

4

Plant Connections

PURPOSE:

- To become familiar with the basic principles and management techniques for reproducing and taking care of plants.

OBJECTIVES:

For youth to:

- list requirements for plant growth.
- explain why planning a garden is important.
- distinguish between perfect and imperfect flowers.
- explain asexual propagation.
- identify five major categories of plant pests.
- discuss alternative pest control measures.

LESSON TIME:

- Lesson time may vary based upon learning activities selected. Most activities are approximately 30 minutes.

ADVANCE PREPARATION:

- Read the BACKGROUND BASICS on How To Grow Plants.
- Review activities and choose appropriate one(s) to use.
- Collect and prepare materials for appropriate activities.

How to Grow Plants

LEARNING ACTIVITIES

1. A MATTER OF LIFE OR DEATH
2. GARDEN PLANNER
3. REPEATING THE PROCESS
4. CLONING AROUND
5. MEET MY FRIENDS
6. BLAST THAT PEST!

DO

The following are suggestions for using the activities in Lesson 4. The materials needed for each are listed within the activity.

- Describe the requirements for plant growth in A MATTER OF LIFE OR DEATH.
- Plan a garden using the GARDEN PLANNER.
- Label the parts of a flower in REPEATING THE PROCESS.
- Demonstrate an asexual propagation method in CLONING AROUND.
- Identify common plant pests in MEET MY FRIENDS.
- Discuss alternative pest control practices in BLAST THAT PEST!

REFLECT

After completing the activities in this lesson, help youth reflect on what they have learned with these questions:

What do plants need in order to grow?

sunlight, water, air, proper temperature, nutrients, space

How would someone in an apartment plant a garden?

plant in containers or window boxes

plant dwarf or smaller varieties

What is the difference between perfect and imperfect flowers?

perfect flowers have both male and female parts, imperfect flowers have only male or female parts

What are some reasons for reproducing plants without seeds?

**to produce plants with the same characteristics as the parent
some plants may not produce viable seeds**

How can insects benefit plants?

pollination

prey on plant pests

What are the five major categories of plant pests?

insects, weeds, nematodes, diseases, animals

APPLY

Help youth learn to apply what they have learned.

- Have youth list the things that plants need to grow and compare it with a list of things people need to grow.
- Have youth display their garden plans. After looking at all the plans, develop one plan for the entire group and plant a garden.
- Using craft supplies, have youth put together a model of a perfect or imperfect flower.
- Compare the growth and development of potato seeds to potato pieces.
- Have youth collect weeds from a garden or schoolyard. Identify the weeds using a plant identification key or get a copy of the "Weeds of Southern Turfgrasses (SP 079) at the IFASbooks.ufl.edu

BACKGROUND BASICS ... How to Grow Plants

Plants exist in close association with each other and their environment. Each part of a natural or artificial environment effects the survival and quality of plants. Environmental factors such as sunlight, water, air, nutrients, and a proper temperature help to regulate plant growth. When one or more of these factors are missing, the plant will not grow as it should and may die.

Review Lesson 3 Background Basics for information regarding environmental factors that affect plant growth.

Plant propagation

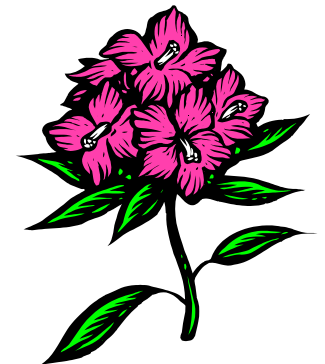
Plant propagation refers to the sexual and asexual reproduction of plants. **Sexual propagation** in plants is the reproduction of plants by seeds. Since most plants reproduce naturally from seeds, this method is often the easiest and least expensive. Sexual reproduction takes place in the flower of the plant. A typical or **complete** flower consists of four parts:

Sepals - leaf-like structures beneath the petals which form a protective covering around the flower until it opens. The calyx is made up of all the sepals on one flower.

Petals - brightly colored leaf-like part of a flower which attracts pollinators.

Stamen - the male reproductive portion of a flower. A stamen consists of a filament or stalk which supports the anther. The anther produces the pollen or male sex cells.

Pistil - the female reproductive portion of a flower. A pistil consists of the stigma, style, and ovary.



Examples of complete flowers include apple, lily, and pea. Flowers that lack sepals, petals, stamens, or pistils are known as **incomplete** flowers.

Flowers are further grouped by the presence or absence of stamens and pistils. **Perfect flowers** contain both stamen (male) and pistil (female) reproductive structures in the same flower, while **imperfect flowers** contain only the stamen or pistil. Examples of imperfect flowers include corn, holly, squash, and willow.

Pollination occurs when a pollinator, such as wind, insects, or animals, transfer pollen grains from the anther to the stigma. The pollen grows from the stigma down the style to the ovary. **Fertilization** occurs when the male and female cells unite to produce a seed. After pollination and fertilization, the flower petals begin to drop and the ovary enlarges and develops into a **fruit**. The fruit is the seed bearing organ of the plant. There are basically two types of fruit:



Fleshy fruit - The mature fleshy fruit is composed of a soft fleshy material with seed or seeds inside. Blueberry, peach, tomato, and melons are all fleshy fruits.

Dry fruit - The dry fruit consists of seeds enclosed in a fruit wall that is hard and brittle when mature. Pea, sunflower, and oak produce dry fruits.

Seeds are the mature, fertilized ovules or eggs. They consist of a seed coat, endosperm (food storage tissue), and embryo. Seed **germination** is a process that begins when the seed absorbs water (imbibition). Besides water, seeds also need oxygen, warmth, and some need light to germinate. The germination process is complete when the seedling can manufacture its own food.

Asexual propagation is the production of new plants from stems, leaves, or roots of a parent plant. In this method of plant reproduction no seeds are used, just portions of the parent plant which are placed in soil, soil-less media (potting soil, vermiculite, peat moss), or even test tubes containing nutrient rich agar. Asexual propagation permits growers to produce more plants faster, especially in cases where seeds are difficult to germinate or are not viable (alive). One of the most important benefits of asexual propagation is that the plants produced are genetically identical to the parent plant.

The most common method of asexual propagation is the use of cuttings. **Cuttings** are detached portions of the plant, such as stems, leaves, or roots which grow into complete plants. Cuttings are often treated with a root inducing hormone and placed in an environment that favors root initiation and development. Other methods of asexual propagation include layering, division, and grafting.

Controlling pests

A **pest** is anything that causes injury or loss to a plant. The five major kinds of pests are: insects, weeds, nematodes, diseases, and animals. The presence of pests in our environment impacts the quality of the plants we produce. Although pest damage can reduce a plant's productivity or even destroy it, the amount and kind of damage varies from pest to pest. For example, conspicuous damage caused by chewing and sucking insects can be less harmful than a difficult to diagnose, but deadly disease. The key to managing a pest control program is to correctly identify the pests and understand their life cycles.

Integrated pest management (IPM) is a pest management strategy that uses a combination of practices to reduce pest damage with the least disruption to the environment. Research has shown that no single control measure works consistently over a long period of time. One reason is that pests can develop a resistance to pesticides and a resurgence can occur. The goal of IPM is to keep pest populations below the point at which plant losses are equal to the cost of control. Crucial steps in IPM involve **pest identification, monitoring, and establishing a tolerable level of plant loss**. When the amount of plant damage is no longer tolerable, a combination of methods is used to control pests.

The combination of methods used to control pest populations include **cultural, genetic, mechanical, biological** and **chemical** controls.

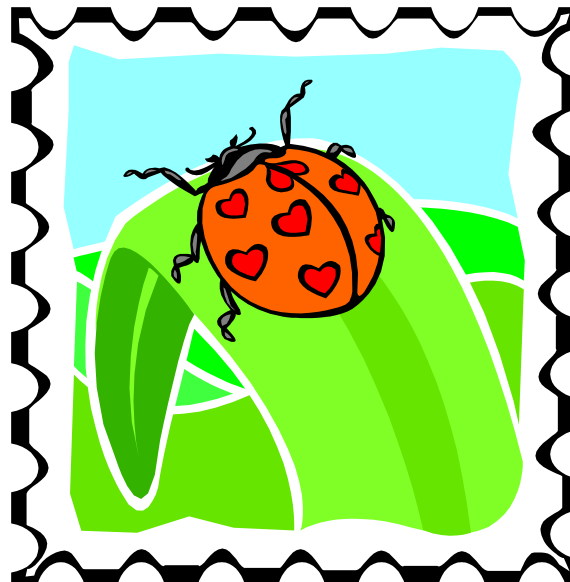
Cultural pest control utilizes management techniques like crop rotation, sanitation and inter-planting to control pests.

Genetic pest control uses plant breeding (genetic manipulation) to make plants resistant to specific pests.

Mechanical pest controls include mowing, plowing and mulching to discourage or destroy pests.

Biological pest control uses predators like lady beetles, praying mantis, and lacewings to control pests.

Chemical pest control includes using pesticides such as insecticides to control insects, herbicides to control weeds, fungicides to control fungi, and bactericides to control bacterial growth. In IMP chemicals are used as a last choice and the least toxic product is used first.





OBJECTIVES:

For youth to:

- list five requirements for plant growth.
- describe plant responses in growth limiting situation.

LIFE SKILL:

- Acquiring, analyzing, and using information through a scientific process.

MATERIALS:

- copies of A MATTER OF LIFE OR DEATH Activity sheets for each youth
- copies of WHAT DID YOU SEE? data sheet for you each youth
- 16 pots or containers with holes in the bottom
- grass seed (rye grass)
- builders sand
- potting soil
- rulers
- mixture of seeds
- seed trays or flats
- pens and pencils
- water
- scissors
- tape

TIME:

- 30 minutes

SETTING:

- A comfortable room with tables, chairs, and access to sunlight.

Activity 1: A Matter of Life or Death

INTRODUCTION

Grasses, like all plants, require certain things to grow - can you name them? (sunlight, water, air, proper temperature, and nutrients) How does a plant use each of these elements? (sunlight - energy and photosynthesis; water - photosynthesis, nutrient transport, cooling; air - carbon dioxide for photosynthesis and oxygen for respiration; and proper temperature and nutrients - to build and maintain plant tissues and to aid in photosynthesis) In this experiment we are going to explore how sunlight, water, and nutrients contribute to plant growth.

DO

- Separate youth into four groups: 2 SUN and 2 SHADE.
- Give each youth a copy of the A MATTER OF LIFE OR DEATH Activity sheet.
- Have each group fill two pots with sand and two pots with potting soil.
- Plant ten grass seeds in each pot (not too deep - add just enough soil to cover them).
- Water each pot with $\frac{1}{3}$ cup of water.
- Fill-in the correct label from the activity sheet and attach it to your pots.
- The SUN groups will place all of their pots in a sunny window and the SHADE groups will place their pots in full shade.
- Lightly water one sand and one potting soil pot in each location every other day for the duration of the experiment.
- Observe the pots for two weeks. Record the number of seeds germinated and the average height of the grass blades in each pot on the WHAT DID YOU SEE? Chart.
- Have the SUN and SHADE groups share their data.
- Have groups present their findings to the class using graphs or charts.

REFLECT

What happened to the plants that had nutrients (potting soil) and water but not enough light?

some seeds may have germinated and the seedlings may appear leggy and yellowed

What happened to the plants that had nutrients and light but not enough water?

no seeds should have germinated

What happened to the plants that had light and water but not enough nutrients?

fairly high germination rate but the seedlings may be smaller or yellowish

What do we do to our lawns or plants to make sure they get enough nutrients, light, and water?

fertilize or use nutrient rich soil, plant in a sunny location, and water

APPLY

- What do plants need in order to grow?

sunlight, water, air, proper temperature, nutrients

- Compare these with a list of things people need to grow.
- Sow several types of seeds in flats. Compare their percent germination, germination time, and rate of growth. Once developed, transplant the seedlings to larger containers.
- Visit a greenhouse operation and observe how the grower artificially supplies plants with the elements they need to survive. Ask the grower to describe how they provide their plants with sunlight, water, air, proper temperature, and nutrients.

A Matter of Life or Death

- Fill 2 pots with sand and 2 pots with potting soil.
- Plant 10 grass seeds in each pot.
- Water each pot.
- Complete the labels below and attach them to your pots.
- The SUN groups will place their pots in a sunny location.
- The SHADE groups will place their pots in the shade.
- Water 1 of the sand pots and 1 of the potting soil pots in each location every other day for the duration of the experiment.
- Do NOT water the other pots!



LABELS:

GROUP: SUN # SAND WATERED DATE:	GROUP: SUN # SAND NOT WATERED DATE:
GROUP: SUN # POTTING SOIL WATERED DATE:	GROUP: SUN # POTTING SOIL NOT WATERED DATE:

GROUP: SHADE # SAND WATERED DATE:	GROUP: SHADE # SAND NOT WATERED DATE:
GROUP: SHADE # POTTING SOIL WATERED DATE:	GROUP: SHADE # POTTING SOIL NOT WATERED DATE:

What Did You See?

GROUP	Number of seeds germinated	Average Height 1 Date: _____	Average Height 2 Date: _____	Average Height 3 Date: _____
SUN				
Sand Watered				
Sand Not Watered				
Potting Soil Watered				
Potting Soil Not Watered				
SHADE				
Sand Watered				
Sand Not Watered				
Potting Soil Watered				
Potting Soil Not Watered				

(over)

What Did You See?

(continued)



Determine the **percent germination rate** for:

sun vs shade pots _____

watered vs not watered pots _____

sand vs potting soil pots _____

Use this formula:

seeds sprouted

of seeds planted

X 100 = _____ % germination

Which treatment had the highest percent germination?

Which pots grew the most? Least?

Why did these similarities and differences take place?





OBJECTIVES:

For youth to:

- identify plants wanted in a garden.
- plan a garden.
- explain why planning a garden is important.

LIFE SKILL:

- Problem solving and decision making.
- Planning and organizing.

MATERIALS:

- copies of the SAMPLE GARDEN PLAN Activity sheet for each youth
- copies of GARDEN PLANNER Activity
- seed and nursery catalogs for youth to share
- list of recommended vegetable crops that can be grown in area from EDIS article: Florida Vegetable Gardening Guide (can be obtained from the County Extension Office or online at: <http://edis.ifas.ufl.edu/vho21>)
- pens and pencils

TIME:

- 30 minutes

SETTING:

- A comfortable room with tables and chairs.

Activity 2: Garden Planner

INTRODUCTION

In previous activities we talked about the five things plants need to grow, can you tell me what they are? (sunlight, water, air, nutrients, and proper temperature) If you give a plant these five elements you'll have a healthy plant, right? Unfortunately it's not that simple. If it were, we'd throw seeds, water, and fertilizer out the back door and we'd have fresh fruits and vegetables every day. In order to get the most out of our plants we also need to consider factors like the amount of space plants need, plant varieties that grow best in your area, watering and fertilizing schedules, and pest control measures. Today, you're going to plan a summer garden where you will concentrate your plants into an area where they will receive appropriate amounts of sunlight, water, air, nutrients, and proper temperature while keeping in mind factors like spacing, variety selection, and pest control. Let's get started!

DO

- Give each youth a SAMPLE GARDEN PLAN Activity sheet.
- Review the SAMPLE GARDEN PLAN with youth. Be sure to point out the spacing between plants, walking room between rows, the watering and fertilizer schedule, and pest control measures.
- Give each youth a GARDEN PLANNER activity.
- Have youth make a preliminary list of vegetables, fruits, herbs, and flowers they would like to grow in a spring/summer garden.
- Once youth have selected their garden plants have them look up the available varieties and growing requirements in printed or online seed and nursery catalogs

DO (continued)

- Have youth make a final list of plants based on the information gathered.
- After the appropriate plants have been selected, have youth draw a garden plan that meets the plant needs, including a maintenance schedule.

REFLECT

How did you supply your garden with the five things they need to grow?

answers will vary

How would someone in an apartment plant a vegetable garden?

plant in containers or window boxes, plant smaller varieties

How would your garden planner change if you were planting a winter garden?

the plants would be different

Summer is when pests can be a real problem in the garden. What kind of pest control measures would you use in your garden?

answers will vary

What might happen if you didn't plan a garden before planting it?

answers will vary

Why do you need to plan a garden?

a plan will help you organize your garden and place the plants where they will grow the best

a plan will help you develop a crop rotation schedule to reduce pest problems.

APPLY

- Have youth display their garden plans. After looking at all the plans, develop one plan for the entire group and plant a garden.
- Visit your local Extension office, nursery, or garden center where garden variety trials are taking place. Find out how they planned their garden.
- Obtain a list of recommended vegetable crops in your area from the local Extension office or search online publications using the University of Florida Extension EDIS (Electronic Digital Information Service) article: Florida Vegetable Gardening Guide: <http://edis.ifas.ufl.edu/vho21>. Make a table listing vegetable crops and the major diseases and insect pests that affect them.

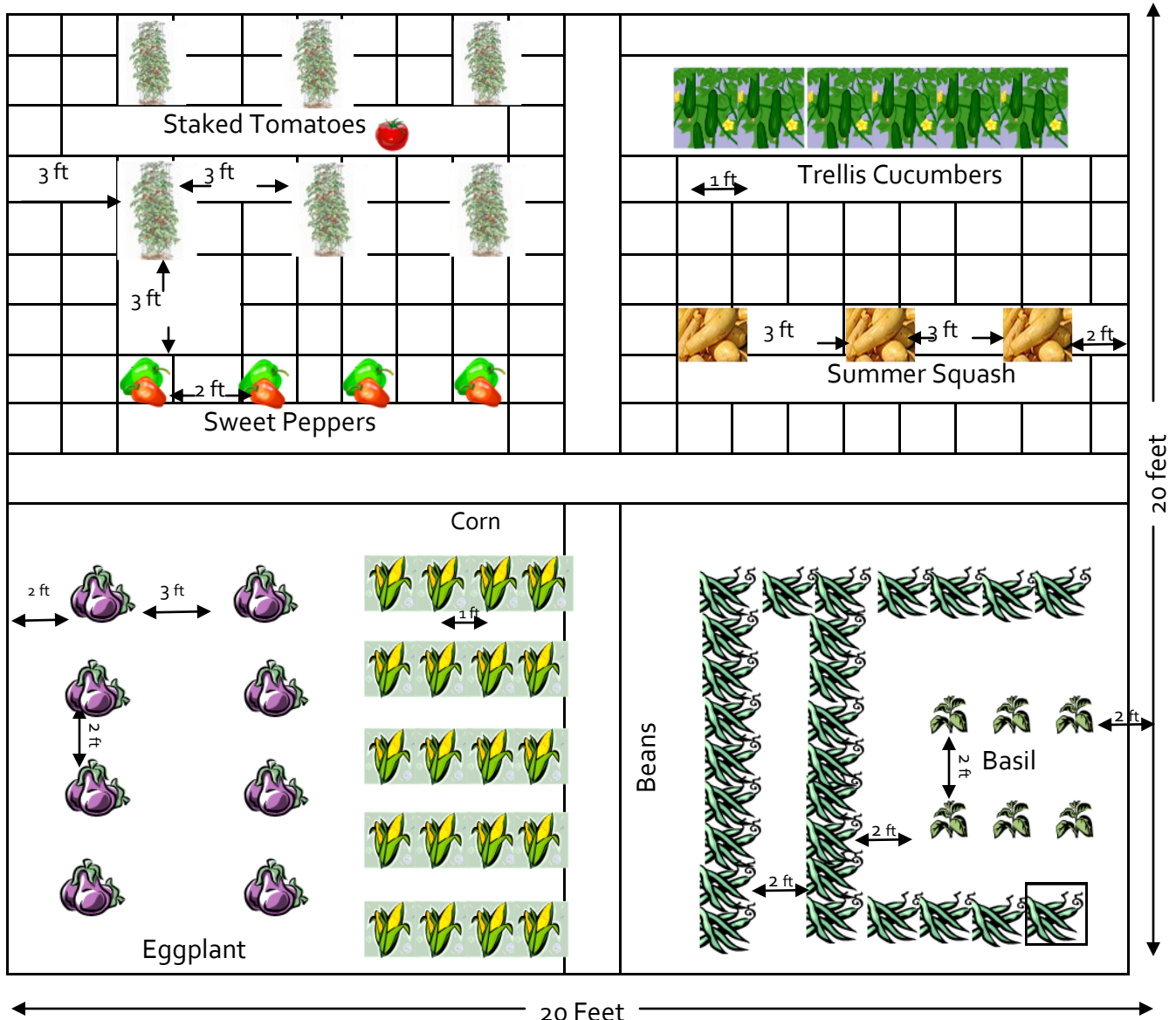
Sample Garden Plan

Preliminary Plant List

<i>Tomatoes</i>	<i>Eggplant</i>
<i>Peppers</i>	<i>Corn</i>
<i>Cucumbers</i>	<i>Beans</i>
<i>Squash</i>	<i>Basil</i>

Final Plant List

Note: Your choices will need to vary depending on your location and recommendations for growing season.



Maintenance schedule:

- ☒ Water in mornings when needed.
- ☒ Fertilize once every 2 or 3 weeks.
- ☒ Monitor for pests.

Garden Planner

Make a preliminary list of vegetables, fruits, herbs, and flowers you would like to grow in a garden. Look up available varieties and growing requirement in seed and nursery catalogs then make a final list of plants based on the information you gathered.

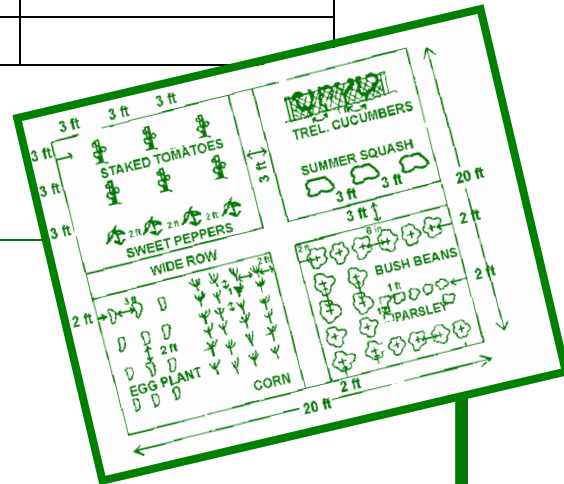
PRELIMINARY PLANT LIST

FINAL PLANT LIST

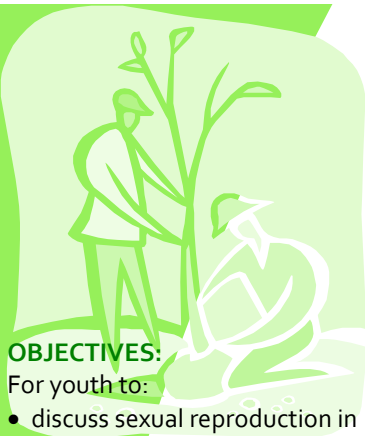
Garden Plan

Now, on separate piece of paper draw a garden plan for your list of plants above. You can use graph paper or a computer program to help design your plan. Be as creative as you would like.

Once you have your garden planned, complete your maintenance schedule below.



Maintenance Schedule:



OBJECTIVES:

For youth to:

- discuss sexual reproduction in plants.
- distinguish between perfect and imperfect flowers.
- identify male and female parts of a flower.

LIFE SKILL:

- Observation skills
- Recordkeeping skills

MATERIALS:

- copies of REPEATING THE PROCESS and SEED to SEED Activity sheets for each youth
- flowers for each youth (perfect and imperfect)
- hand lenses for youth to share
- window box or pots for each youth
- fast growing annual seeds (e.g. salvia, marigold, phlox)
- potting soil
- water soluble plant food
- cotton swabs
- copies of PARTS OF A FLOWER Activity (optional)
- craft supplies
- Farmer's Almanac
- paper and pens/pencils

TIME:

- 30 minutes

SETTING:

- A comfortable room with tables and chairs

ADVANCE PREPARATION:

- Grow four corn or bean plants five weeks before experiment. Each plant should be grown in a different soil type (e.g. sand, clay, potting soil, and a mixture of soil types).

Activity 3: Repeating the Process

INTRODUCTION

Plant propagation refers to both the sexual reproduction of new plants from seeds, and the asexual reproduction of plants from vegetative structures (leaves, stems, and roots). Today, we're going to learn about sexual reproduction in plants. In most plants, sexual reproduction starts when pollen or male sex cells are transferred to the stigma or female part of a flower. How does pollen travel from one flower to the next? (bees, other insects, wind, water) Let's take a closer look at the sexual reproductive cycle of plants and the role flowers play in the cycle.

DO

- Give each youth a flower and a hand lens (if the flowers are small).
- Give a copy of REPEATING THE PROCESS Activity sheet to each youth and review the information aloud.
- Have youth sketch and label the flower parts.
- Give each youth a copy of the SEED TO SEED Activity sheet.
- Have youth fill window boxes or pots with potting soil (within 1 inch of the top).
- Place a few seeds in each pot.
- Cover with soil then water.
- Place pots in a windowsill where they will receive lots of light.
- Water the pots every other day or when the soil is dry to the touch. After plants have emerged, water with a water soluble plant food once a week.
- If time allows, have youth pollinate flowers using cotton swabs.
- Collect the seed and start again.
- Have youth keep a record of the plants growth and development.

REFLECT

What is the difference between imperfect and perfect flowers?

perfect flowers have both male and female parts in the same flower

imperfect flowers have only male or female parts

What are some ways in which pollen is transferred from flower to flower?

insects, wind, people, water

What is meant by the term asexual reproduction?

reproduction of new plants from the stems, leaves, or roots

How can growers manipulate a plants' sexual reproduction?

hand pollinate, select the parents based on certain characteristics

Can you think of a reason why a grower would want to manipulate a plants sexual reproduction?

to produce plants with fragrant flowers, bigger fruit, or increased disease resistance

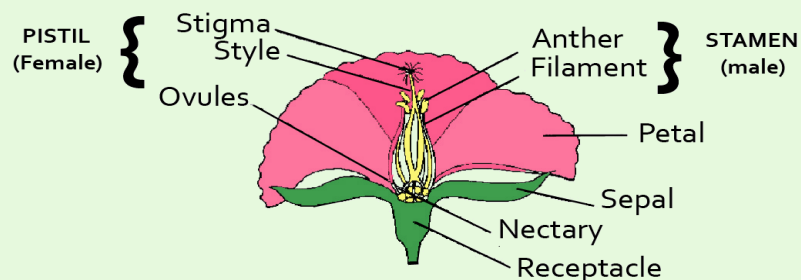
APPLY

- Create a skill-a-thon or use the PARTS OF A FLOWER Activity sheet to have youth demonstrate their knowledge of parts of the flower.
- Have youth collect seeds from their neighborhood or schoolyard. Compare the size, shape, and color of the seeds.
- Using craft supplies, have youth put together a model of a perfect flower.
- Look at a Farmer's Almanac or and Extension publication on annual flower gardening to learn about planting times in different areas.

Parts of a Flower-Answer Key

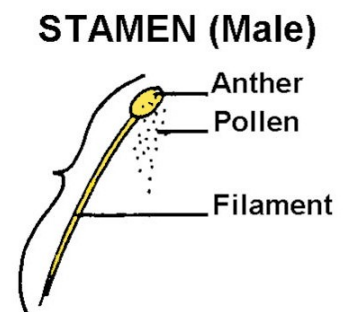
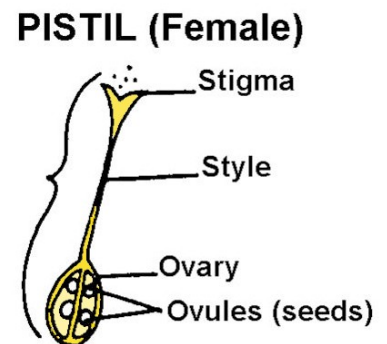
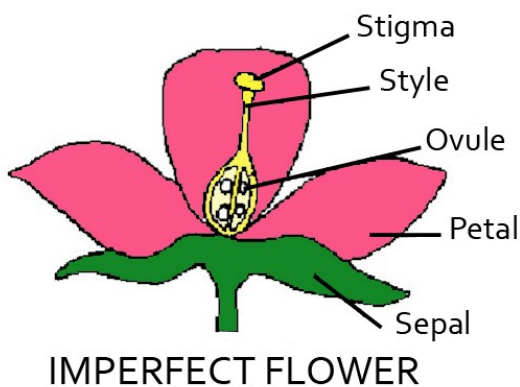
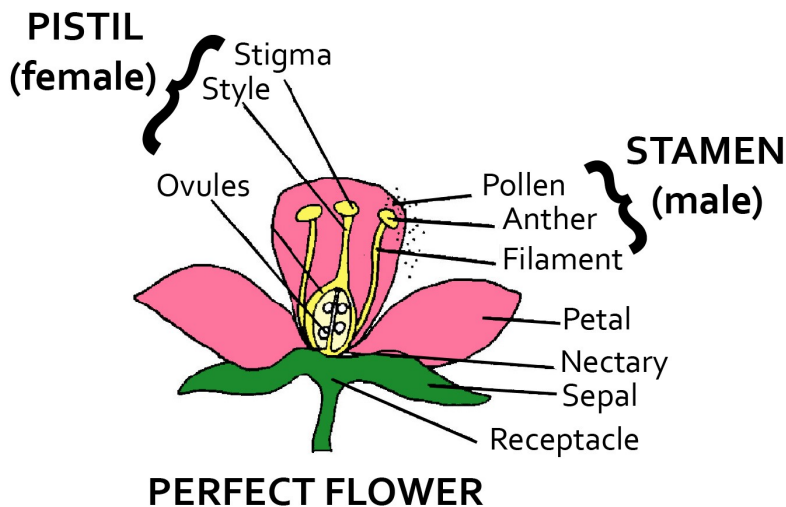
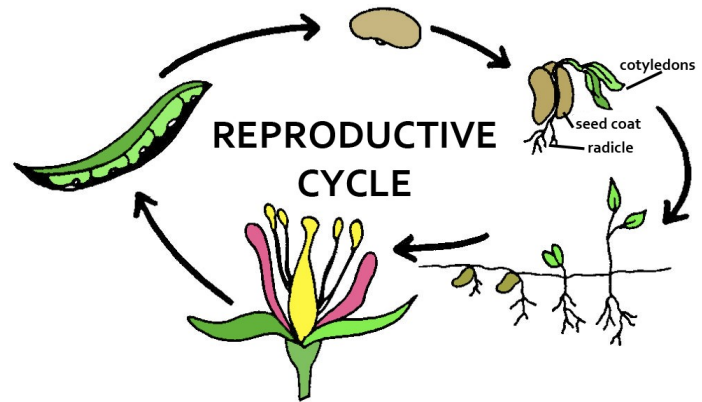
Label the parts of this flower using the following words:

stamen	pistil	filament	ovule	petal	nectary
sepal	receptacle	anther	stigma	style	



Repeating the Process

Seeds are dispersed by wind, animals, water, and a wide variety of self-propulsion mechanisms. When the environmental conditions are favorable, the seed will swell and sprout (germinate). The young plant will grow and develop flowers. Perfect flowers contain both male and female parts in the same flower, while imperfect flowers have male and female parts in different flowers. In either case, pollen must be transferred from the anther to the stigma for sexual reproduction to occur. The pollen grows from the stigma down the style and into the ovary. In the ovary, the male and female cells unite to produce seeds. Review the sexual reproductive cycle of a plant and learn the parts of a flower.

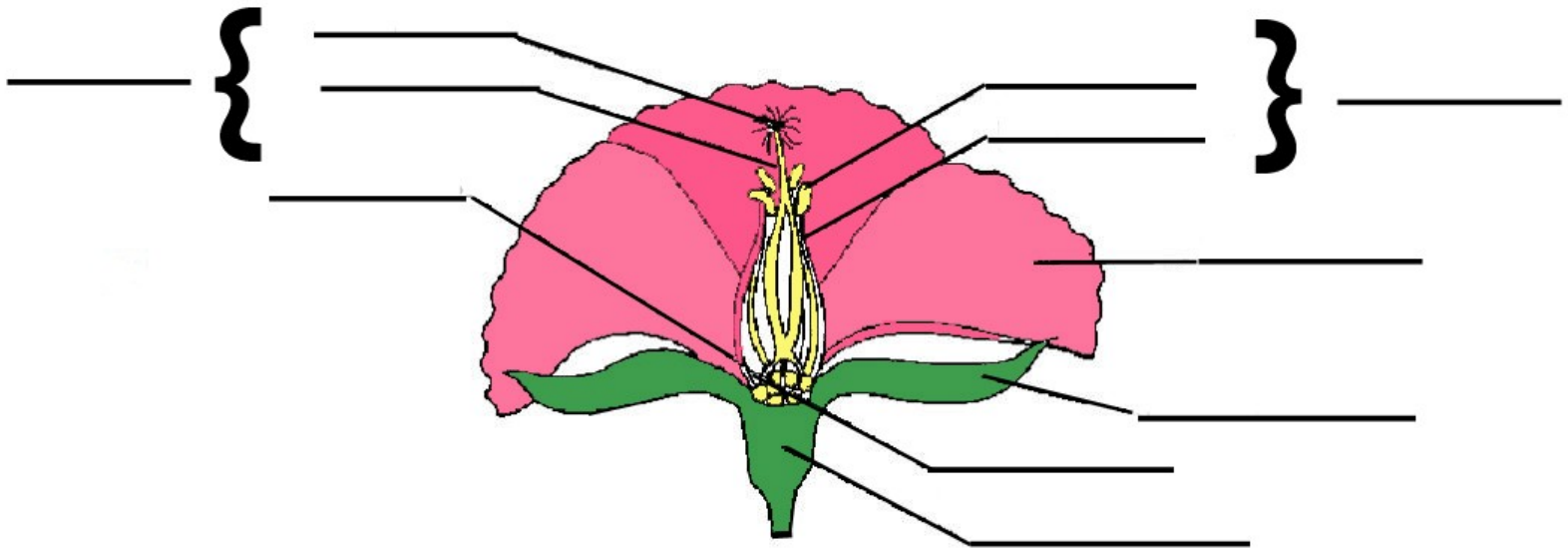


Parts of a Flower



Label parts of this flower using the following words:

stamen	pistil	nectary	anther
stigma	style	sepal	receptacle
filament	ovule	petal	



Seed to Seed

Planting Instructions:

- 1) Fill a window box or pot with potting soil (to within 1 inch from the top).
- 2) Place a few seeds in each pot.
- 3) Cover with soil and water.
- 4) Place pots in a windowsill where they will receive lots of light.
- 5) Water every week with a nutrient solution.
- 6) Keep a weekly record of your plant's growth and development.



Observations

DATE	What's Happening Here?
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	

Seed to Seed (continued)

Compare your observations with the information on the back of the seed packets. Was the information accurate?

How many days did it take for your seeds to germinate?

When did flowers appear?

Did you hand pollinate your flowers?

How many days did it take for your plants to go from seed to seed?



Could you start over again with your new seeds?



OBJECTIVES:

For youth to:

- explain asexual reproduction.
- demonstrate asexual propagation methods.
- list reasons for reproducing plants without seeds.

LIFE SKILL:

- Observation skills.
- Record keeping skills.

MATERIALS:

- house plant (begonia, ivy, African violet, philodendron)
- scissors
- small pot filled with potting soil
- one precut leafy carrot top for each youth
- small shallow bowl or plastic dish for each youth
- water
- sphagnum moss
- plastic wrap
- aluminum foil
- potato pieces and seeds

TIME:

- 30 minutes

SETTING:

- A comfortable room with tables and chairs.

ADVANCE PREPARATION:

- Cut the top inch off of a carrot for each youth.

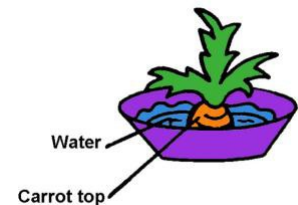
Activity 4: Cloning Around

INTRODUCTION

Asexual propagation is the production of new plants from the stems, leaves, or roots of a parent plant. The most common method of asexual propagation is the use of cuttings. A stem, leaf, or piece of root is cut from the plant, eventually it will grow a new plant. Asexual propagation allows growers to produce more plants faster, especially in cases where seeds are difficult to germinate or the seed is not viable (alive). One of the most important benefits is that the plants produced are genetically identical to the parent plant, therefore they have the same characteristics as the parent. This type of plant is called a **clone**. Today, we're going to produce clones.

DO

- Using a pair of scissors, take a leaf cutting (begonia, African violet) or stem with leaf cutting (begonia, philodendron) from a house plant and plant in a small pot filled with potting soil. Explain that after time, new roots, shoots, and leaves will emerge from the cutting.
- Have youth produce new plants from carrot tops.
 - ◇ Give each youth a precut carrot top.
 - ◇ Have youth place the carrot top in a shallow bowl with about 1/2 inch of water.
 - ◇ Keep a journal of the carrot's root and shoot development.



Please note: While carrots will allow for a quick view of sprouting roots and new tops, they will not produce an edible tap root. Pineapple tops do produce a great house plant as another alternative.

REFLECT

Farmers grow carrots from seeds and not from cuttings - why not grow carrots from cuttings?

seeds are cheaper; furthermore, the cutting will not grow a long orange carrot which can be sold, the carrot plant will have a shallow root system, the plant will send up new shoots, then flowers

Farmers usually grow potatoes from potato pieces - why not grow potatoes from seeds?

**clones will have the same characteristics as the parents
seeds may not be viable
cuttings grow faster**

What are some reasons for reproducing plants without seeds?

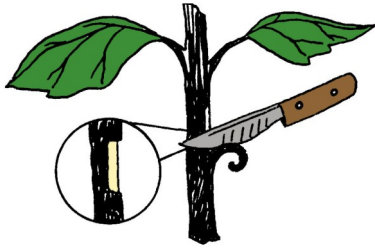
- 1) to produce plants with the same characteristics as the parent**
- 2) seeds may not be available or are slow and difficult to grow**
- 3) plants may not produce viable seeds**

APPLY

- Ask an horticultural extension agent, Master Gardener, or nursery to demonstrate other methods of asexual propagation (grafting, budding, and tissue culture) to youth.
- Have youth practice air layering on a nearby shrub (eg. azalea).
- Conduct a sexual versus asexual experiment where youth compare the growth and development of potatoes using potato seeds and potato pieces (if it is conducive to the growing conditions or season in your location).

How to Grow Plants

Air layering is a simple method of asexual propagation in which roots are formed on a stem (branch) while it is still attached to the parent plant.



Remove a two inch portion of bark from around a branch.

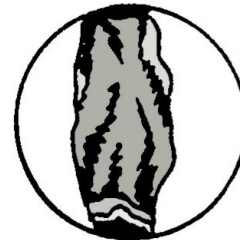
Place moist, sphagnum moss over the exposed area.



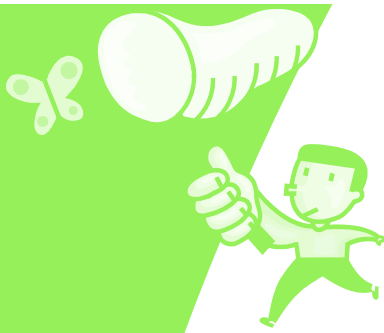
Cover with plastic wrap.



Then place a piece of aluminum foil over the plastic wrap and tighten the ends.



Be sure to label the stem with the your date and name. Periodically, check under the wrapped layers to make sure the moss is moist. By the end of the growing season new roots should have formed in the moss. Cut the new plant from the stem and plant it.



Activity 5: Meet My Friends

OBJECTIVES:

For youth to:

- identify common plant pests.
- distinguish between beneficial and harmful insects.
- describe the negative effects of pests on plants.

LIFE SKILL:

- Acquiring, analyzing, and using information.

MATERIALS:

- jar with lid for each youth
- hammer and nails for poking holes in lid
- copies of PLANT FRIENDS AND ENEMIES Activity sheet for each youth
- insect field guides and keys for youth to share
- hand lenses or dissecting microscope, if available
- weeds from a schoolyard or neighbor
- weed identification guides
- poster paper

TIME:

- 30 minutes

SETTING:

- An outdoor area and a comfortable room with tables and chairs.

INTRODUCTION

Can someone describe a plant pest? A pest is anything that causes injury or loss to a plant. Pests damage plants by making them less productive, affecting reproduction, or by destroying them. Pests can be put into five categories - insects, nematodes, weeds, diseases, and animals. Can you give me an example of an insect pest? (caterpillar, aphid, cut worm) Are all insects plant pests? Can you name some insects that are beneficial to plants? (lady bug, butterfly, bee) There are about 100,000 insect species in North America, so identifying the pests from the beneficials can be tricky. Today, we're going to collect insects and identify which insects are plant friends or enemies.

DO

- Using a hammer and nail have youth poke air holes in their jar lids.
- Give youth about 15 minutes to collect insects (avoid bees, wasps, and spiders). Insects tend to hide under the leaves or in dark places, early morning is a good time to collect them.
- After the insects have been collected, move youth indoors.
- Have youth complete the PLANT FRIENDS AND ENEMIES Activity sheet.
- Using field guides and insect keys help youth identify their insects.
- Youth may need to use a hand lens or dissecting microscope to identify the insects.

REFLECT

What type of insect (beneficial or pest) did you find more of?

answers will vary

Do you think we would find these same insect species if we looked six months from now?

some of the same species would be present but many more insects will be found in the summer than the winter (some insects have a dormant stage, migrate, or lay their eggs over winter and new generations appear in spring and summer)

What do beneficial insects do for plants?

pollinate, eat plant predators

What do lady bugs do in the garden?

they eat insect pests like aphids

What are the names of some of the pests you saw?

answers will vary

What are the effects of insect pests on plants?

destroy the plant, render it less productive, affect reproduction

Besides insects, what are some other plant pests?

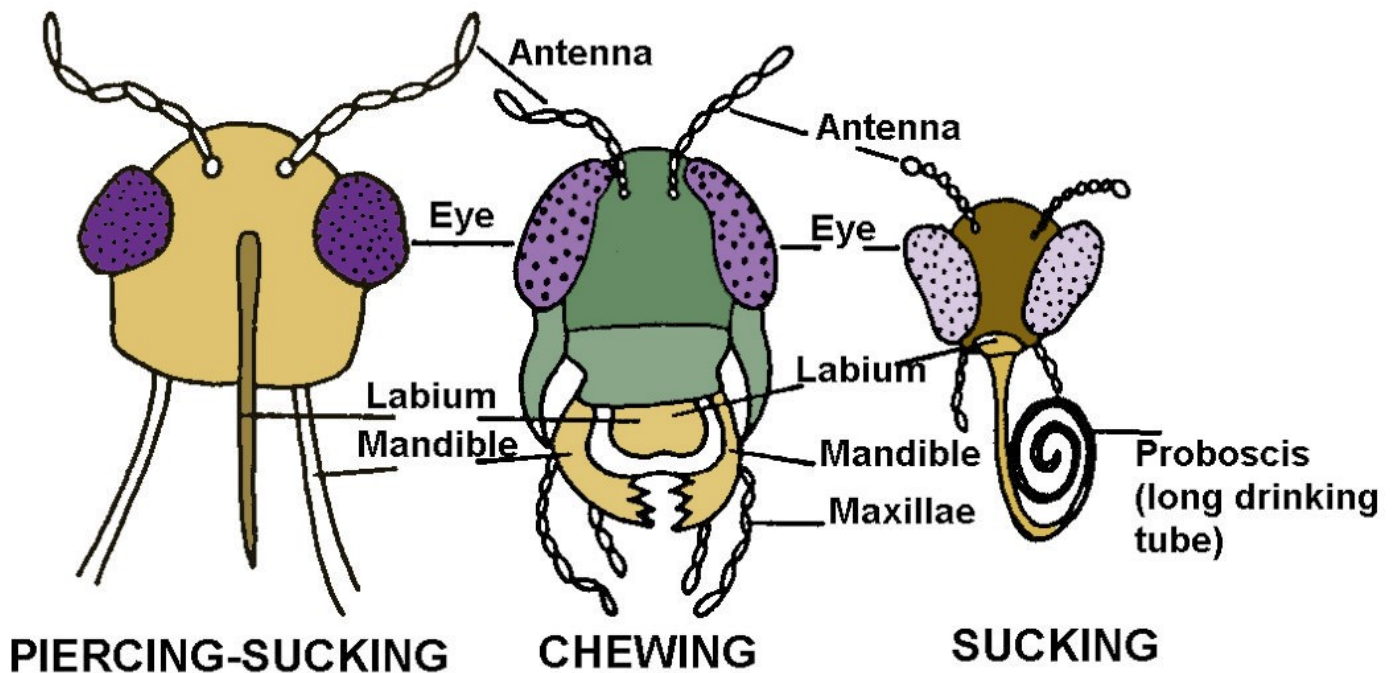
diseases, weeds, animal predators

APPLY

- Take your insects home and observe their behavior. Make sure your insects have food, water, warmth, and shelter. After a few days release in a field (pest) or in your garden (beneficial).
- Have youth bring in articles and report on insects that are in the news.
- Collect weeds from your neighborhood or schoolyard and try to identify them using a plant identification key.
- Select an insect and learn about its life cycle. Make a poster of the insects life and share it with the class.

Plant Friends and Enemies

Insects have three distinct body parts (head, thorax, and abdomen), three pairs of legs, and zero, one, or two pairs of wings. Of the 1 million different species of insects in the world approximately 100,000 species are found in the United States and less than 1,000 are pests to plants and people. Plant damage caused by insects is often related to the structure of the insects mouth. Mandibles are for chewing leaves and stems and elongated beaks are used for piercing and sucking plant sap. Chewing insects include grubs, beetles, and caterpillars. Piercing-Sucking insects include aphids, leafhoppers, and mosquitoes.



Mexican bean beetle damage.



Eggplant leaf damage caused by the melon thrips, *Thrips palmi* Karny.

Sketch and label your insect:

Where did you find your insect?

Does your insect have three distinct body parts?

Does your insect have 3 pairs of legs?

Does your insect have wings? How many pairs?

What type of mouth parts does your insect have?

Using a field guide or an insect key, try to identify your insect.





OBJECTIVES:

For youth to:

- identify five major categories of pests.
- explain integrated pest management.
- discuss alternative pest control techniques.

LIFE SKILL:

- Working with groups.
- Problem solving

MATERIALS:

- copies of BLAST THAT PEST! Activity sheet for each youth
- insect identification guides
- cardboard
- vaseline
- string
- 6 cloves garlic
- 1 medium onion
- 1 tbsp cayenne pepper
- 1 tsp liquid soap
- 1 gallon water
- fine mesh strainer
- 3 or 4 spray bottles
- weed identification guides
- pens or pencils

TIME:

- 30 minutes

SETTING:

A comfortable room with tables and chairs.

Activity 6: Blast That Pest!

INTRODUCTION

The presence of pests in our environment impacts the quality of plants we grow. The five major kinds of pests are: insects, nematodes, weeds, diseases, and rodents and other animals. Controlling pests can be expensive and may cause damage to the environment. **Integrated pest management (IPM)** is a pest management strategy which uses a combination of biological, cultural, mechanical, genetic, and chemical controls to keep pests at a manageable level with the least disruption to the environment. It is important to use an integrated program, but it is also important to use methods that are safest for the environment. Can you name a biological or genetic control method that we might use in a garden? (biological control - using a predator to control other pests, e.g. ladybugs eating aphids; genetic control - using pest resistant plants, e.g. planting watermelon that is resistant to virus) Today, we're going to identify pests in our area and learn ways to control their populations.

DO

- Give a copy of the BLAST THAT PEST! Activity sheet to each youth.
- Read and discuss the information sheet aloud with youth.
- Divide youth into four groups:
 1. home gardener with an insect problem
 2. golf course manager with a weed problem
 3. tomato grower with a rodent problem
 4. vegetable grower with a fungus disease.
- Have groups discuss a strategy to solve their pest situation using IPM controls.
- Have groups present their strategies and solutions to the class.

REFLECT

What are the five major categories of pests?

insects, weeds, nematodes, diseases, rodents and other animals

What is integrated pest management?

a pest management strategy which uses biological, cultural, genetic, mechanical, and chemical methods to control pests

How does a grower determine when to act on a pest problem?

when the amount of plant damage is no longer tolerable

What are some IPM controls that a gardener can use to reduce pests?

cultural - wash tools after working on the garden to prevent the spread of diseases to other areas

biological - grow plants that attract beneficial insects so they will prey on garden pests

mechanical - mulch to prevent weed growth

genetic - plant disease resistant varieties

chemical - spray an insecticide

APPLY

- Make an inventory of all pesticides at your school or home. List the pest controlled, active ingredient, and toxicity (or poison) level of each pesticide. Discuss what was found and alternative methods that could be used instead of or in combination with the chemicals.
- Make insect traps using yellow or blue cardboard, petroleum jelly (like Vaseline), and a string. Place them around a garden or landscaped area. Collect and identify the insects. Determine if they are pests.
- Make an organic pesticide to control chewing insects. Combine 6 cloves crushed garlic, 1 minced onion, 1 tablespoon cayenne pepper, 1 teaspoon dish washing soap, and 1 gallon of water. Mix ingredients and let sit for 15 minutes. Strain into a spray bottle and mist the plants. (NOTE: This is not guaranteed to work!)
- Collect weeds from your garden or school yard. Identify, label, and press the weeds. Be sure to include common name, date, scientific name, where it was found, and collectors name.



Blast That Pest!

Integrated pest management (IPM) is a pest management strategy that uses a combination of practices to reduce pest damage with the least disruption to the environment. Research has shown that no single control measure works consistently over a long period of time. One reason is that pests can develop a resistance to pesticides and a recurrence can occur. The goal of IPM is to keep pest populations below the point at which plant losses due to the pests are equal to the cost of control. Crucial steps in IPM involve pest identification, monitoring, and establishing a tolerable level of plant loss. The combination of methods used to control pest populations include cultural, genetic, mechanical, biological and chemical controls. The cultural, genetic, mechanical and biological controls should be in constant use. However, when the amount of plant damage is no longer tolerable, a chemical methods may be used to control the pests.

Cultural pest control uses management techniques to control pests. Examples: keeping tools clean, crop rotation, and proper watering and fertilizing.

Genetic pest control uses genetic manipulation to make plants resistant to specific pests. Examples: planting crops which are resistant to fungi and nematodes.

Mechanical pest control methods involve tools or equipment for control. Pests are destroyed or removed. Examples: mowing, plowing, pruning, mulching, and crushing the pests.

Biological pest control uses living organisms that are predators to control pests, e.g. lacewings and ladybugs.

Chemical control of:

- insects = insecticides
- weeds = herbicides
- nematodes = nematicides
- fungi = fungicides
- bacteria = bactericides



Which method or combination of methods will you use to solve the following pest problems?

- Groups:
- (1) home gardener with an insect problem
 - (2) golf course manager with a weed problem
 - (3) tomato grower with a rodent problem
 - (4) vegetable grower with a fungus disease

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