to put his/her dried bean in the container of water. Explain that these will soak overnight (no more than 24 hours as they will

begin to ferment and smell). Add 30+ extra beans to the container making sure that the seeds are completely covered in water.

9. Encourage the children to make predictions. Explain that a prediction is much more than a guess. It is based on observations, experience, or scientific reasons. Students should be able to give reasons whenever they make predictions.
10. *Journal Activity:* Can be done in science journal or on computer. Record your prediction: *What I Think Will Happen to the Soaked Seeds. Why?* Give supporting reasons.

Center suggestions:

Science/Social Studies: Observe miscellaneous plants/seeds, walk around school and gather seeds.

Math: Measure plant height, leaf and seed size, weigh seeds, compare and contrast specimens.

Language Arts/Writing: Write vocabulary words in science notebook and use each one in a sentence.

Reading: Informal viewing/reading of books in center.

Listening/Music: Listen to book on tape.

Art/Cooking: Make a collage of seeds.

Extensions:

Ask students to:

- Survey seeds around the house and home. How many different kinds of seeds can they find?
- Bring in seeds for the science center.

Step 2: What is Inside a Seed?

Procedures

NOTE: Teacher rinses the lima bean seeds that have been soaking since yesterday. Do NOT soak more than 24 hours.

1. Background information: A seed is protected by an outside coating called the seed coat. Inside there are two main parts: the embryo, an undeveloped plant, and the seed's food supply, a thickened leaf called the cotyledon. Even though the embryo is a tiny baby plant, it has all the parts of a mature plant. The cotyledon contains the nutrients necessary for the initial underground growth of the plant until the plant has broken ground and developed leaves. At that time photosynthesis begins and the plant can manufacture its own food.
2. Ask student helpers to pass out the materials.
3. Review their observations from the previous day and discuss how their senses were used to gather information. Ask several children to share their predictions with the class.
4. Instruct students to begin observing the soaked beans, measure, photograph and record the new information on the *Seed Observation Chart*. Is there any difference between the dry and wet bean? Some students may say the bean is wet, soft, has an odor or has swelled. What other changes have taken place? Can you explain why? How close was your prediction? Inform them that predictions are never really right or wrong, but are just thoughts about what we think will happen.
5. Explain to the students they are to dissect the bean by removing the seed coat and gently prying open the bean. Tell them that the place where the seed was attached to the pod of the parent plant is called the seed scar. It is easier to open the seed from the opposite side. Ask, can you find the embryo, the cotyledons, stem, leaves?
6. Ask each child to dissect another seed to see if the findings are the same.
7. Instruct each child to photograph, draw and label the dissected bean on the *Seed Observation Chart*.
8. Ask students to return supplies to distribution station and inform them that during the next part of the lesson they will plant the *Brassica* seeds.
9. *Journal Activity:* Can be done in their science journal or on a computer. Record the results of your prediction. Explain why your prediction was close or not.

Center suggestions:

Science/Social Studies: Look through an almanac to determine best time to grow tomatoes and cucumbers in your area, consult seed catalogs, either paper or online to learn about the different varieties and planting times.

Math: Determine how many plants you will need, the cost for supplies and what size area you will need for planting.

Language Arts/Writing: Write a list of supplies needed to plant your garden or complete a Venn diagram comparing and contrasting the dry/wet seed.

Reading: Informal viewing/reading of books, catalogs in center .

Listening/Music: Listen to a book on tape or one of the Banana Slug or Raffi tunes.

Art/Cooking: Draw a picture of your garden and plants.

Technology: Visit the Web site, [The Great Plant Escape](#), and complete *Case 3, Is it Dust, Dirt, Dandruff or a Seed? & Facts of Case, All About Seeds.*

Step 3: Planting the Seed: The Life Cycle Begins (Day 1)**Procedures**

NOTE: Prior to planting, the teacher must set up the lighting system, arrange the watering system and prepare the materials for distribution. Be sure to label each item and write the quantity needed. Additional information may be found at the Fast Plants Web site, <http://www.fastplants.org> or in the STC Plant Growth and Development Teacher's Guide. This will take longer than 45 minutes.

1. Review the basic needs of plants and tell students that they will be planting their *Wisconsin Fast Plant™* seeds today.
2. **INSERT** the video, *Teams Science, Fast Plants #1, Fast Plants.*
3. **CUE** video to the teacher, Mr. Gary Widdison saying, "These plants that we're going to be using are really fascinating."
4. Provide the students with a **FOCUS FOR MEDIA INTERACTION** by asking students to listen while Mr. Widdison explains about fast plants. Tell them you will ask them, Why are they called fast plants? Who is responsible for this species? (Paul Williams) Why do we use them in classrooms? What is the difference between plants and animals? (plants make own food) What do plants need, seeds need? Are they the same?
5. **PLAY** the video.
6. **STOP** when the segment "It's your time - Plants and Seeds Need..." begins.
7. **FAST FORWARD** to the section after the call-ins where Mr. Widdison says: "Let's talk about the water reservoir."
8. Provide the students with a **FOCUS FOR MEDIA INTERACTION** by telling the students to watch carefully how the teacher assembles the water reservoir. Why would you use this system instead of just watering them individually?
9. **PLAY** the video.
10. **STOP** when the segment "It's your time – Preparing for planting" begins.
11. **FAST FORWARD** to the section where Mr. Widdison says: "Now get started with the actual planting..."
12. Provide the students with a **FOCUS FOR MEDIA INTERACTION** by telling the students to watch carefully how the teacher explains the soil preparation and shows how seeds are planted. They will discuss as a group: Why does moist soil help in planting? What can you do to keep the small seeds from falling or blowing away? What does the wick do in the individual quads?
13. **PLAY** the video.
14. **STOP** when the segment, "It's your time – Planting Fast Plants"
15. Tell students that the video segments they have just viewed will be fresh in their minds as they plant their own seeds. Remind them that you will be moving about the room to see if anyone needs help.
16. Divide students into groups of four and assign each group a work area/table. Explain to all how to move through the distribution station to gather their supplies. Remind them that some supplies will have to be shared within the group such as water, droppers, forceps, lenses, but that they will each plant seeds in a quad.

17. Distribute and review the *Planting Wisconsin Fast Plant™ Seeds* instructions. Each student picks up his supplies and one person from each group picks up shared supplies.
18. Students begin planting using the checklist while the teacher circulates around the room.
19. Ask questions such as, What will happen if the seeds are planted too deeply? What will happen if you pour a lot of water in the quad section? Is it necessary to place the quads under the lighting system?
20. Observe, photograph and record findings for *Days 1-3* on the *Plant Growth Data Log*. Have students keep it in their *Scientific Notebook*.
21. *Journal Activity*: Can be done in their science journal or on a computer. Predict what will happen to your seeds during these next few days. Why? Or, write a paragraph about the planting process and illustrate.
22. Check the quads daily for the next few days to ensure that they are moist. If the soil is dark and moist the wicking system is working properly. Just keep the water tanks filled. If not, water plants from the top until the wicking system begins.

Center suggestions:

Science/Social Studies: Plant extra quads of fast plants with different variables such as *no water, no warmth, no light, no soil, different liquid instead of water* (other than water, such as cola, salt water, fertilized water) to serve as a control specimens. In addition, plant several quads of different seeds to serve as a comparison.

Math: Write a statement predicting the growth of your fast plant and use the think-pair-share method to discuss the predictions.

Language Arts/Writing: Write on computer or on paper a story telling how Fast Plants evolved and why they are used in the classroom.

Reading: Informal viewing/reading of books in center.

Listening/Music: Listen to book on tape.

Art/Cooking: Make *Dirt Desert*.

Technology: Visit the site, [The Great Plant Escape](#): and complete *Case 2, Soiled Again!*

Step 4: Thinning and Transplanting (Day 4)**Procedure**

1. Ask students what would happen if a plant did not get the proper amount of food, water, nutrients, light, air or place to grow. After a brief discussion explain to the students that they are going to observe the quads, then thin and transplant the plants that are removed.
2. Allow the students to get their plants/quad and supplies.
3. Students should be given time (15-20 minutes) to visually observe and note the changes/ differences/comparisons of their seedlings on their *Plant Growth Data Log*.
4. Encourage them to look for similarities and differences among the plants. Did all their seeds grow/ germinate? How big are they? Did all seedlings develop equally? How do they compare to the experimental plants? At this time students should also take pictures of their seedlings. As before, photographed images should be saved in the student's folder on the network or saved to a disk.
5. Once the observation time is over, the students may begin thinning. Students may use the toothpick to loosen the dirt around the seedling and the forceps to pull the seedling (roots and all) out of the quad. Another photo moment! Also ask the students to see if they can identify the plant parts in the uprooted seedling.
6. Explain to them that each section of the quad will have only 1 seedling remaining. Each section in the quad will have 1 plant for a total of 4 remaining plants. Those seedlings that have been removed may be transplanted into a section where the seeds did not germinate, planted in one of the extra class quads or given to a classmate. If it is not needed, it may be discarded.
7. *Journal Activity*: Can be done in their science journal or on a computer. Write a short paragraph about the importance/benefits of thinning plants. What do you think would happen if you did not thin your plants? Explain

Center suggestions:

Science/Social Studies: Examine the watering system and explain orally to another classmate how it works and why it is used.

Math: Write a comparison statement about the plants in your quad before you thinned them.

Language Arts/Writing: Write an acrostic poem using the word PLANTS.

Reading: Informal viewing/reading of books in center.

Listening/Music: Listen to book on tape or one of the music CD/tapes.

Art/Cooking: Draw a picture of an overly crowded quad

Technology: Visit the [Team's Electronic Classroom](#) and read about the *Fast Plant project*.

Step 5: Leaves, Stems & Buds: Measurable Growth (Days 5-13)**Procedure**

1. Background information: Remind the class that because the plants are rapid growing, they complete their life cycle in about 40 days. Now that the seeds have germinated and seedlings have surfaced, they will continue the process of documenting the plants growth. Growth is active during the first 18 days and slows drastically after that. Just as boys and girls have growth spurts, so do *fast plants*. This takes place during days 9-13 allowing students to observe, measure, record and photograph dramatic changes.
2. Explain to the class that they are to choose 1 of their 4 plants to observe for this process. After choosing the plant they want to observe, ask each student to move their name label and put it in that quad section.
3. Demonstrate to the class how to measure a plant using the various methods: centimeter cubes, paper centimeter strips, rulers, etc. Stress the importance of placing the measuring device at the same level (base of plant or rim of quad) each time for accurate measurement.
4. Ask students to observe their plant and focus on the leaves closest to the soil. There should be two smooth heart-shaped leaves called *seed leaves*. These were the food-producing cotyledons that were observed earlier when the lima beans were dissected. Ask students to look above the *seed leaves* and look for larger leaves that have a rough texture with wavy, triangular edges. These are referred to as the *true leaves*. Ask them which of the two types will wither, die and fall, the seed or true leaves? (Seed leaves will die.) Explain to students that once the true leaves form, *buds* appear in a cluster at the top of the stem. They will be greenish yellow and will open into a 4-petaled yellow *Brassica* flower.
5. Students will continue to observe, measure, compare, photograph and record the growth process 2-3 times weekly on their *Plant Growth Data Log* for the remainder of this lesson. This process will continue for the remainder of the fast plants' *life cycle*. Two other lessons have been written to extend the study of the stages in the Wisconsin Fast Plant life cycle: *Just Bee-Tween Flowers!* and *Flowers, Pods & Seeds*. Remind them to use their senses and hand lens during observations, compare their plants to the controlled ones and make/record predictions about future growth.
NOTE: Transfer the Plant Growth Data Log entries to an Microsoft® Excel® spreadsheet (or Graph Master™). Students can enter several days' data at one time. It is assumed that the class has had previous experience with graphing.
6. Visit the site, *The Life Cycle of Fast Plants*, http://www.fastplants.org/resources/life_cycle.html to compare your plant's growth. Is your plant healthy? Why?
NOTE: This can be done as a center activity.
7. *Journal Activity:* Can be done in their science journal or on a computer. Since this takes place over several days, there is more than 1 journal activity. Write a short paragraph about:
 - Why do you think plants are different sizes? Explain.
 - When did the growth spurt take place and what evidence backs up your observation?
 - Plan a dinner where you will eat parts of a plant. What choices did you choose for the root, stem and flower?

Center suggestions:

Science/Social Studies: Do You Eat Leaves, Stems, Flowers, Roots? Research various foods you eat to find out from what part of the plant it comes.

Math: Measure other plants in Science center, compare to Fast Plants™.

Language Arts/Writing: Draw seed and true leaves. Label parts.

Reading: Read the [Science is Cool-Plants Unit](#) to learn about the parts of a seed, plant and flower

Art/Cooking: Make a salad using roots, stems, leaves and flowers.

Technology: Visit the site, [Cool Science for Curious Kids-Meet the Plant Parts](#), read about the plant parts that are common ingredients in salads, then make a virtual salad.

CULMINATING ACTIVITIES:

1. Open the **Kidspiration**® concept map and review. Pose the following essential questions to the class.
 - *What does a plant need to grow?* (light, air, temperature, water, nutrients, time, space).
 - *What process do all living organisms have in common?* (life cycle including growth, reproduction, death).
2. While they are thinking, add these concepts to the original concept map. Allow time for group discussion. Expand visual map with student responses to the questions.
3. Save map to disk/network drive. Can print and display in Science Center. This concept map will be expanded in the third lesson, *Flowers, Pods and Seeds*.

CROSS-CURRICULAR EXTENSIONS:**ART:**

- Seed collections
- Rubbings/Tracings
- Create note cards for gifts/personnel use. Use dried flowers, seeds, etc. Cover with contact or laminate.
- Design a collage with seeds/plants/flowers
- Draw (on computer or paper) and label parts of a dissected seed or parts of a plant

COOKING:

- Make a salad (virtual one or with real ingredients).
- Dirt Dessert (complete with gummy worms).
- Vegetable soup (tie in with book).

LANGUAGE ARTS/WRITING:

- Journals.
- Vocabulary word wall.
- Word search puzzles/games.
- Record observations of plant growth.
- Write poem or story describing observations.
- Listen to poems, songs, stories.

MATHEMATICS:

- Measure and chart growth of plants.
- Compare and make predictions.
- Chart, graph, measure circumference of tree trunk.

MUSIC:

- Listen to books, poems on tape and songs, etc.

SCIENCE/SOCIAL STUDIES:

- Research to learn what plants grow best and when in specific geographical zones.
- Consult almanac to determine best time for planting and harvesting.
- Chart local weather using *Weather.com* to find temperature and precipitation averages.
- Plan, design and plant a school or home garden.
- Collect and label seeds/flowers/leaves .
- Plant a tree – Arbor Day celebration.

TECHNOLOGY:

- Digital photos of life cycle (decide on timeframe – weekly).
- Draw life cycle of plant KWL, Venn diagram (cause/effect), (compare/contrast).

COMMUNITY CONNECTIONS:

- Ask an expert.
- Consultants to speak to class, Baton Rouge Green.
- Field trip to local nursery, Hilltop Arboretum.
- Make nature stationary/cards/frames to bring to the homebound, hospital, nursing homes.
- Neighborhood planting.

STUDENT MATERIALS:

See attached:

- **Kidspiration® Concept Map Template** (file)
- **Fast Plant™ Vocabulary** Word List
- **Plant Growth Data Log** (file)
- **Experimental Values** (file)
- **Science Journal Template** (file)
- **Seed Observation Chart**
- **Planting Wisconsin Fast Plant™ Seeds**

NOTE:

This lesson (unit) correlates to the East Baton Rouge Parish Science Kit, STC *Plant Growth and Development Science Kit*.

Plant Growth and Development

Science and Technology for Children

National Science Resource Center

Smithsonian Institution – National Academy of Sciences

Arts and Industries Building, Room 1201

Washington, DC 20560

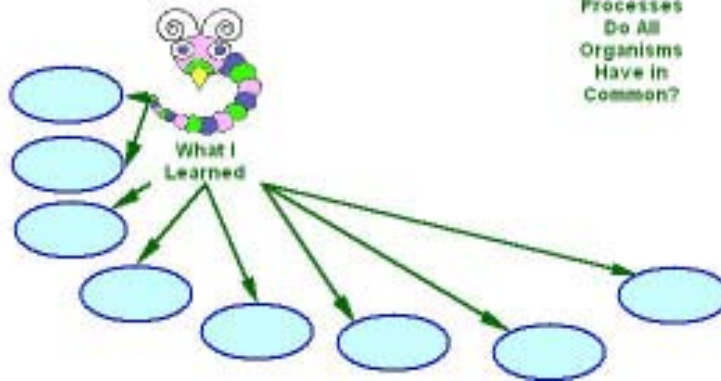
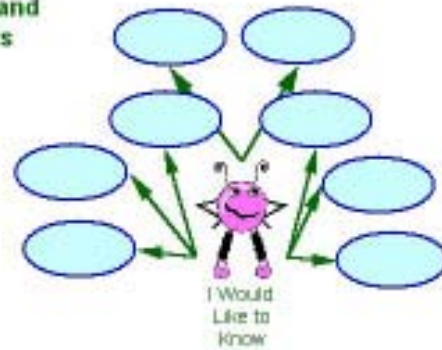
C1991 National Academy of Sciences

Published by Carolina Biological Supply Company

Kidspiration Concept map template



Seeds and Plants



Fast Plant™ Vocabulary



plants

seeds

grow

life cycle

Wisconsin Fast Plants™

Brassica rapa

thin

transplant

sprout

germinate

seed coat

seed scar

leaves

embryo

cotyledon

roots

stem

flower

leaf

fertilizer

true leaves

growth tip

photosynthesis

petal

anther

stigma

pistil

stamens

sepals

pollination

pollen

seed pod

harvest

thresh

Plant Growth Data Log

Age of Plant	Date	Height in cm	Observations	Predictions/Problems	Photos
Day 1					
Day 3					
Day 5					
Day 7					
Day 9					
Day 11					
Day 13					
Day 15					
Day 17					
Day 20					
Day 23					
Day 26					
Day 29					
Day 32					
Day 35					
Day 38					
Day 41					

Experimental Values

	No Soil	No Water	No Loght	No Warmth	Different Liquid	None - My Plant
Day 1						
Day 3						
Day 5						
Day 7						
Day 9						
Day 11						
Day 13						
Day 15						
Day 17						
Day 20						
Day 23						
Day 26						
Day 29						
Day 32						
Day 35						
Day 38						
Day 41						

Science Journal template

These are the journal topics (lessons 1-3) if not completed in a written science journal.

Date	Journal Topic	Response
	Record your prediction: <i>What I Think Will Happen to the Soaked Seeds. Why?</i> Give supporting reasons.	
	Record the results of your prediction. Explain why your prediction was close or not.	
	Predict what will happen to your seeds during these next few days. Why? Or, write a paragraph about the planting process and illustrate.	
	Write a short paragraph about the importance/benefits of thinning plants. What do you think would happen if you did not thin your plants? Explain.	
	<p>Since this takes place over several days, there is more than 1 journal activity. Write a short paragraph about: Why do you think plants are different sizes? Explain. When did the growth spurt take place and what evidence backs up your observation? Plan a dinner where you will eat parts of a plant. What choices did you choose for the root, stem and flower?</p>	
	Explain why nectar is important for bees and flowers?	
	Ask students to illustrate the Brassica-Bee connection and predict what will happen to your plant if it did not produce nectar. Why?	
	<p>Since this takes place over several days, there is more than 1 journal activity. Write a short paragraph about: Predict what you think will happen to the plants that were not pollinated? Why? Write a short paragraph about the interdependence between the bee and the Brassica flower. Explain in a short paragraph how the bee and the flower benefit from each other.</p>	
	In your studies about Fast Plants, you learned many things. Explain why Brassica rapa are called Fast Plants? How do these plants differ from other seeds/plants?	

Seed Observation Chart

Name: _____ Date: _____

Directions: Write a description of the seed you observed when it was dry and then after it was soaked. Think about the color, shape, texture, odor and size of the bean.

<p align="center">My Observations of the Dry Bean Seed</p>	<p align="center">My Observations of the Soaked Bean Seed</p>
Empty space for observations of the dry bean seed	Empty space for observations of the soaked bean seed
<p align="center">My Drawing of the Dry Bean Seed</p>	<p align="center">My Drawing of the Soaked Bean Seed</p>
Empty space for drawing of the dry bean seed	Empty space for drawing of the soaked bean seed

Planting Wisconsin Fast Plant™ Seeds

Name: _____ Date: _____

Directions: Read and follow these directions when planting the seeds. Check off each step as you complete it.

- Pick up supplies from the distribution station before planting:
 - 1 planter quad
 - 1 spoon
 - 1 cup potting mix
 - 4 wicks
 - 12 fertilizer pellets
 - 8 Wisconsin Fast Plant™ seeds
 - 1 toothpick
 - 1 plant label
 - 1 pair forceps
 - 1 paper towel
- Place 1 wick in each section of the planter quad and pull the wick through the bottom hole until the tip sticks out about 1 centimeter.
- Fill each section of quad halfway with potting mix.
- Add three fertilizer pellets to each section. These are slightly larger than the seeds.
- Fill each section of the quad to the top with potting mix. Press down a little with fingers.
- Put a drop of water on you tray and dip your toothpick in it. Use the wet toothpick to pick up 1 seed and place it just below the potting mix. Cover it and plant a second in the same way. Continue to plant 2 seeds in each section.
- Water very gently, one drop at a time until water drips from the bottom of each wick.
- Write your name and date on the planter label and place it in one of the sections.
- Place your quad under the lighting system. Check to see if your planter is on the water mat.
- Return all leftover supplies to the distribution station.
- Clean up your work space.