

PLANT PROPAGATION

A 4-H Horticulture Project for
Senior 4-H Members

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INTRODUCTION

You are about to begin a project that is useful and fun; Plant Propagation. The skills you develop from the project will be useful throughout life.

Specifically, this project is designed to help you be able to:

1. Propagate plants
2. Make a rooting medium
3. Grow plants from seeds
4. Grow plants from cuttings
5. Grow plants by plant divisions
6. Grow plants by layering
7. Practice good propagation methods
8. Share the knowledge gained through this project with others
9. Report your 4-H work by keeping a written record of (a) activities undertaken, and (b) what was learned from each activity

Planning My "Plant Propagation" Project

This project may be taken as an individual project or as a group project. It can be taken for two years — doing at least two sections each year.

Begin the project by reading through the entire project book. Go back and select the two or more sec-

tions you would like to carry out. Do the activities discussed under the sections chosen by you. Your involvement is not limited to the activities discussed in this project book. Your imagination and interests are the only boundaries.

Write down your project goals on page 12 . Your goals should reflect what you plan to do and what you want to learn from this project.

Make a plan of action for reaching your goals. Keep a record of what you do, what you learn, and how you share this knowledge with others. A 4-H project summary form is included in the back of this project book.

Summary Of Steps To Follow In Carrying Out This Project:

1. Review the entire project book.
2. Select two or more sections which you plan to carry out.
3. Set your project goals. Record these goals.
4. Make a plan of action.
5. Carry out the plan
6. Keep a record of what you do, what you learn, and how you share your knowledge with others.

PLANT PROPAGATION

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What Is Plant Propagation?

Plant propagation is any method of increasing or multiplying plants. Put simply, it means getting new plants from old ones. Many different plant parts can be used, including seeds, leaves, stem pieces, bulbs, root pieces, or even buds. Most ornamental plants can be propagated from at least one of these plant parts.

Methods of Plant Propagation

There are two basic methods of plant propagation — sexual, by seed, and asexual, by means of some vegetative part such as a shoot, root or leaf. In asexual propagation, there is generally no change in the make-up of the new plant. All of the characteristics of the parent plant such as plant size, flower color and leaf shape occur in the new offspring in most cases. Some common methods of asexual plant propagation are: cuttings, division, layering and modified stems.

Plants propagated from seed (seedlings) do not always resemble the parent plant. Seedlings from the same plant may vary greatly in shape, color and growth habit.

Section I — Seed

Seeds are living organisms that are in a dormant or resting stage. A seed contains a miniature plant or embryo and stored food which is surrounded by a protective seed coat (illustration 1).

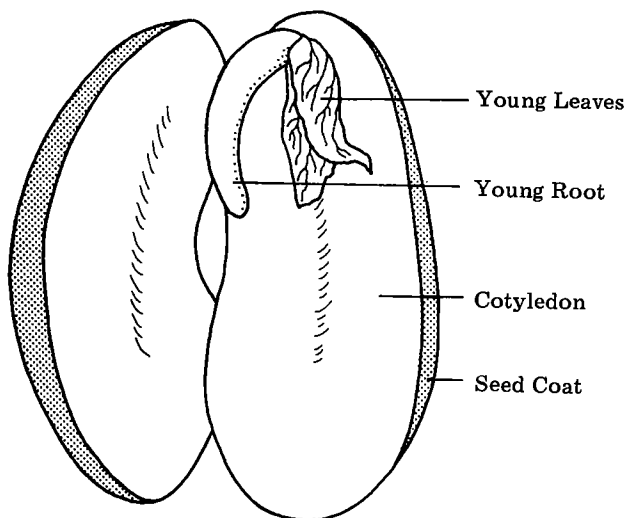


Illustration 1

When the embryo inside a seed starts to grow, we say the seed germinates or sprouts (illustration 2). The first two leaves that emerge from most seeds are cotyledons or "seed leaves." These supply food for the young plant until it can develop "true" leaves and produce its own food.

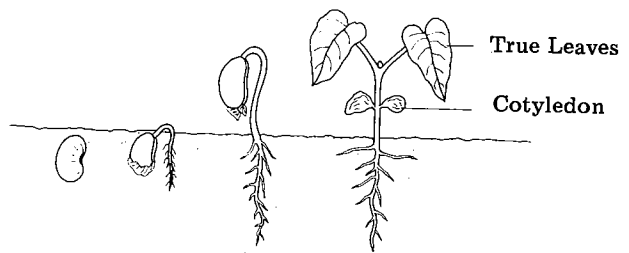


Illustration 2

The conditions must be just right before a seed germinates. This means that there must be enough moisture, warm temperature, and oxygen around the seed. Most seeds do not need light to germinate, but after germination the seedlings need light to make food by photosynthesis.

Activity One — Germinating Seed

1. Make a germination container by cutting down a milk carton. (illustration 3)

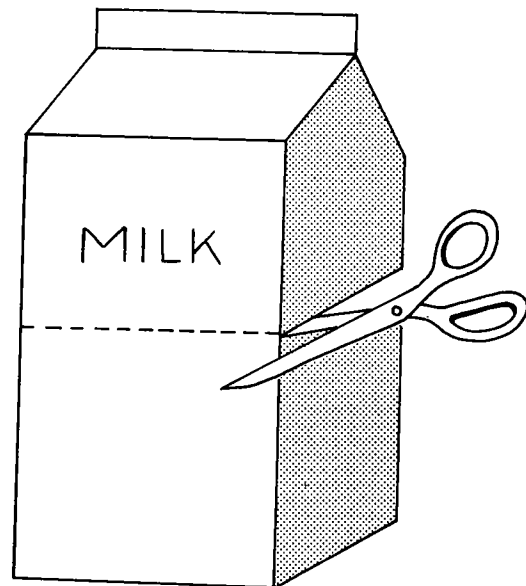


Illustration 3

2. Punch three or four drain holes in the bottom and fill to 1 inch of top with an artificial soil mix (illustrations 4 and 5). Artificial soil-mixes do not contain soil and are usually disease free, light weight, and easy to handle. Some of these mixes which can be purchased at garden supply stores are Ready Earth, Pro-Mix, Jiffy-Mix and Metro-Mix. In most cases, these materials contain fertilizers.

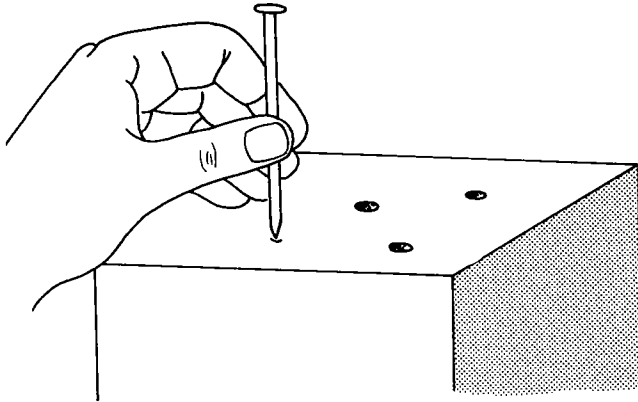


Illustration 4

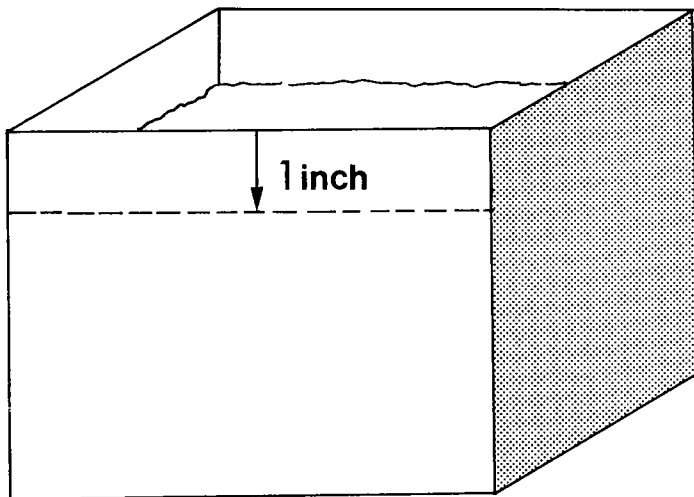


Illustration 5

3. Plant marigold, zinnias or other seed by sprinkling the seed on the artificial mix surface. Lightly cover the seed with mix so that they are barely hidden.
4. Gently water the artificial soil mix until water runs out the bottom of the carton.

5. Place the milk carton in a plastic bag and put in a warm room such as the kitchen (illustration 6). Avoid placing the carton in direct sunlight as heat build up in the plastic bag could kill emerging seedlings.

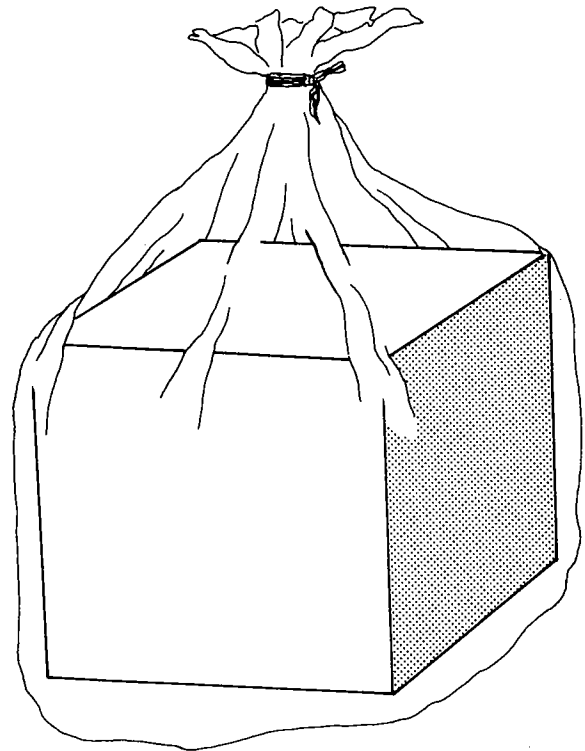


Illustration 6

6. The seeds should germinate in five to six days. After germination, take the carton out of the plastic bag and put it near a window.
7. Check daily to be sure that the soil mix in the carton is moist. When it begins to look and feel dry add enough water to the mix that the water will run out of the bottom of the carton. Keep the carton on a dish or pie pan.

Activity Two — Transplanting Seedlings

The seedlings will soon become overcrowded and a reduction in growth rate will occur if they are not promptly transplanted. After the seedlings have developed two to four true leaves and are large enough to handle, they should be transplanted to pots or other containers filled with the same artificial soil used in Activity One.

1. Gently remove each seedling from the milk carton with a table knife or other suitable instrument, being careful not to damage the roots (illustration 7).

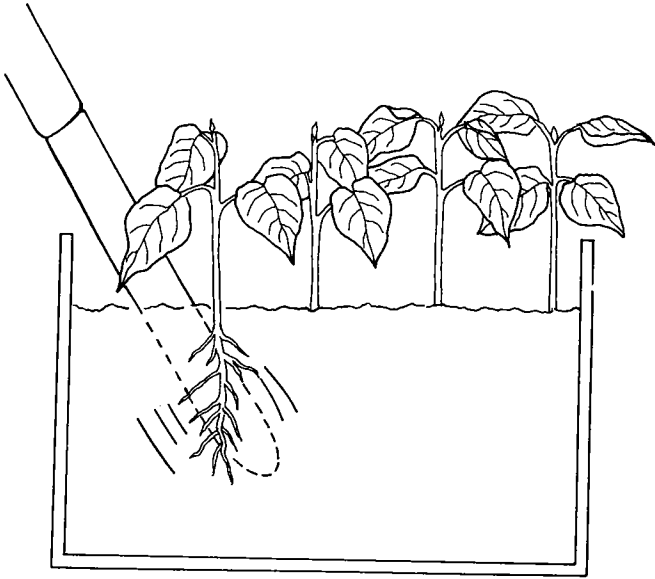


Illustration 7

2. Plant each seedling in a pot or milk carton filled with artificial soil at approximately the same depth as it was growing. (illustration 8).

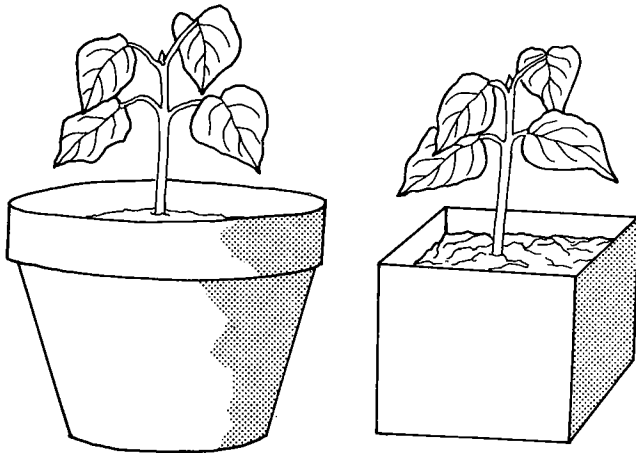


Illustration 8

3. Water well with a mist spray and place the containers in a shady area for several days.
4. After the seedlings have become reestablished, place them near a window where they can receive full light.
5. When the seedlings have grown so that they are well developed (4 to 6 inches tall) they can again be transplanted, this time into either larger containers or into a flower bed.

Before moving into Section II, answer each of the following questions.

- a. What type of seed did you plant?

- b. How many days did it take for your seed to germinate?
- c. Did you put the milk carton in a plastic bag?
 Yes No
- d. If the milk carton was not put into a plastic bag, what additional care would be needed for the seed to germinate?
- e. How often did you water your plants after removing them from the plastic bag?
- f. How many seedlings did you transplant?
- g. How many transplanted seedlings survived?

Section II — Cuttings

A cutting is a portion of a plant taken from a parent plant. There are many types of cuttings, but most cuttings consist of stems and/or leaves. You will have an opportunity to make several cuttings in the next few activities. To complete the activities, you will need a quantity of rooting medium. Activity One tells you how to make the rooting medium.

Activity One — Rooting Medium

A rooting medium must have good drainage. This means that the water should move through the medium and not stand in puddles. A good rooting medium would be made up of equal amounts of peat and sand. You may substitute perlite for the sand.

You will probably need two gallons of rooting medium to finish the activities in this book. Take one gallon of sand or perlite and mix it with one gallon of peat. These three materials may be obtained at any garden supply store.

You may also wish to purchase a root-inducing hormone before you take your first cutting. A root-inducing hormone can be used on woody shrubs which are usually difficult to root. When conditions for rooting are ideal, these growth substances may reduce the time for rooting. A rooting hormone will usually increase the number of cuttings which root. Rooting stimulants are available in a powdered form from garden supply stores. Be certain that you follow directions on the container label when using the hormones.

Activity Two — Stem Cutting

Now that you have your rooting medium mixed you are ready to take some cuttings. The first cutting will be a stem cutting. You will need the following materials:

1. A flower pot, a fruit or vegetable can, or the bottom of a milk carton.
2. If a can or milk carton is used, punch three or four holes in the bottom for drainage.

3. Fill the container to within 1 inch of the top with your rooting mixture.

Select a plant from which your stem cutting will be taken. Some plants which root easily are: coleus, rose, ivy, jasmine, begonia, hydrangea, poinsettia, chrysanthemum, and geranium. To take your stem cutting, follow these steps:

1. Use a sharp knife to cut a 4 to 6 inch long section from a stem tip (illustration 9). Make a clean cut about ¼ inch below a node. A node is where a leaf attaches to the stem. Tips of healthy plants make the best cuttings. Make sure cuttings from woody plants are not tender or soft or they will wilt quickly.

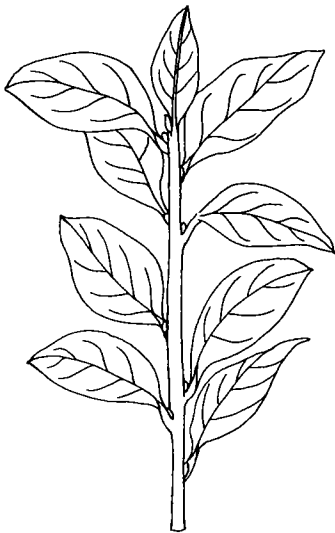


Illustration 9

2. Remove leaves from 1 to 2 inches above the cut end of the cutting (illustration 10). This makes it easier to place into rooting medium and reduces water loss from the cutting.

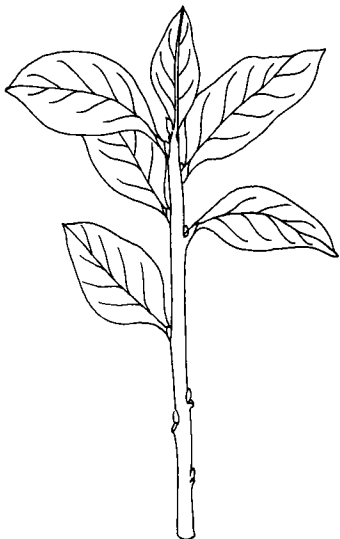


Illustration 10

3. Optional but desirable: dip the bottom end of the cutting in a rooting hormone (illustration 11).

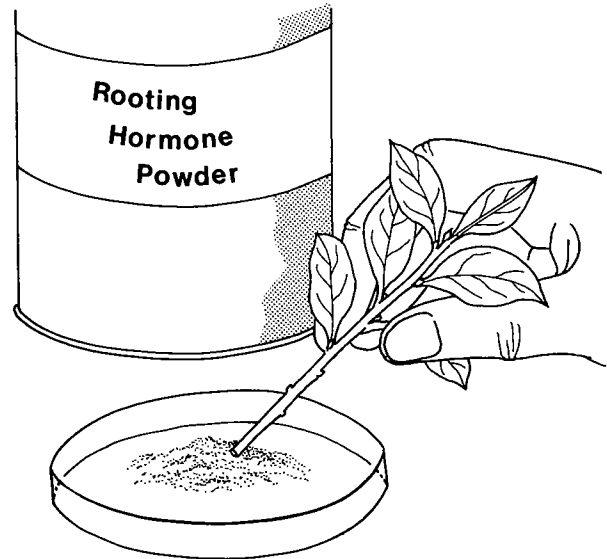


Illustration 11

4. Stick the cut end of cuttings in the moist medium about 1 to 1½ inches deep and 1 to 2 inches apart and press the medium around them (illustration 12). Carefully water the medium.



Illustration 12

- Place the container in a plastic bag (illustration 13). The plastic cover allows the cuttings to breathe but prevents loss of water; the cuttings should not need watering until they are well rooted.



Illustration 13

where the roots and shoots arise from the base of the petiole, such as African violet and gloxinia. Try each of the following experiments to learn about different types of leaf cuttings.

Leaf Blade Cuttings

A. Sansevieria leaf cuttings

- Cut sansevieria leaves into sections about 2 to 3 inches long and stick them $\frac{3}{4}$ of the way into a moist rooting medium (mixture of $\frac{1}{2}$ peat moss and $\frac{1}{2}$ sand) (illustration 14). The leaf sections must remain right side up. The leaf will form roots only on the bottom edge.

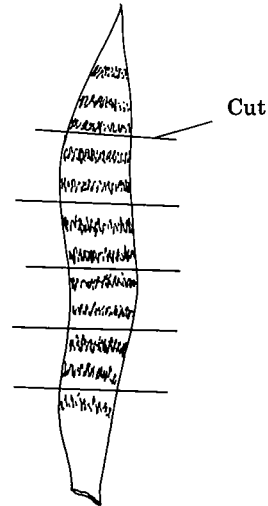


Illustration 14

- Set the container in a warm, well-lighted place but not in direct sunlight.
- Plant cuttings into individual pots when roots are about $\frac{1}{2}$ to 1 inch long. Most cuttings will be rooted within 2 to 12 weeks after sticking.

- Place the container in a plastic bag and put it in a warm place, but not in direct sunlight (illustration 15).

After you have completed Activity Two answer the following questions.

- When did you take the cutting? _____
- What kind of plant or plants did you use? _____
- How many cuttings did you take? _____
- How many cuttings rooted? _____
- Did you use a rooting hormone? _____
- When did you plant the rooted cuttings? _____

Activity Three — Leaf Cuttings

Leaf cuttings are of two types — those where new plants arise from the leaf blade, such as sansevieria (snake plant), rex begonia and kalanchoe and those

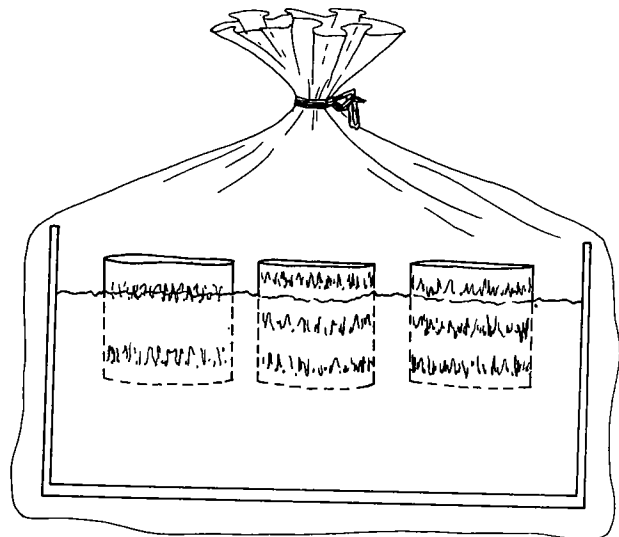


Illustration 15

3. Roots and shoots will form at the base of each section (illustration 16). The original leaf cutting does not become a part of the new plant.

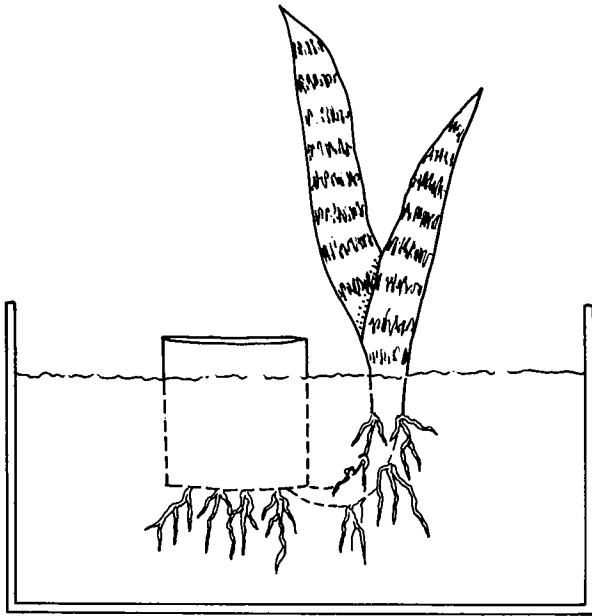


Illustration 16

B. Rex Begonia leaf cuttings

1. Make small cuts across the larger veins on the undersurface of the leaf.
2. Lay the leaf right side up on a moist medium ($\frac{1}{2}$ peat moss and $\frac{1}{2}$ sand) (illustration 17).

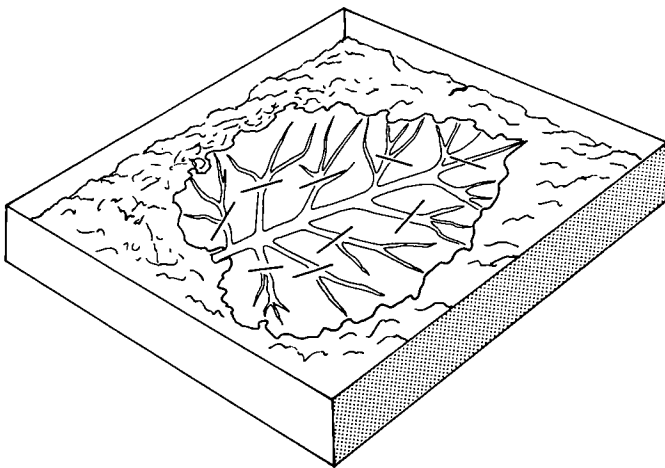


Illustration 17

3. Bury the leaf petiole and pin down the leaf edges with toothpicks or hairpins.
4. Keep the medium moist and new plants will form at the point each vein was cut.
5. When the new shoots are 2 to 3 inches high, they can be planted into individual containers.

C. Kalanchoe leaf cuttings

1. Lay leaf right side up on a moist medium ($\frac{1}{2}$ peat moss and $\frac{1}{2}$ sand) (illustration 18).

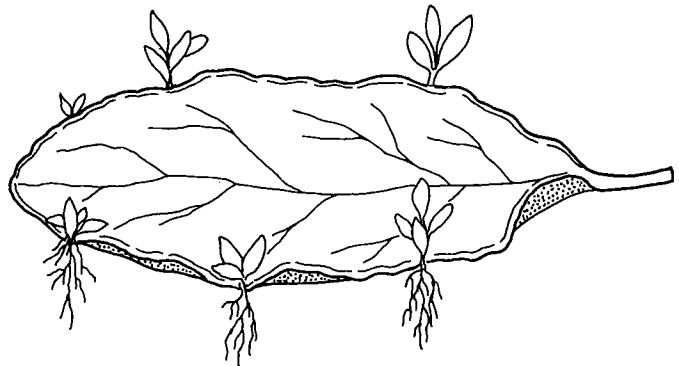


Illustration 18

2. Partially cover with rooting medium or pin down the leaf with toothpicks to hold the leaf margin in close contact with the rooting medium.
3. New plants will arise from foliar embryos in the notches at the margin of the leaf. These can be removed and planted.

Leaf Blade and Petiole Cutting

A. African Violet and Gloxinia

1. Cut the leaf from the plant leaving $1\frac{1}{2}$ inch of petiole attached to the leaf.
2. Place the leaf cutting into the moist rooting medium deep enough to keep the cutting upright (illustration 19).

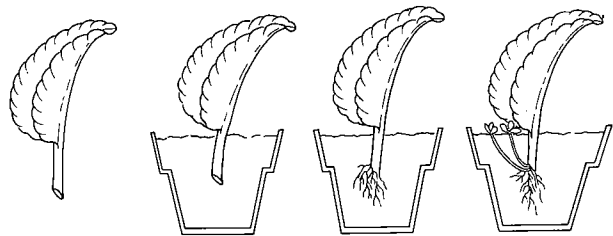


Illustration 19

3. Roots and new plants will form at the base of the petiole.

After completing each of the leaf cutting exercises in activity three, complete the following chart and answer the questions below.

1. Leaf cuttings	Date cuttings taken	Number of cuttings taken	Date cuttings rooted	Number of cuttings rooted
------------------	---------------------	--------------------------	----------------------	---------------------------

Sansevieria
Rex Begonia
Kalanchoe
African Violet
Gloxinia

- Which of the cuttings in activity three turned out most successful? _____
- What might have caused some cuttings to do better than other cuttings? _____
- What percentage of your cuttings rooted? _____
To find out divide the number rooted by the number taken as follows:
$$\frac{\text{Number Rooted} \times 100}{\text{Number taken}} = \% \text{ rooted cuttings}$$
- What did you observe about your cutting that might have caused some to die? _____

Section III – Division

Some plants can be started by dividing a larger plant. This is called plant division.

Division is simply pulling apart one large plant into two or more plants. Plant division is often used for propagating African violets, sansevierias, ferns, daylilies and many other plants that produce several shoots from a central growing plant.

Division can be done by hand or a knife can be used to split the plant apart.

Activity One – Division of an African Violet Plant

Select a large African violet for this activity. The plant which you select must have more than one crown (illustration 20). To divide the plant, follow the steps below:

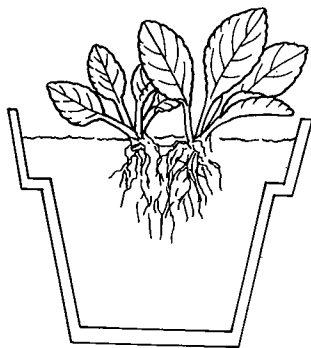


Illustration 20

- Remove the multicrown plant from the container.
- Divide the plant into two or more sections with a sharp knife (illustration 21).

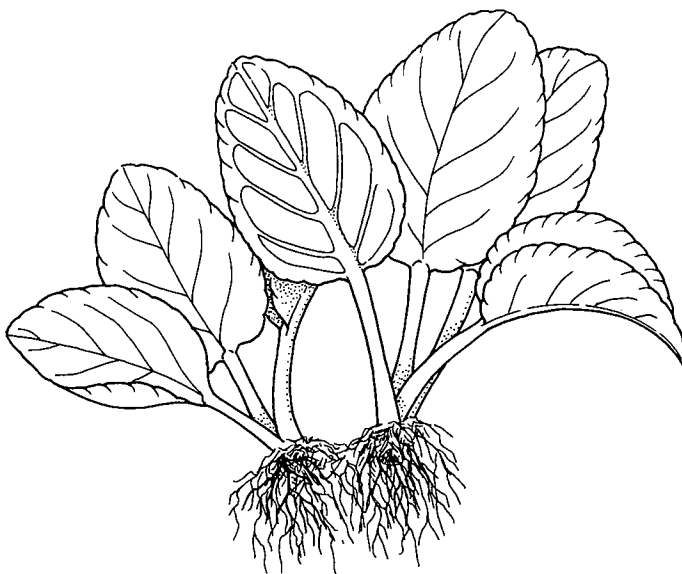


Illustration 21

- Pot the individual plant sections in 2½ to 3-inch pots (illustration 22).

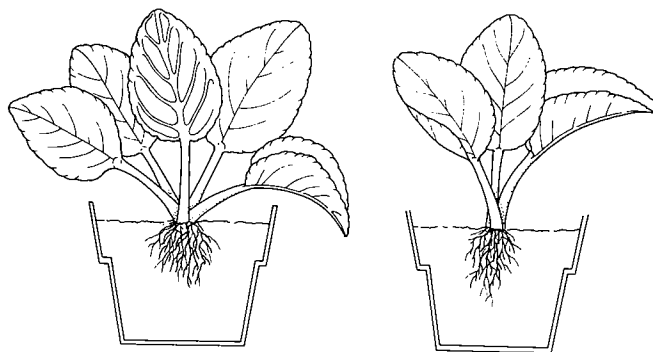


Illustration 22

Section IV – Layering

Layering is a method of plant propagation used to induce plant stems to root while they are still attached to the mother plant. The stem is wounded by cutting with a knife and kept moist in some media to stimulate root growth. The rooted stem is then detached to become a new plant growing on its own roots.

There are two basic types of layering – simple layering and air layering. With simple layering, branches are wounded and rooted in soil. Branches which are air layered form roots in moist rooting media above ground.

You can learn about layering by completing the next two activities.

Activity One — Simple Layering

1. Select a plant with branches near the ground. Most shrubs (azaleas, ligustrums, viburnums, etc.) can be propagated by simple layering.
2. Wound the underside of a branch by making a slanting cut $\frac{1}{4}$ of the way through the branch about 12 inches from the tip (illustration 23).

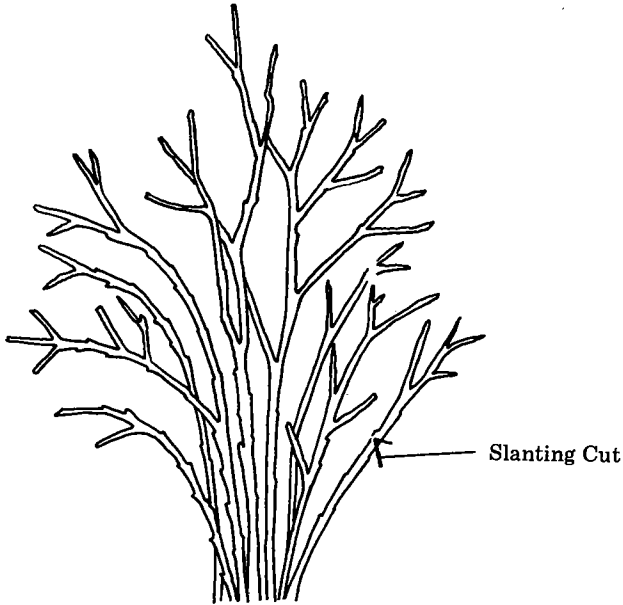


Illustration 23

3. Insert a splinter (such as a toothpick or match stem) into the cut so the stem does not grow back together.
4. Optional but desirable: dust the cut with rooting hormone.
5. Bend the branch to the ground directly at the point of the cut. Pin the branch down with a wooden peg or wire wicket, or weight it with a stone (illustration 24).

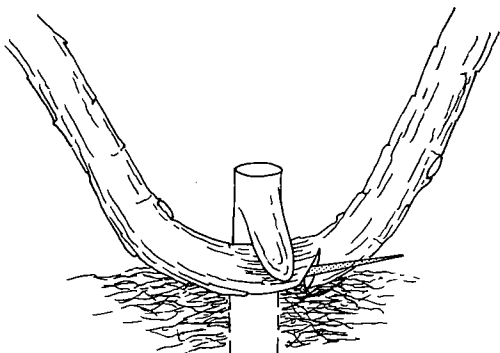


Illustration 24

6. Cover the cut area with 4 to 6 inches of soil with the tip of the branch exposed.
7. Allow 4 to 6 months for rooting.
8. When roots are established, cut the rooted branch free from the parent plant (illustration 25).

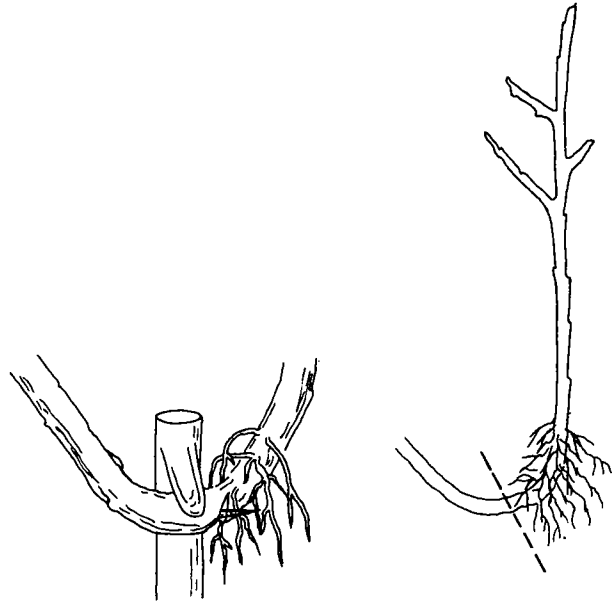


Illustration 25

9. Plant the rooted branch in a pot and grow until the plant is well established. Replant where desired in the yard.

Activity Two — Air Layering

1. Select a healthy, vigorously growing branch about 1 year old. Plants which are commonly propagated by air layering are rubber plants, dieffenbachias, philodendrons, and crotons.
2. Completely girdle the branch by removing a strip of bark from all around the stem. Make the girdle 12-18 inches from the top of the branch (illustration 26).

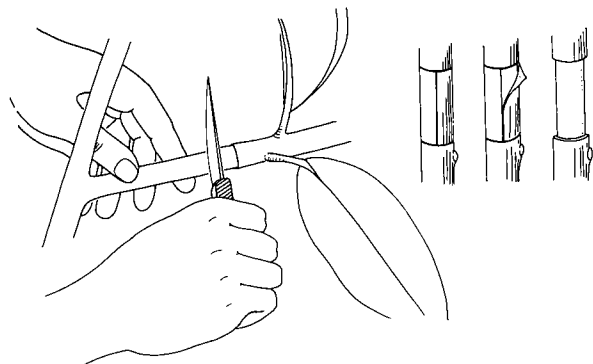


Illustration 26

- Partially girdle the stems of nonwoody (herbaceous) plants. Make slanting cuts on opposite sides of the stem. Extend the cuts 1 inch upward and one-third of the way through the stem. Place a toothpick or match stem into these cuts so the stem does not grow back together. (illustration 27).

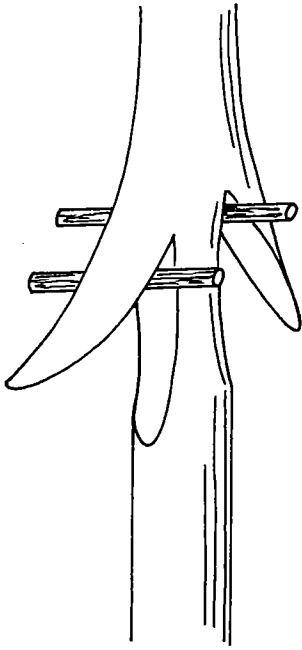


Illustration 27

- Optional but desirable: dust rooting hormone on the cut surface. (illustration 28).

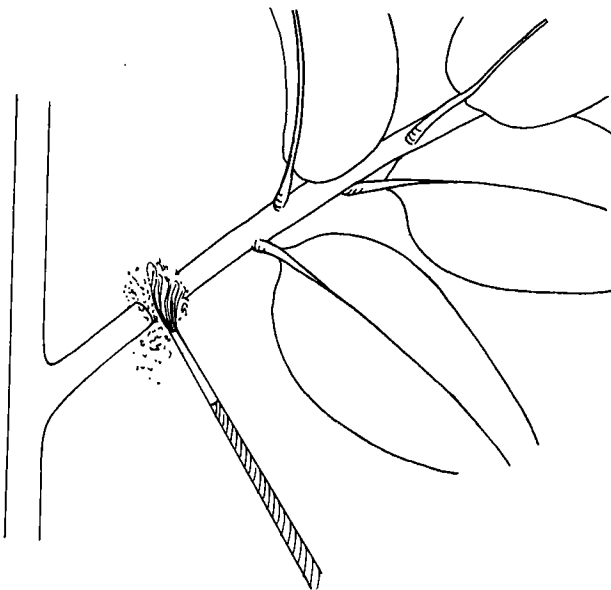


Illustration 28

- Place a moist ball of sphagnum moss about the size of a baseball around the stem and over the girdle (illustration 29).

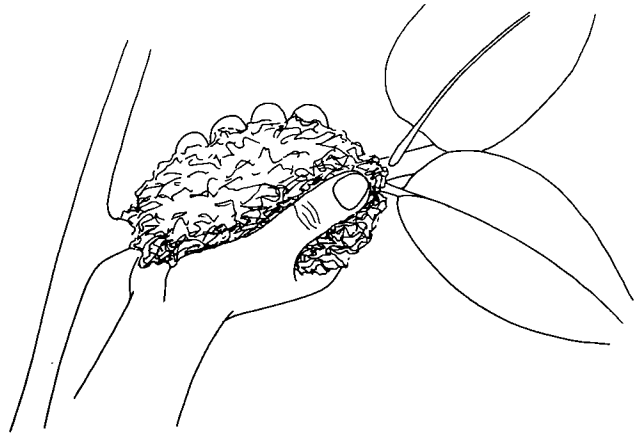


Illustration 29

- Wrap a piece of aluminum foil carefully around the branch so that the moss is completely covered (illustration 30).

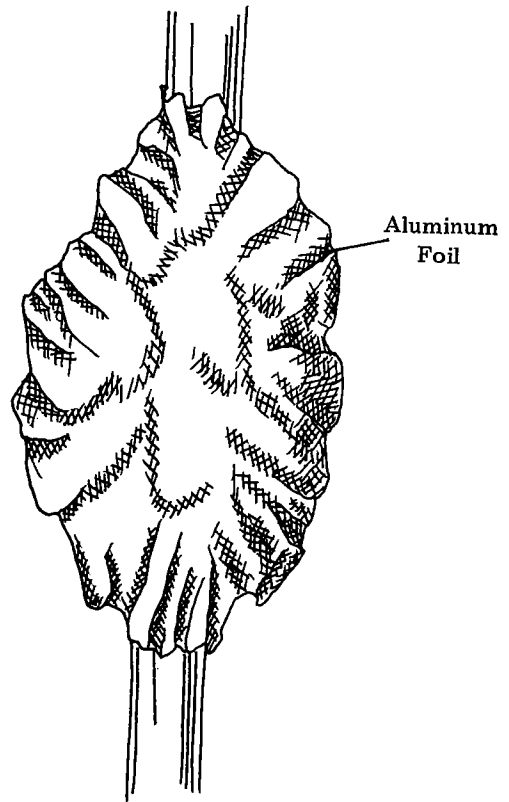


Illustration 30

- Examine the moss every two weeks and add water if the moss has dried.

8. When the new root system is well formed (four to six weeks), remove the newly rooted plant from the parent plant with a sharp knife, making the cut just below the ball of moss and roots (illustration 31).



Illustration 31

9. Carefully remove the aluminum foil. Without disturbing the roots or removing the ball of moss, plant the newly rooted plant in a pot (illustration 32).

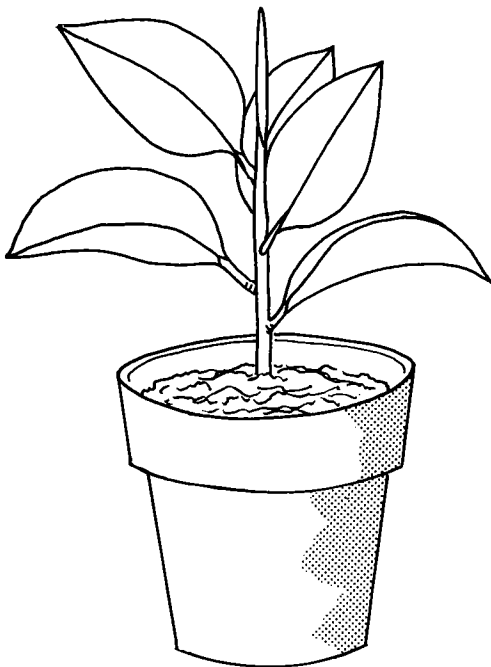


Illustration 32

Before moving to the last section of this project, answer the following questions about layering plants.

1. Which kinds of plant did you select for:
 - a.) Simple layering _____
 - b.) Air layering _____
2. Tell about any problems which you had in completing the experiments.

3. What could you do differently the next time you conduct this experiment to correct the problems?

Section V — Modified Stems

A bulb is a modified stem which has been compressed into a short oval shape. The stem is covered with leaves which have been modified into fleshy scales tightly laid one on top of another. Onions, lilies, amaryllis and tulips are typical bulbs. Small bulbs called bulblets develop on bulbs. After separation from the parent these bulblets will grow into full size bulbs (illustration 33).

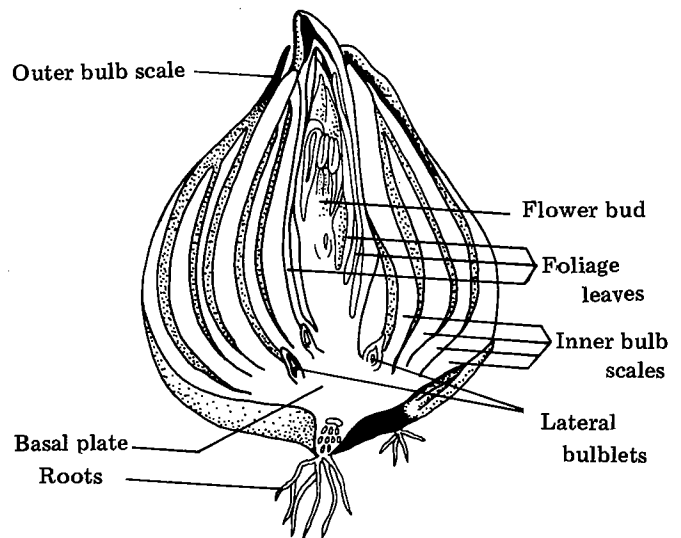


Illustration 33 (Bulb)

Other modified stem structures are corms and tubers. A gladiolus is a typical corm and the potato and the caladium are examples of tubers. The gladiolus corm produces miniature corms called cormels. These

cormels are separated from the mother corm and will grow to a full size corm in one to two years. Potato and caladium tubers are propagated by planting the tubers whole or by cutting them into sections, each containing a bud or eye (illustrations 34 and 35).

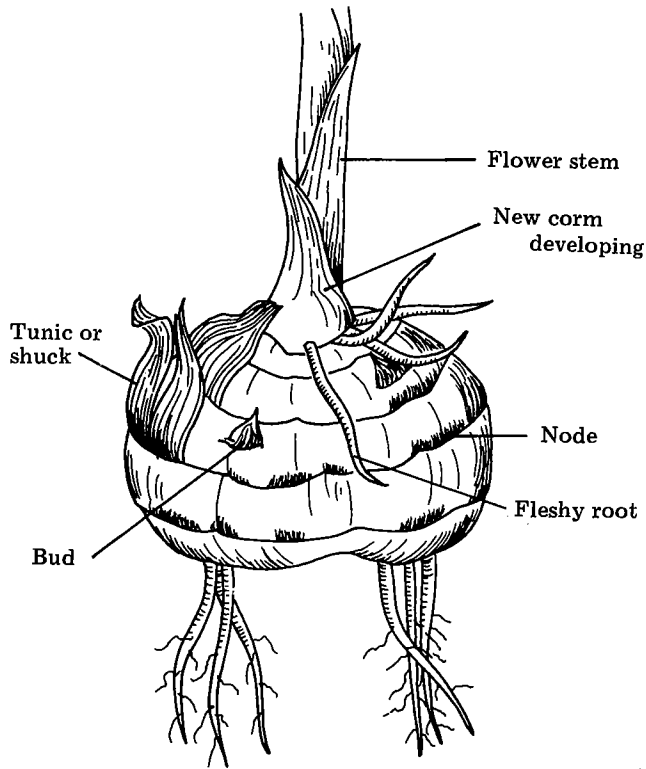


Illustration 34 (Gladiolus Corm)

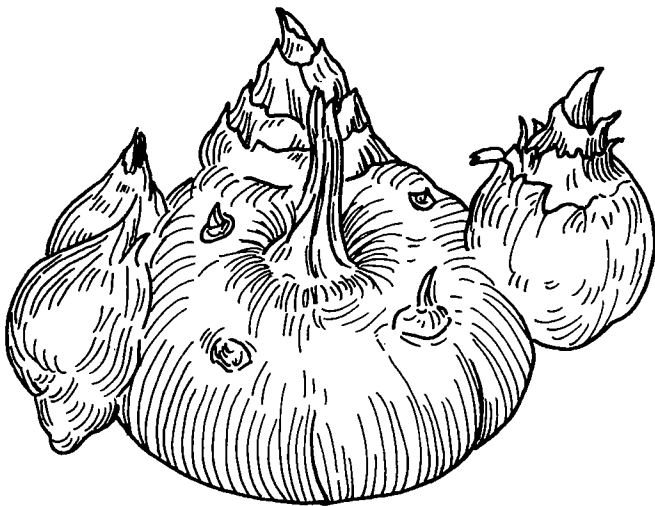


Illustration 35 (Caladium Tuber)

warm, humid weather is not favorable for growing tulips and hyacinths. For satisfactory results, the bulbs should be stored for 60 to 75 days at a temperature of 35°F to 40°F. The vegetable drawer of the refrigerator generally meets the temperature requirement for bulb storage. Plant bulbs immediately after removal from the refrigerator. Water the soil after planting and keep soil continuously moist. For spring planting use an amaryllis or onion bulb. These bulbs do not require a cold treatment.

2. After the bulb has flowered and the plant shows signs of die-back, dig the bulb up and note how new bulblets are formed and describe their characteristics. _____

Activity Two — Propagation by Tubers

You can start a tuberous plant by dividing the tuber following these steps:

1. Cut an Irish potato into 1 to 2 ounce sections so that some sections contain a bud or eye and other sections do not contain eyes (illustration 36).

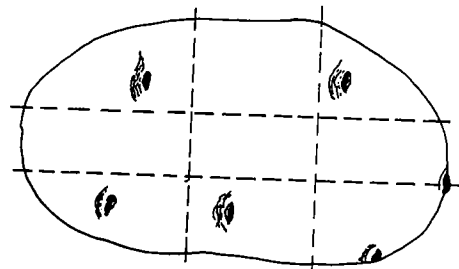


Illustration 36

2. Plant 2 inches deep in separate containers. Label the containers as to which have eyes (illustration 37).

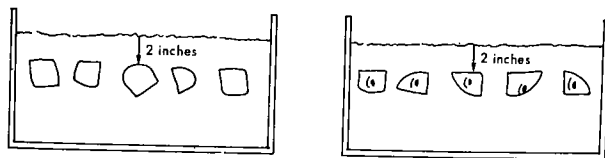


Illustration 37

3. Keep moist and in a warm place.
4. Observe the difference between the potato sections with and without eyes. Write that observation below.

Activity One — Propagation by Bulbs

1. In the fall, plant a tulip, hyacinth or narcissus bulb in a pot containing potting soil. Florida's

PROJECT SUMMARY
4-H PLANT PROPAGATION

Name _____ Address _____

Age _____ Grade in School _____ Years in 4-H _____

Years in Horticulture Project _____ Name of 4-H Club or Group _____

My Horticulture Plant Propagation Goals for This Year:

Report on 2 sections completed:

SECTION 1 – SEED

What I did _____

What I learned _____

How I shared my knowledge with others _____

SECTION 2 – CUTTINGS

What I did _____

What I learned _____

How I shared my knowledge with others _____

SECTION 3 – DIVISION

What I did _____

What I learned _____

How I shared my knowledge with others _____

SECTION 4 – LAYERING

What I did _____

What I learned _____

How I shared my knowledge with others _____

SECTION 5 – MODIFIED STEMS

What I did _____

What I learned _____

How I shared my knowledge with others _____

OTHER:

Additional Horticultural activities in which I have been involved _____

Illustrations for this text were rendered by Lynda Chandler

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