

# CYLINDER GARDENING

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For Young Gardeners on the Move

Teacher's Guide





THE CYLINDER GARDENING PROJECT IS A COOPERATIVE EFFORT OF:

Texas AgriLife Extension Service - Harris County

The Texas A&M University System

Harris County Master Gardener Association

Harris County 4-H

SPECIAL THANKS TO:

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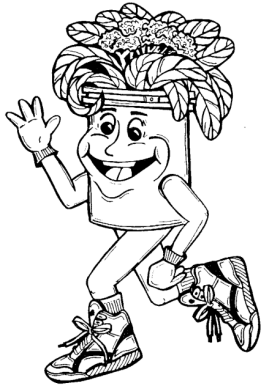
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# Cylinder Gardening

## *Planting Seeds: Growing Minds*

### PURPOSE

Texas A&M AgriLife Extension delivers this program. This Cylinder Gardening program is designed to educate students on plant growth from seed planting to harvesting. By growing plants, children will gain a sense of pride, a sense of responsibility and a sense of determination. This program is an enriched Cylinder Gardening project started in 1986 under the leadership of the Men's Garden Club of Houston, TX and the Harris County Master Gardener Association.

### METHOD

Cylinder Gardening is a method of gardening that uses bottomless cylinders as small, individual gardens. This works especially well in areas with poor soil, which would normally need extensive amendments and labor to support an actively producing garden. This method, which is not labor-intensive, works well for demonstration purposes for numerous gardening experiments for students. Cylinder gardening requires little land and little pre-gardening preparation or experience. Once the cylinders are filled and planted, the only labor is minor maintenance, watering, and harvesting. This type of gardening eliminates the time consuming effort that is usually needed for soil preparation for a successful garden. Plants mature from seed in 30 to 90 days. Installation and removal of garden is quick and clean.

### MATERIALS PROVIDED

Materials provided by Texas A&M AgriLife Extension and the Harris County Master Gardener Association include:

- Teacher references
- Directions for preparation of cylinders
- Seeds
- Fertilizer
- Containers

# General Information and Instructions

The basic outline below shows the steps to cylinder gardening and what to do at each step. Major deviations from these steps can cause the program to not function properly. Your area must look like a garden patch and have a neat layout and design. Other classes and parents will visit your garden and learn from your efforts. This program is set up for a class of 24 students, working in teams of two per cylinder.

## MATERIALS

Currently, the Houston Men's Garden Club has a good supply of cylinders to provide to teachers through the Harris County Extension Service and the Harris County Master Gardener Association. However, cylinders can be made from any large, 5-gallon buckets, such as those used by school maintenance crews that floor cleaning solution comes in. Rinse well with water and again with a weak bleach solution (10% solution - 9 parts water to 1 part bleach). The tops are removable and will come off easily. Using a hand saw or electric saber saw, remove the bottom and cut the cylinder in half. If the white buckets are unavailable, the heavy, recyclable 5-gallon plant pots may be used. These also need to be washed with a 10% bleach solution and have the bottoms cut out with a sturdy pair of scissors or electric saber saw. The plant pots will not need to be cut in half.

Potting soil can be obtained from local feed stores, nurseries, garden supply, or home improvement centers. The potting soils that work best for cylinder gardening are peat moss/perlite mixes. Some brands of potting soils come in a loose form - a 3 cu. ft. bale will fill approximately 7 cylinders. Plan to use two 3 cu. ft. of uncompressed mix for 12 cylinders.

Time-release, season appropriate fertilizer will be provided. The time-release is a one-time application. *Applications (1 teaspoon per gallon of water) of water-soluble fertilizer may be used along with the time-release once a month if needed.*

Appropriate seed selections will be provided to each school courtesy of the Harris County Master Gardener Association.

## LAYOUT OF THE GARDEN

Place garden in an area that is accessible and easily viewed for all to see, including other classes, teachers, and visiting parents. Being in view will help ensure the plants will be cared for regularly and also will decrease the opportunity for vandalism or neglect. Choose a well-drained location. Don't place in standing water or under a gutter drain.

Try to place garden near a water source or be prepared to transport water. (Clean plastic milk or water gallon jugs work well.)

Place in an area with sufficient sunlight (a minimum of 4-6 hours of direct sunlight). For winter, full sun exposure is required - garden should be on the south side of any close buildings.

Arrange 6 cylinders 10" apart in rows. Place rows 24" apart to allow accessibility to all cylinders. Arrange cylinders so that the overall effect is shaped like a regular garden.

Cylinders must be level with large end down. Where weeds and nut grass are a problem, cylinders may be placed on a concrete or asphalt surface.

## FILLING AND PLANTING THE CYLINDERS

After arranging cylinders, place grocery sack or several layers of newspapers under them and fill with potting soil. Water well after filling. Potting soil must be to the very TOP of the cylinder. Do not compress or compact the potting soil. Some settling will occur after watering - this is normal and will result in a 1/2-1 inch space at the top of the cylinder. Do not add more potting soil at this point. Plant seeds to approximate depth of the diameter of the seed. Water well again.

## WATERING THE GARDEN

The first week, water every day - new seeds need constant moisture for germination. Starting the second week, water every Monday, Wednesday, and Friday that it does not rain. Use 1/2 gallon of water per cylinder. Apply carefully so you do not injure young plants. Pouring water through your hand held over the cylinder will help to keep from displacing the seeds or small plants. Continuous watering is essential to the success of this project.

## FERTILIZING

Time release capsules - place 3 Tablespoons in each cylinder and mix well throughout soil before planting. This should last for about 4 months of growth. If plants seem to need it, a weak (1 teaspoon



per gallon of water) application of water-soluble fertilizer may be used once a month. Water-soluble fertilizer - use 1-2 tablespoons per gallon of water per week for every 2 cylinders.

#### THINNING AND TRANSPLANTING

Move plants around within the cylinder/garden to fill in empty spots.

After seeds sprout, they should be thinned regularly to allow adequate room for growth without competition. This is difficult, but necessary. Unless you need the thinned seedlings to fill in an empty spot, do not try to add to your garden area at this stage. Young greens, lettuce, spinach, etc. can be eaten - other thinned seedlings should be discarded or sent home with the students for their personal use.

#### PESTS AND DISEASE

Each visit, check for signs of pests and disease that could damage your plants. Take immediate action - some can do extensive damage very quickly. Keep garden area clean and weeds pulled. It would be helpful if maintenance crews can keep the surrounding area mowed. This will help cut down on insect and disease opportunities. Any diseased plants should be completely removed. You will want to keep the garden clean and attractive because there will be others watching and learning from your example.

#### TASTING

Lettuce, Radishes, and Greens can be tasted early. Pick young leaves, wash, and eat. Even though pesticides are not used in cylinder gardening, it is important to wash all produce before eating. Harvest when mature. Some plants, such as broccoli, will produce secondary flower buds if the weather allows. Encourage students to try vegetables even if they claim they don't like them - peer pressure and the pride of growing it themselves will make lots of converts. If harvest is abundant - send the extra home or share with other classes.

#### GARDEN REMOVAL

Garden may be completely removed or plants removed and potting soil left in place for the next season. To prepare for next season: Leave cylinders in place and remove all mature or spent plants. Fluff up the soil in the cylinders and use extra soil or the soil from an end cylinder to fill any others low on soil. Remove empty cylinders from the site - they can be refilled and reused next season. To completely remove garden: Lift cylinder and place in yard trash bags. Remove the cylinder from the bag. Put the soil from up to 3 cylinders in each bag - more is too heavy. This soil may be added to gardens or allowed to compost inside the trash bags in an out-of-the-way area. Stack cylinders in an out of sight area for next use or discard. Grocery sack/newspapers under the cylinders should be discarded or composted. Soon all traces of the garden will be gone.

## Safety Precautions

1. Check fertilizer rules and regulations with your school administration before handling chemicals.
2. Your students will be eating much of what they grow in the garden, but remind them that not all plants are edible. Allow them to eat only those plants or plant parts that you know to be safe. Alert them to the dangers of eating other plant material.
3. When you pour prepared potting soil containing perlite, vermiculite or peat moss, a cloud of dust will rise which is irritating to respiratory passages. Reduce this dust by pouring some water into the mix first to wet it before pouring, and pour carefully. Cover your nose and mouth with dust mask or cloth whenever you pour. For children with allergies, a handkerchief and rubber gloves may be worn.
4. When cleaning the plastic cylinders or other garden equipment with mild (10%) bleach solution, take extra care, especially around children. Bleach is toxic and can burn skin and damage clothing.
5. Certain seeds that are susceptible to fungus problems (beans, cucumbers, corn) are often treated with a fungicide and dyed (usually pink) for identification. Check rules and regulations with your school administration before handling.
6. Botanical and synthetic pesticides are toxic substances. We strongly discourage their use in the Cylinder Gardening program.

# Materials List

To use this series, you will need to review the lessons, determine which materials you want to use and set a date for teaching the series. Be sure to review the important safety precautions included.

When your date is set, you may order the materials that you wish to use from the sources listed at the end of this section. Order all materials several weeks in advance. The materials will be needed in the sequence outlined below.

## LESSON 1 - INTRODUCTION TO SEEDS

### Pre-test

ACTIVITY SHEET - "PARTS OF A SEED"

Bean Seeds - one or more per student

SMALL CONTAINER TO HOLD WATER

Activity Sheet - Vegetable information lists

### *Optional Activity "Seed Growth Viewing":*

3 Glass pint jars or drinking glasses

Seeds

Paper towels

### *Optional Activity "Plant People":*

Potting Soil

Rye Grass Seed

Construction Paper

Scissors

Moveable Eyes

Container

Soluble Fertilizer

Knee-high Panty Hose

Paint Pens

Glue

Tape

Buttons, Plastic Beads, or Jewels

Water

## LESSON 2 - WHAT PLANTS NEED

Cylinders made from 5-gallon plastic buckets, bottoms cut off and cut in two (See introduction for more details.)

Potting soil (approximately 2 gal. or 1/4 cu. ft. per cylinder)

Time release fertilizer (3 Tbsp. per cylinder)

Water hose or container

Water (about 1 gal. per cylinder)

Seeds

Brown grocery sack or 3-4 sheets of newspaper (without color print)

Activity sheets - "What Do Plants Need to Grow?"

Plant Journals & Instructions

Activity sheet - "Plant Word Puzzle"

Activity sheet - "Plant Growth Chart"

## LESSON 3 - HOW PLANTS GROW

Sprouted bean seeds started in Lesson 1.

Small digging tool, weeding tool, or fork for thinning.

Activity sheet - "Parts of a Bean Plant"

Activity sheet - "Germination of a Seed"

Activity Sheet - "What is Photosynthesis?"

Growth Journals (ongoing)

"Plant Growth Chart" (ongoing)

## LESSON 4 - BIOLOGICAL CONTROL OF INSECTS AND DISEASE

Teacher Reference - "Disease Symptoms"

Teacher Reference - "Insect Identification Short Course"

Teacher Reference - "Insect Damage"

Teacher Reference - Growth Journals (ongoing)

Activity Sheet - "Bad Guys/Good Guys - Who am I?" Game

"Plant Growth Chart" (ongoing)

## LESSON 5 - PARTS OF THE PLANT

Activity Sheet - "What do Roots do?"

Activity Sheet - "What do Leaves do?"

Activity Sheet - "What do Stems do?"

Activity Sheet - "What do Fruit do?"

Activity Sheet - "Flowering - Pollination and Fertilization"

### *Optional Activity "Dyed Celery":*

Large piece of celery with a few leaves attached.

Two glass beakers or jars

Food coloring - two colors, preferably red and blue

Water

### *Optional Activity "Vegetable Mobile":*

Handout: "Vegetable cutouts"

Colored markers or crayons

String

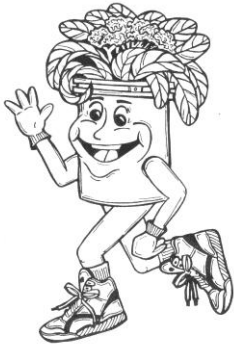
Coat Hanger - one per mobile

"Plant Growth Chart" (ongoing)



# 1

## Lesson 1. Introduction to Seeds



**OBJECTIVES:**

- Increase students' knowledge of the basic parts of a seed. To increase their understanding of the assessment and selection of plants appropriate for their area

**VOCABULARY WORDS FOR LESSON 1:**

- Seeds
- Seed coat
- Germinate
- Embryo

**MATERIALS NEEDED:**

- Pre-test
- Activity Sheet - "Parts of a seed"
- Bean Seeds - one or more per student
- Small container to hold water
- Activity Sheet - Vegetable information lists

**INSTRUCTIONS:**

DO	SAY
Pre-Test	This is not for a grade, but to test the students' basic knowledge of the subject. Volunteers may request pre & post test for evaluation purposes only.
Activity Sheet: <b>Parts of a Seed</b>	Seeds have several parts. Most seeds have a hard outer covering called the seed coat that protects the seed. Under the seed coat is stored food that will be used by the new plant to germinate. The embryo or baby plant, is found toward the center of the seed. This is the part of the seed that grows and becomes a plant.
Distribute seeds - one per student	Let's examine the parts of a seed up close.
Have each student place their seeds in a container of water for 20 - 25 minutes. This can be done ahead of time if you have additional seeds. Return the seeds to the students.	We will soak the seeds to soften the seed coat, as if it were planted in damp soil. Peel off the seed coat and separate the seed parts. Let's compare the parts of your seed to the drawing.
Distribute vegetable information lists.	Here is information on different vegetables which can be grown in this area.
Discuss requirements and attributes of various plants, using Vegetable lists attached.	Let's evaluate the options and decide on which we would like to grow as a class. Try to select at least one from each of the 6 plant parts (root, stem, leaf, flower, bud, fruit and seed.)
Optional Activity: <b>Seed Growth Viewing</b>	See directions in Activity Pack.
Optional Activity: <b>Chia Plant People</b>	See directions in Activity Pack.
Optional Activity: <b>Grow Cards</b>	See directions in Activity Pack.

DO	SAY
Optional Activity: <b>Nursery Tour</b>	Let's take a tour of our local nursery and see how many plants we recognize and how many new plants we can learn.
Optional Activity: <b>Library visit/research</b>	Let's take a trip to the library and see what reference information we can find on gardening and vegetable production.

**MATERIALS NEEDED FOR LESSON 1 OPTIONAL ACTIVITIES:**

Here are some optional activities related to seed growth and development. See packet for instructions.

*"Seed Growth Viewing"*

3 Glass pint jars or drinking glasses

Seeds

Paper towels

*"Plant People"*

Potting Soil

Construction Paper

Rye Grass Seed

Scissors

Moveable Eyes

Container

Soluble Fertilizer

Knee-high Panty Hose

Paint Pens

Glue

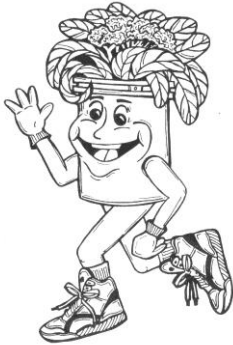
Tape

Buttons, Plastic Beads, or Jewels

Water

# 2

## Lesson 2. What Plants Need



**OBJECTIVES:**

- Increase students' knowledge of basic requirements of plant growth.
- Increase students' understanding of the rules of garden layout.
- Increase students' knowledge and practice of proper planting techniques.

**VOCABULARY WORDS**

- Fertilizer
- Nutrients
- Compacted
- Roots
- Leaves

**MATERIALS NEEDED:**

- Cylinders (See pg 2)
- Potting soil (approx. 2 gal. or 1/4 cu. ft. per cylinder).
- Fertilizer (3 Tbsp. per cylinder).
- Water hose or container.
- Water (about 1 gal. per cylinder).
- Seeds.
- Brown grocery sack or 3-4 sheets of newspaper
- **Activity Sheets** - "WHAT DO PLANTS NEED TO GROW?"
- Plant Journals & Instructions
- **Activity Sheet** - "PLANT WORD PUZZLE"
- **Activity Sheet** - "PLANT GROWTH CHART"

**INSTRUCTIONS:**

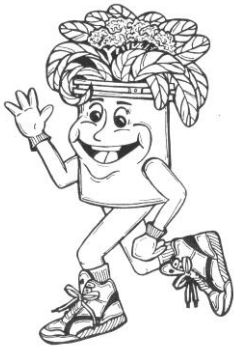
DO	SAY
<p>Take class to location of planned garden.</p>	<p>Each of the plants we will grow will have certain requirements to succeed. They will need soil that will retain air once the water has drained out; a regular and uniform supply of water, nutrients or minerals in continuous supply, sunlight and a chance to grow, free of damage by insects, diseases, weather, weeds, and human interference.</p>
<p>Place cylinders large end down 5-7 in a row, 10-20" apart, in rows 24" apart on the grass in a sunny area. Arrange them so they look like a garden. Nothing needs to be done to the grass. It will become composted through the season.</p>	<p>Some areas have soil that is very compacted and does not drain well; therefore, we are using cylinders to raise the plants so they will drain better and allow air to get to the roots of the plants. If water stands around the roots, they will rot and the plants will not be able to absorb the nutrients they need to grow.</p>
<p>Fill cylinders to the top with potting soil. <b>DO NOT PACK.</b> Mix in 3 tbs of the fertilizer provided. Water thoroughly.</p>	<p>We are using a standard potting soil, which we know is clean and will support the plants. We will add a time-release fertilizer, which will feed the plants a little at a time as the particles dissolve and will support plant growth and crop production throughout the season.</p>

DO	SAY
<p>Distribute seeds to be planted. Make small holes or grooves in soil. Plant seeds and cover with loose soil. Water again with light sprinkle (at least 1 gal per cylinder)</p>	<p>Different seeds require different planting depths. A good rule is to plant seeds as deep as they are wide. Large seeds, like beans, will need to be planted down in the soil. Radish seeds will just need to be sprinkled on top of the soil and brushed gently into the soil. After we have planted them, we will water them a little more to settle the soil. (See page 2 for instructions on thinning &amp; transplanting.)</p>
<p>Handout: <b>Growth Journals</b></p>	<p>We are going to track our activities each visit. We will keep complete records of each cylinder and, at the end of this project, we can evaluate the success of each individual cylinder.</p>
<p>Handout: <b>Plant Word Puzzle</b></p>	<p>Let's use the new words we've learned through our gardening lessons to complete the Plant Word Puzzle.</p>
<p>Activity Sheet: <b>"Plant Growth Chart"</b></p>	<p>As the plants grow, use your ruler to measure in centimeters the growth and record it on the chart.</p>
<p>Optional Activity: <b>"Seed Growth Viewing" from Lesson 1</b></p>	<p>We've talked about how plants need light to grow. Let's compare the growth of the seeds grown in the dark, shade and bright light.</p>



# 3

## Lesson 3. How Plants Grow



**OBJECTIVES:**

- Increase students' knowledge of life cycles of plants.
- Increase students' knowledge of what plants require to grow.
- Increase students' knowledge of how plants use light, air, water, and nutrients to grow.

**VOCABULARY WORDS:**

- Thinning
- Growth
- Chlorophyll
- Carbon Dioxide
- Protein
- Oxygen
- Minerals
- Photosynthesis

**MATERIALS NEEDED:**

- Sprouted bean seeds from Lesson 1.
- Small tools for weeding and thinning.
- **Activity Sheet** - "Parts of a Bean Plant"
- **Activity Sheet** - "Germination of a Seed"
- **Activity Sheet** - "What is Photosynthesis?"
- Growth Journals (ongoing)
- "Plant Growth Chart" (ongoing)

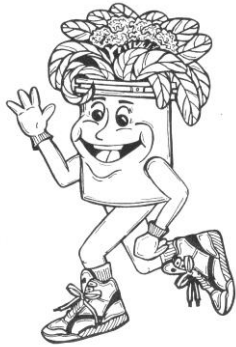
**INSTRUCTIONS:**

DO	SAY
Distribute handout " <b>Parts of a Bean Plant</b> "	We've studied seeds and how they germinate and develop into plants. Now we will see how plants grow and produce their end product, whether it be stems/leaves (such as celery, lettuce, spinach, or other greens); roots (carrots, beets, radishes); flower buds (broccoli, cauliflower); or seeds/fruit (beans, peas, tomatoes, squash).
Distribute handout " <b>What is Photosynthesis?</b> "	Now that our plants have grown leaves and a strong support system, they will make their own food. This is called Photosynthesis. The leaves use the sun's energy to combine water, minerals, and carbon dioxide to make food for them to continue to grow. Light absorbed by chlorophyll causes carbon dioxide and water to form sugar and release oxygen. Sugar and minerals are
Remove sprouting bean seeds from containers. Examine the sprout closely, using the " <b>Germination of a Seed</b> " handout for guidance and comparison.	Let's examine the parts of the young plant. In our " <b>Germination of a Seed</b> " handout, we can see the remains of the stored food and the first leaves. The stalk and stems are getting stronger to support the additional leaves which will be showing soon. The stems are composed of hundreds of tiny straws used to transport water and minerals to the rest of the plant.
Relocate to the cylinder garden. Plants should need thinning by this stage. Thin everything to one inch apart to begin with. Later, thin more depending on how large the vegetable will grow. Thinning of some plants, especially greens, can be consumed at this time.	We need to thin out the sprouts to ensure that there will be room for the plants to grow and produce. Some plants need more room than others, depending on their mature size. We will thin periodically, giving the plants more individual room as they grow. First we will thin out any weak or damaged plants; then, we will thin out any plants that touch each other. Eventually, we will thin until there are only the number of plants per container as recommended on our plant list. After we decide which plants should be removed, push down beside the sprout using your finger, a pencil, or other small digging tool, wiggle the soil, lift the plant by the leaves and remove. Repeat as needed.

DO	SAY
Record results of visit in <b>Growth Journals.</b>	Plants will do better if they do not have to compete for the things they need; water, soil, fertilizer, oxygen, light. If the plants are too crowded, they have to share the available resources, which could result in an inferior product.
Record plant growth on " <b>Plant Growth Chart</b> "	Continue to chart the progress of your plants on the " <b>Plant Growth Chart</b> "
Optional Activity: <b>"Plants are Beautiful"</b>	See Directions in Activity Pack
Optional Activity: <b>"Seed Growth Viewing"</b> sprouted seeds from Lesson 1.	Let's examine the thinned out sprouts and compare with the condition of those that were grown in the classroom, without the benefits the cylinder-grown outside plants had. What advantages do you think each had?

# 4

## Lesson 4. Biological Control of Insects and Disease



**OBJECTIVES:**

- Enable students to identify crop problems.
- Increase students' understanding of biological methods to control
- Enable students to differentiate between beneficial and harmful insects.

**VOCABULARY WORDS:**

- beneficial
- poisons
- Biological control
- slugs
- pollinators
- spider
- predators
- healthy
- parasites
- insecticides

**MATERIALS NEEDED:**

- Teacher Reference - "Disease Symptoms"
- Teacher Reference - "Insect Identification Short Course"
- Teacher Reference - "Insect Damage"
- Teacher Reference - Growth Journals (ongoing)
- **Activity Sheet** - "Bad Guys/Good Guys - Who am I?" Game
- "Plant Growth Chart" (ongoing)

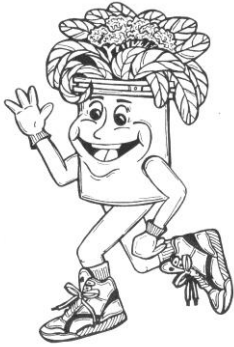
**INSTRUCTIONS:**

DO	SAY
<p>Visit garden to inspect for any developing disease or insect problems.</p>	<p>Why do we have to worry about insects and disease? Insects and diseases can destroy every part of a plant. Plants must be carefully and regularly checked for fresh damage. First, you must determine if your problem is due to insects or disease. Then, you must decide what is the most effective method of Biological treatment</p>
<p>Check for any signs of developing disease.</p> <p>Teacher Reference: <b>"Disease Symptoms"</b></p>	<p>Disease control can be improved by spacing plants and planting in raised areas like cylinders to allow better air circulation. You can reduce the severity of the disease by immediately removing any diseased part of the plant. Let's check our plants for any signs of developing disease. Do you see any black or soggy spots on the leaves, stems, or vegetables? Let's try to identify what the problem might be.</p>
<p>Check for any signs of insect damage or occupation.</p> <p>Teacher Reference: <b>"Insect Identification Short Course"</b></p>	<p>Let's look for any signs of insects. The first and most important thing we must do is to identify any insect or insect damage we find. Once we have identified it, we can then decide what action, if any, we need to take to protect our plants.</p> <p>Of the more than 250,000 species of insects found in the U.S., 90% are of no or little importance to us. The remaining 10% is divided between "good guys" and "bad guys."</p> <p>7% (or about 17,500) species are classified as beneficial. This group includes predators and parasites that attack "bad guys" and provide important natural control. Pollinators are also included in this group.</p> <p>Only 3%, or about 7,500 species are harmful and can be classified as economic pests. Of this number, only 150-250 species regularly cause damage.</p>

DO	SAY
.(See Appendix I)	Often, it is not easy to distinguish the beneficial from the harmful species in the garden. If we spray insecticides, we not only kill the "bad guys," but we kill the "good guys" too. We also poison the vegetables that we want to protect and the poison can run off to cause further damage.
<p>Teacher Reference:  <b>"Insect Damage"</b></p> <p><b>"Bad Guys/Good Guys - Who am I?"</b> Game            (see following instructions).</p>	<p>The best method of insect control is to identify the pest and either leave it (good guy) or remove it (bad guy). "Bad guys" are usually soil, sucking, or chewing insects.</p> <p>The <u>soil insects</u> generally attack the seed at planting time or the young, tender plants. This group includes wireworms, cutworms, white grubs, mole crickets, slugs, and pillbugs. Using cardboard protectors and keeping the area clean help fight these.</p> <p>The <u>sucking insects</u> damage plants by sucking plant juices. Plants become wilted, yellowed, deformed or stunted and may eventually die. Some sucking insects inject poisons and/or diseases into the plant while feeding. Aphids, leafhoppers, stinkbugs, squash bugs, thrips and spider mites are sucking insects.</p> <p><u>Chewing insects</u> feed on all parts of the plant, destroying both foliage and fruit. Chewing insects, the group that causes the largest amount of damage in the garden, include grasshoppers, leafminers, beetles, weevils, and numerous caterpillars. Control of the group is to pick off the culprit and destroy it.</p> <p>The "good guys" are a varied group, ranging from the earthworm that improves the soil to the praying mantis which feeds on numerous insects. Parasitic wasps and other wasps eat insects and caterpillars, as do spiders. Both the adult and the larvae of the ladybug and the lacewing eat aphids and other pests.</p>
Record findings and progress in growth journals.	Keeping debris and dead plant refuse cleaned out of the garden helps to reduce disease and insect build-up. Also, keeping plants well-fed and well-watered keeps them strong enough to resist most problems and recover from others. Healthy, well-spaced plants growing in a rich soil are less likely to have pest and disease problems.
Record plant growth on the <b>"Plant Growth Chart"</b>	Use your rulers to measure the plants progress and record it on the <b>"Plant Growth Chart."</b>

# 5

## Lesson 5. Parts of the Plant



**OBJECTIVES:**

- Enable students to identify the different parts of the plant and their functions

**VOCABULARY WORDS:**

- root hairs
- flowers
- fruit
- roots
- vegetative parts
- reproductive parts
- pollination

**MATERIALS NEEDED:**

- **Activity Sheet** - "What do Roots do?"
- **Activity Sheet** - "What do Leaves do?"
- **Activity Sheet** - "What do Stems do?"
- **Activity Sheet** - "Flowering - Pollination and Fertilization"
- **Activity Sheet** - "What do Fruit do?"

**INSTRUCTIONS:**

DO	SAY
<p>Activity Sheet: <b>"Parts of a Bean Plant" from Lesson 3.</b></p>	<p>The parts of most plants can be divided into two groups, growing or vegetative parts and reproductive (parts required to produce seeds). Reproductive parts include flowers or flower buds, fruit, and seeds. The vegetative parts; leaves, roots, and stem are necessary to sustain the plant and help it grow.</p>
<p>Activity Sheet: <b>"What do Roots do?"</b></p>	<p><u>Vegetative parts of a plant:</u></p> <p>Even though we don't often see the <u>roots</u> of a plant, they are just as important as any other part of the plant. Roots hold plants in place and act as vessels to transport water and nutrients to the rest of the plant and often to store food.</p> <p>There are three types of root systems: tap roots, fibrous roots and bulbs. Carrots, radishes, sweet potatoes, beets, and turnips are examples of roots that we eat.</p> <p>Roots grow from their tips. Each tip contains a growing point which continually produces cells that constantly push the roots downward or further out in search of moisture and nutrients. Behind each tip are the delicate root hairs, which absorb water and nutrients. These tiny root hairs can be damaged very easily, so great care should be taken when transplanting or the plant will wilt.</p>
<p>Activity Sheet: <b>"What do Stems do?"</b></p> <p>Optional Activity: <b>"Dyed Celery"</b></p>	<p>The <u>stem</u> of a plant has three functions: support, food storage and fluid transportation. Some stems are rigid, such as those in woody trees and shrubs. Vines develop flexible stems. There are many familiar plants that use modified underground stems such as rhizomes, bulbs, tubers, or corms. These unusual stems will store food to enable the plant to live through a dormant period while preparing for spring growth. Potatoes are</p>

DO	SAY
	examples of this kind of stem. Another function of the plant stem is to conduct plant fluids that contain water and nutrients absorbed by root hairs upward to the points of growth and food that have been manufactured in the leaves downward to be stored and used by the stem and root cells. Asparagus, celery, and broccoli stems perform this function.
Activity Sheet: <b>"Flowering - Pollination and Fertilization"</b>	<u>Reproductive parts of a plant:</u>  <u>Flowers</u> permit the plant to reproduce. The size, shape, and color of flowers attract insects and birds that transmit the pollen from one part of the flower to the other or from one plant to another. The flower or flower bud is the edible part of broccoli and cauliflower.
Activity Sheet: <b>"What do Fruit do?"</b>	<u>Fruit</u> is the container for seed. Some edible fruits that have seeds enclosed within the container are squash, tomato, cucumber, eggplant, green beans, peppers, okra, and melons.
Optional Activity: <b>"Plant Parts Charades"</b>	See directions in Activity Pack.
Optional Activity: <b>"Vegetable Mobile"</b>	See directions in Activity Pack.
Optional Activity: <b>"3D Plants" (Fantastical Plants)</b>	See directions in Activity Pack.
Record plant growth on <b>"Plant Growth Chart"</b>	Measure and record your plants growth on the <b>"Plant Growth Chart."</b>

## MATERIALS NEEDED FOR OPTIONAL ACTIVITIES

*"Dyed Celery":*

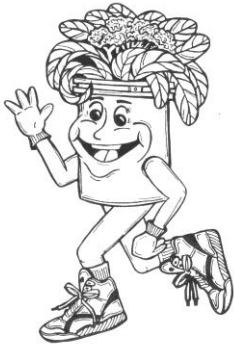
Large piece of celery with a few leaves attached.  
 Two glass beakers or jars  
 Food coloring - two colors, preferably red and blue  
 Water

*"Vegetable Mobile":*

Handout: "Vegetable cutouts"  
 Colored markers or crayons  
 String  
 Coat Hanger - one per mobile  
 "Plant Growth Chart" (ongoing)

# 6

## Lesson 6. Harvesting and Tasting



**OBJECTIVES:**

- Enable students to evaluate success of plants.
- Increase students' knowledge of steps to prepare garden for next season's plants.

**VOCABULARY WORDS:**

- circulation
- disease
- compost

**MATERIALS NEEDED:**

- Growth Journals
- **Activity Sheet** - "Vegetable Information Lists" (Lesson 1)
- **Activity Sheet** - "What do Plants Need to Grow?" (Lesson 2)

**INSTRUCTIONS:**

DO	SAY
<p>Prepare final entries for <b>Growth Journals</b></p>	<p>This is the final lesson for the Cylinder Gardening program. You have practiced many aspects of gardening and are now experienced gardeners. We will now evaluate the success of our garden and decide what, if anything, we could have done to improve our results.</p>
<p>Activity Sheet: "<b>What do Plants Need to Grow?</b>" (from Lesson 2)</p>	<p>Let's go over the basic plant needs again. Did we place our garden properly? Did the plants get enough light or were there buildings or taller plants shading the smaller ones? Was circulation/air flow enough to help keep plants healthy? Was the fertilizing and watering done often enough to support the crops we anticipated? Was the weather a factor in the outcome of our garden?</p>
<p>Activity Sheet: "<b>The Know and Show Sombrero</b>"</p>	<p>See Directions in Activity Pack</p>
<p>Activity Sheet: "<b>Vegetable Information List</b>" (from Lesson 1)</p> <p>Compare results actually obtained to expectations.</p>	<p>Actual production is not always exactly as expected. We know the basic plant needs. Are there any other things you can think of that would have helped our project? Should we plant the same type of vegetables again in the future? Are there other vegetables you think should be tried?</p>
<p>To prepare for next season: Leave cylinders in place and remove all mature or spent plants. Fluff up the soil in the cylinders and use extra soil or the soil from an end cylinder to fill any others low on soil. Remove empty cylinders from the site - they can be reused next season.</p>	<p>It is time to begin clean-up and preparation for the next season's garden. We have been removing any diseased or dead plants to keep the garden clean, now we will remove any plants that are mature or done producing. These can be added to a compost pile and recycled as compost in the school flower or shrub beds. To minimize the spread of disease, we won't use this compost in the vegetable garden. The cylinders will be left in place ready for the next season.</p>

DO	SAY
<b>Optional Activity:</b> Pictures/write-up on favorite plant or vegetable.	Draw a picture and/or write a short essay describing your favorite plant or vegetable you learned about during the Cylinder Gardening program.

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## Appendix I - Insect Control Guide

Check rules and regulation with your school administration before  
use

Insect control can be difficult especially around children. Whenever using pesticides, follow all labeled precautions.

LIQUID SOAPS	Use 2 tablespoons per 1/2 gallon and spray the tops and bottoms of all the leaves for control of a wide range of pests.
SEVIN	Follow label instructions for general insect control. Don't use when children are present.
B.T. (BACILLUS THURINGIENSIS)	Follow label instructions for control of chewing worms. Don't use when children are present.

## Appendix II - Teacher References

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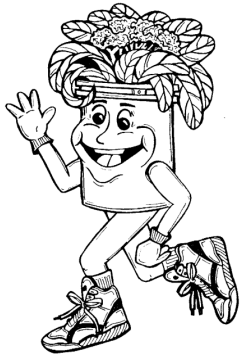
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## Appendix III - Cylinder Gardening Benefits to Leadership Development in Children

**Individual Responsibility and Ownership** - Students are actively responsible for bringing about and nurturing plant life by following a structured process. They prepare the soil, plant the seed(s), provide nourishment, clean and treat for disease, monitor progress, and maintain data regarding the plant. Upon completion of the project, they are able to benefit from their efforts by enjoying the plant individually and together with their class.

**Direction & Planning** - Students begin the project by establishing the goals and objectives which they hope to accomplish. They implement these goals and objectives by planning the location of the garden and the plants within it, establishing a feeding schedule, monitoring their progress, and remaining focused on them throughout the project.

**Observation, Data Gathering & Journal Skills** - Students regularly record in their journals their observations regarding the plant's growth, the existence of harmful insects, the effect of different weather patterns, and the maturity of the plant as a food source.

**Value of Organized Effort** - The individual student's efforts are seen in the context of the entire garden and appreciated as a whole - the student takes pride both in individual and the collective efforts of the entire class. The final outcome is the enjoyment of a salad or other product which is greater than the sum of the individual parts.

**Respect for Others** - Students must follow the directions of the teacher/advisor, work together with fellow students, help and receive help from others, learn from the successes and failures of others, and benefit from the efforts of the entire class in a cooperative manner.

**Accountability** - By regularly reporting to the class their observations and data, students are held accountable for the success or failure of their plant.

**Teamwork** - Students divide roles & responsibilities according to their interests/abilities, such as weeding, watering, and required activities. Two students work together and realize the benefits of cooperation.

**Experimentation/Risk-Taking** - Students can see the direct results of watering vs. not watering a plant, fertilizing vs. not fertilizing, playing music as opposed to no music; they can learn from their mistakes and experiment with different techniques for supporting plant life.

**Learning from Failure** - Given the realities of plant life in a school setting wherein some plants die, others are vandalized, or some might be defective and not grow, students learn to adjust to momentary failure or disappointment and start over to achieve success.

**Recognition & Rewards** - Students recognize those who supported the project by writing thank-you letters, describing their activities and results. They are rewarded by the success of the garden when they bring home their produce or consume the salad.



Cylinder Gardening is a program of the Texas Cooperative Extension Service in Harris County. The program is made possible by through the volunteer assistance of Harris County Master Gardeners and funding is provided by the Harris County Master Gardener Association.

For more information visit our websites at <http://harris-tx.tamu.edu/hort> and <http://cylindergardening.tamu.edu> .

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