Plant Life Cycles

Seeds We Eat

GK+up

Objective

Learners will explore the parts of a seed and taste common seeds.

Background

Seeds have proteins, fats and carbohydrates that sustain seedlings during plant growth and protect them from harsh environments. Those same nutrients provide nutritious foods for humans. Seed proteins provide more than half of global protein sources. Use this activity to demonstrate the wide variety of seeds we eat.

Materials

Garden Journals
Pencils
Small plates
Seed Words Worksheet on page TK
1 cup each edible seeds
(roasted soy nuts, sunflower seeds, pumpkin seeds, canned chickpeas, sugar snap peas)
8 oz. mung bean sprouts

Preparation

Place a sample of each seed on a plate.
Make one plate per learner.
Pass out journals and pencils to each learner.
Pass out a copy of the **Seed Words Worksheet** on page TK.

Activity

1. Discuss the functions of the parts of the seeds for plants as well for as humans.

2. Pass out the plates of seeds and sample them.

3. Pass out the mung bean sprouts and have the learners examine them. Compare the mung been sprouts to the illustration on the worksheet.

4. Have the learners choose one of the seeds to draw in the empty box. Have them label the parts of their seed.

Discussion

Discuss the following questions:

- Which seeds were your favorite and why?
- How do the legume seeds taste compared to the seeds?
- What are seeds for? What happens to them when they are planted?
- What do seeds need to grow?

Create a Spread

GK+up

Objective

Learners will be able to make their own spread according to their flavor preference.

Background

Seeds are nutrient dense foods that provide fiber, healthy fats, B vitamins and minerals. They are ideal snacks because they are filling as well as nutritious. Mixing beans or peas with nuts or seeds will give learners a good mixture of protein, carbohydrates and healthy fats. All of the legumes should be cooked. Use the equation on the following page to try spreads with different combinations of legumes and seeds or nuts.

Materials

1 food processor or blender
1 spatula

For each station:
1 medium sized bowl
Pita bread cut into triangles or crackers for tasting
Spoon for serving
Plates for each learner
Container of water
Assortment of ingredients from **Create a Spread**
(each group should have a different type of legume)

Preparation

Young learners or short on time—Prepare additional ingredients ahead of time and divide into the number of groups.

Older learners or more time available —Have them prepare additional ingredients at each table.

Wash the ingredients.
Make sure all of the desktops and/or counters are cleared of materials, cleaned and sanitized.
Make sure everyone has washed his/her hands.
Divide the class into groups of no more than 8 learners.
Place the blender or food processor at the front of the room.

Activity

1. Have each group assemble the ingredients for a spread using the **Create a Spread** guidelines on the next page.

2. After they have finished, one learner from each group will bring his bowl of ingredients to the front of the room and the instructor will blend them into a paste. The instructor may need to add water to create a spread consistency.

3. The instructor will use the spatula to scrape the spread back into the bowl. The learners will bring it back to their table and adjust the flavor with more salt, lemon or other seasonings if needed.

4. Learners will dip and compare.

Discussion

Have the learners compare the dips and explain why they like each one.
What was the main flavor of the beans before they added enough salt?
What does salt do to bitter flavors?
Do they feel full after eating these dips? How much could they eat?
Which ingredients are seeds? Are beans seeds?

From the Garden

Use freshly blanched: 1. Garden peas; 2. Shelled fava beans; 3. sugar snap peas; or 4. Fresh shelling beans. The legumes will not become creamy unless they are blanched or cooked first, softening the fiber. The translucent casing should be removed from the fava beans before puréeing.

Create a Spread

Use the Spread equation and chart to create a delicious fresh spread. Choose a variety of ingredients from each category. If you like, you can structure the activity as a friendly competition between groups.

Spread =

Beans + Seeds

Canned chick peas
Canned black beans
Canned white beans
Shelled Edamame
Blanched, peeled fava

Sesame
Sunflower
Pumpkin
Walnuts*

+

Liquid + Flavorings

Olive oil
Water
Lemon juice
Orange juice

Garlic
Fresh herbs
Olives, pitted
Green onions
Salt

**Nuts are common allergens. Often sunflower or pumpkin seeds are good alternatives.*

Seed Windows

GK+up

Objective

Learners will be able to explain seed germination and root growth during the first stages of plant growth, and the differences between monocot and dicot plants.

Background

This activity will allow learners to see inside the seed during the first stages of plant growth. They can also observe the root and cotyledon emerging from the seed coat. Learners will be able to clearly identify the two basic types of plants: monocots and dicots. Monocots only have one cotyledon (first leaf) and are often members of the grass family. In addition, they usually have fibrous root systems, without one main root. Dicots (most vegetable plants) have two cotyledons and usually have tap roots. Monocots take advantage of shallow surface water, while dicots prefer infrequent deep watering.

Note: These seedlings will not be useful for transplanting. Usually corn and beans are planted directly into the ground.

Materials

Garden journals
Pencils
1-2 packages of any kind of bean seeds
1-2 packages of any kind of corn seeds
1 clear plastic cup per learner
Black construction paper
Paper towels
Spray bottle filled with water per table

Preparation

Soak the seeds over night.

Measure the height of the cups. Cut the construction paper into strips that are as wide as the height of the cups.

Pass out materials so that each learner has a cup, two paper towels, one construction paper strip, two bean seeds and two corn seeds.

Activity

1. Line the inside of the cup with the black strip of paper. Dampen the paper towel and place in the middle of the cup.

2. Place the seeds between the cup and the paper, so that you can clearly see them against the black background. Each cup should have 2 corn seeds and 2 bean seeds.

3. Spray the paper towel with water so that it is wet, but there is no standing water in the cup.

4. Spray the paper towel as needed as the seed germinates and grows. Check the moisture level every day.

5. After the third day, remove one seed from each cup. Split it open and observe the embryo. Have learners identify the root and first leaves (cotyledon) and draw the embryo in their garden journal.

6. After 4-7 days, the root and leaves will emerge from the seed. Split open the seed (if it is not already) and observe the seedlings. Which seedling is a monocot? Which is a dicot?

Note: Learners may want to transplant these baby plants to the garden. Allow them to take them home to show their family what they have discovered.

Further Exploration

Use the **Seed to Plant Worksheet** on the next page to go over vocabulary words and learn the parts of the germinated seed.

Read *Bean and Plant* by B. Watts and compare the pictures to your seeds to the pictures in the book.

Sowing Seeds

GK+up

Objective

Learners will be able to plant a seed and describe how to care for the developing young plants.

Materials

Light table (to make your own, see **Light Table Appendix**)
2 plastic dish tubs
8 qt. Soilless seed starting mix
Seed packets
4 permanent markers
1 4-pack starting container per learner
2-3 plant trays without drainage holes
1 short plastic plant tag per learner
1 plastic dome for each tray
Small watering can or water bottle with squirt type top
Extra tub of water to wash off hands
2 towels

Preparation

Divide soilless seed starting mix between two tubs. Moisten each tub of soil to encourage seed germination. It should not be soggy or dripping with water, but damp like a wrung out wet sponge.

Set up two stations: one for "warm seeds" or those that need a warming mat and one for "cool seeds" or those do not need to be warm to germinate (see **Plant Cultivation Chart** on page 54).

Each station should have:
Tub of moistened potting soil
Selection of 3-5 types of warm or cool seeds
2 permanent markers
4-pack plastic containers
1-2 flats with plastic dome covers
1 short plant tag per learner
1-2 plastic dome covers

Set up a tub with water and paper towels so the learners can rinse their hands and minimize dirt in the classroom sink.

Divide the learners into two groups. Explain how to plant the seeds. Have them line up 3-4 at a time at each station. Those that are not planting can do other class work or reading.

Activity

1. Loosely fill the 4-cell tray with potting soil, almost up to the top.

2. Pour a few seeds into the learner's hand. Have her place one seed into each cell.

3. Cover seed loosely with more potting soil, about 1/4".

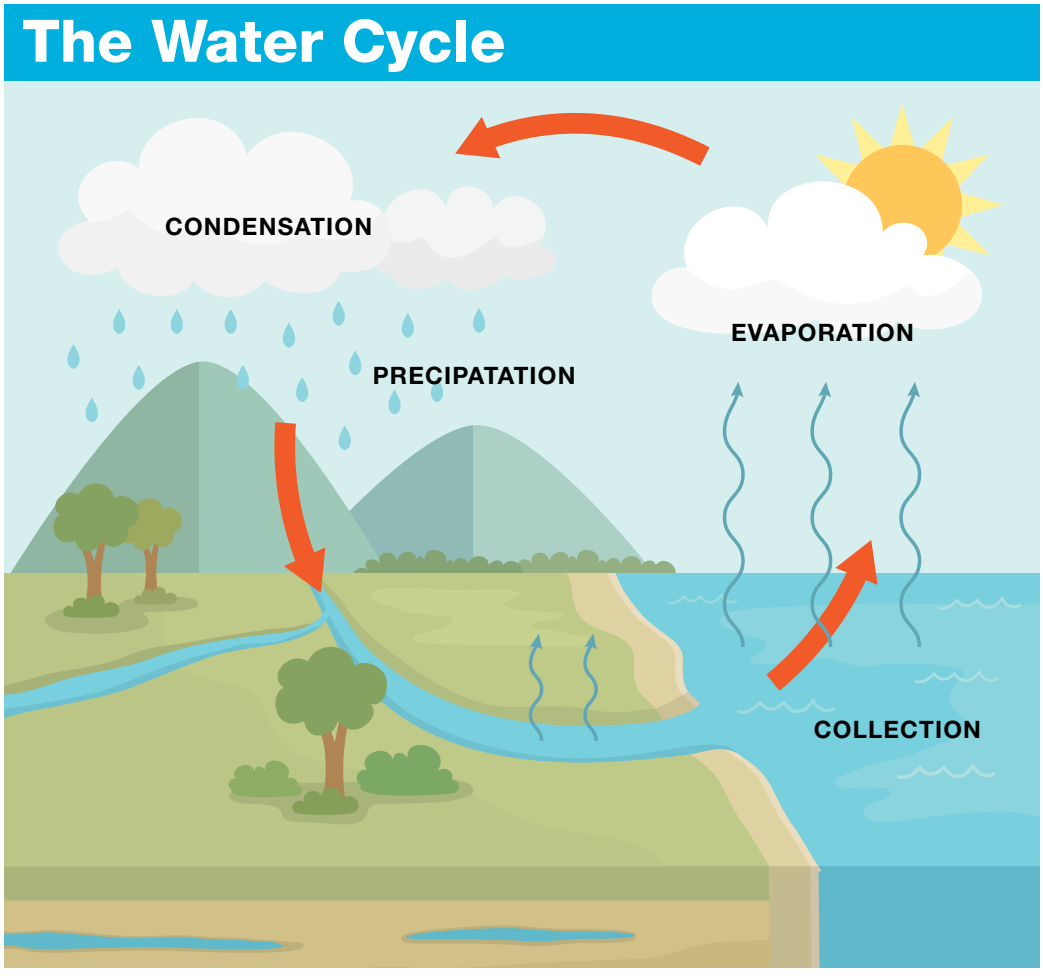
4. Label the plant tag with the learner's name and classroom number on one side and the plant variety on the other. Place the tag in the 4-pack.

5. Place the planted container into a large plant tray. Make sure to group "warm seeds" and "cool seeds" together in separate trays.

6. When each group has finished, have them write down the date and type of seed they planted in their garden journals, so that they can note the number of days until germination.

7. If time permits, follow up with the **Seeds We Eat** on page TK.

8. Introduce the dome to the learners. Ask if they know what it is for. Discuss the water cycle, evaporation and condensation. Ask them what they might observe in a couple of days?



Watering the trays:
Once covered, the trays should not need water until the seeds germinate. If the domes get knocked off and the water evaporates, go ahead and lightly sprinkle the potting soil with water and replace the domes. Position each plant tray on light table shelf. Talk about “cool” seeds and “warm” seeds. Which trays require a heat pad? Why or why not?

Turn on the lights above the tray. The lights serve the role as the sun. Small seedlings can receive 24 hours of light until they are transplanted. Ask the learners if they know what purpose the light serves.

After germination, water them when they are dry with the water bottle with the squirt top. Do not leave the seedling containers in standing water.

Dome:
Leave the dome on in between watering to help conserve water.
Remove the dome when the seedlings brush the top of the dome.

Water:
Water at the base of the plants with a gentle stream, using the water bottle with squirt top to minimize spills.

Over watering is a common cause of seedling failure.
Water the seedlings only when the soil is dry on the top. Do not let seedlings sit in water.

If the seedlings wilt over the weekend, it is time to transplant them to a larger pot.

The weekend is a time when the seedlings can die. It is best to water extra heavy on Friday afternoon and then be sure to water first thing Monday morning.

If you have a fan available, leave it on about 5 feet away from the seedlings.
It will help to promote air circulation and make the seedlings stronger.

Thinning and Transplanting

G2+up

Objective

Learners continue basic gardening skills by learning how to how to transplant and thin plants.

Background

They will also understand the difference between tender annuals and hardy annuals.

Six to eight weeks after your seeds have germinated, they will become crowded in the small 4-packs. At this point, you will transplant the tender annuals to 4" pots. These will remain inside until two weeks after the last frost date. The hardy annuals can be planted outside two weeks before the last frost date if they have been hardened off first. Hardening off means that you gradually get them used to the outside world, first in the shade, exposing them to more sunlight each day. If there is a heavy frost forecasted, bring them inside at night. The hardening off period should be about a week.

While you are transplanting the plants, you should also thin them. Often learners plant more that one seed in each cell. For the cold hardy plants, pull out but the strongest seedlings. For the tender plants, you can separate the seedlings and plant each one into its own 4" pot. Save the discarded seedlings for the plant observation activity.

We recommend using a potting soil that has some nutrient amendment either in the form of worm castings, manure or fishmeal. The larger plants will need a balanced form of N-P-K in order to thrive.

Materials

Garden book from recommended list to read to the learners
2 plastic dish tubs
2 8-qt. bags of potting soil
Light table (to make your own, see Light Table Appendix)
30-40 4" pots
4 permanent markers
30-40 plant tags
3-4 plant trays

Preparation

Separate the cold hardy plants from the tender plants. Examples of cold hardy plants include broccoli, cabbage, kale, spinach, and lettuce. These will not be transplanted, but can be hardened off. Planting the hardy vegetables first will save you space in the classroom.

Tender annual vegetable plants include basil, tomatoes, eggplant, peppers, and squash. Any plant that must be planted after the last frost date will die if exposed to freezing temperatures. Only transplant these into larger pots unless you have plenty of indoor space for seedlings with a good light source. Windows often do not provide enough light for seedlings, they need supplemental grow or florescent lights.

Set up planting stations that include empty 4" pots, flats to be transplanted, moistened potting soil, plant tags and markers.

Activity

1. Have a tub of moistened potting soil ready to go and four 4” pots.

2. Fill 4” pots with potting soil about half way up and keep a small indentation the middle of the pot.

3. Transplant only the tender annuals unless you have plenty of indoor growing space. Take a 4-cell pack and loosen the dirt in one cell by pinching the outside of the cell. Gently turn the cell over and place the stem between your fingers, cupping the roots in your hand.

4. If there is more than one seedling in a cell, save the strongest ones and discard the rest. Save the discarded seedlings for the Plant Part Observation activity on page TK.

5. Place seedling into new pot and cover roots with more potting soil. Press down gently on soil and make sure that the seedling is standing tall..

6. If the plant is a tomato plant, place it in the bottom of an empty pot and fill the pot with soil to the top. The top two sets of leaves should still be showing. Tomatoes will make new roots along the stems, strengthening the plant.

7. Make new name tag and place into pot.

8. Place pot into plant tray and repeat with the rest of the cells.

9. Look over the cold hardy plants. If there is more than one seedling in a cell, remove the weakest and save them for the Plant Part Observation Activity. Top off the cells with fresh soil if needed.

10. While learners are waiting for their turn to transplant, have them do the **Plant Part Observation** activity on page TK.

If you would like each learner to take a plant home, then have them transplant one of their plants from the 4-pack into a 4” pot. They can use their original tag to put in their pot to bring home. Make sure they know when they can plant it outside and how to care for it.

Use a liquid fish/kelp or other organic fertilizer once a week to provide nutrients to the growing plants.

If you are planning a plant sale, make sure all of the plants are labeled, thinned, filled with soil and are fertilized so that they can look their best for the sale.

Plant Observations

G2+up

Objective

Learners will observe the immature parts of the plant and learn simple botanical terms.

Background

Using the thinned seedlings from the previous lesson, learners observe how the small plants grow. They will still be able to see the cotyledons ("seed" leaves), as well as the true leaves of the plant, the stem and immature root system. The flowers and fruit will not be visible until the plant matures outside in the garden. Most of the seedlings will be dicots (two first leaves) as opposed to monocots (one first leaf).

Each plant will have five basic parts with different functions:

Roots	Stem	Leaves	Flowers	Fruit
Anchor plants in soil, provide nutrients to the plant	Keeps plants upright, moves water and nutrients to leaves	Make food through photosynthesis	Pollination of fruit	Holds seeds, attracts animals to help spread seeds

Materials

For each learner:
Plant journals
Seed to Plant worksheet on page 61
1 or 2 seedlings to observe
Magnifying glass or loop for closer observation
Pencils and/or colored pencils

Preparation

Give each learner the materials above.

Place the discarded seedlings in the middle of the table.

Activity

Review plant vocabulary and the activity instructions.

Have each learner label the plant parts on the worksheet. Page 46 has the answers.

Learners will observe the seedling in front of them.
They will try to match the parts of their seedling to the worksheet.

Each learner will draw her own seedling and label the parts in her journal.

If the learner knows the name of the plant, add that as well.

Discussion

Have the class answer the following questions as a group, or individually in their journals:

- How many seed leaves (first leaves) does the plant have? If there are two, it is a dicot (most plants, with a tap root). If there is one, it is a monocot (grass type plants with fibrous roots).
- Can you find all of the plant parts?
- What does each plant part do?
- Which parts are missing from the young seedling?
- When do you think that the missing parts will grow on the plant?

Seed to Plant Worksheet: Beans

Radicle

Cotyledon

Leaf

Seed Coat

Stem

Bean Pod

Seed

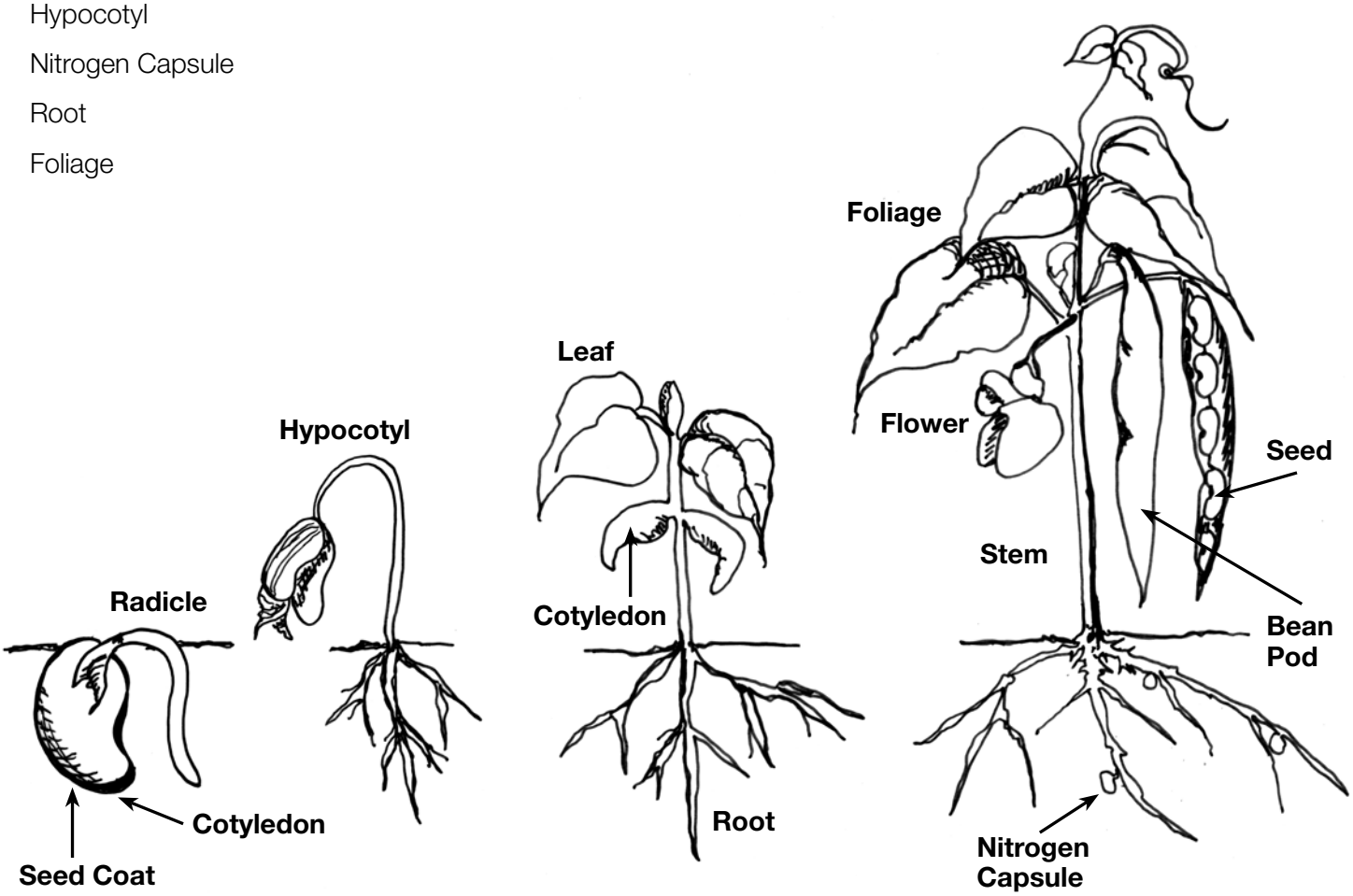
Flower

Hypocotyl

Nitrogen Capsule

Root

Foliage



Seed to Plant Worksheet: Beans

Radicle

Cotyledon

Leaf

Seed Coat

Stem

Bean Pod

Seed

Flower

Hypocotyl

Nitrogen Capsule

Root

Foliage