

Plant Propagation

Brief Description:

Plant propagation is the process of creating new plants from a variety of sources: seeds, cuttings, bulbs and other plant parts. There are several methods of plant propagation used in commercial horticulture besides planting seeds. This lesson will introduce the industry skills of plant propagation, such as grafting, budding, rooting cuttings, seed scarification, air layering and tissue culture. Students will also research on the internet about several types of plant industries, and gain an appreciation for how economically important they are.

Objective:

Students will:

1. Be introduced to the different methods of plant propagation.
2. Understand the importance of plant propagation in agribusiness.
3. Explore plant propagation techniques through teacher demonstration and hands-on trials.

Time:

Introduction: 30 to 60 minutes

Activity 1: 60 to 90 minutes (depending on how much at-home time)

Activity 2: One to two hours to demonstrate methods (One hour to create a manual and multiple class periods depending on how many propagation methods are attempted).

Materials:

Will vary depending on propagation method used.

- Budding tape
- A lab hood with positive pressure for sterile technique (preferred for best tissue culture results)
- A spray bottle of 70 percent alcohol to sterilize
- A spray bottle of 10 percent bleach to sterilize
- Pruners
- Budding knife
- Grafting clips

- Aluminum foil
- Plastic wrap
- Plant material: Many schoolyard shrubs can be used for budding, grafting and rooting cuttings. *Avoid oleander as these plants are VERY poisonous!
 - Budding – hibiscus or shrub
 - Rooting cuttings – coleus, geraniums, crepe myrtle, woody ornamentals
 - Grafting – tomato seedlings
 - Scarification seeds – morning glory or birds of paradise

Vocabulary:

air layering, asexual propagation, budding, cloning, fungicide, genetically modified organism, grafting, rooting cuttings, rootstock, scarification, scion, seeding, sterile, tissue culture and transplant

Background:

Vegetable plants, such as tomato and bell pepper, are often started in a greenhouse, where they are seeded in trays and allowed to grow for four to six weeks. In Florida, one reason this is done is to get the harvested fruit to the market as early as possible. Florida's advantage is early season. It is not long before other large vegetable producing states, such as California and Texas, flood the market with their produce. This causes prices to become lower for Florida farmers.

Some vegetables, notably tomatoes, are grafted while young transplants. This involves taking a Florida hearty root system of one tomato, and using it to grow a very tasty tomato fruiting plant, whose roots may not be suited for Florida's soil diseases.

Some vegetables, such as cucumber, are directly seeded. Cucumber, in particular, is a very fast growing crop, and transplanting does little to make the crop grow faster. Grains, such as corn and soybean, are also seeded. Soybean is often a cover

Florida Standards:

SC.7.L.16.3, SC.7.L.16.4, SC.7.L.16.2, SC.8.N.4.2, SC.912.L.14.1, SC.912.L.14.10, SC.912.L.14.33, SC.912.L.14.7, SC.912.L.16.10, SC.912.L.16.12, SC.912.L.17.16, LAFS.68.RST.1.3, LAFS.68.WHST.2.6, LAFS.68.WHST.3.7, LAFS.68.WHST.3.8, LAFS.68.WHST.4.10, LAFS.910.RST.1.3, LAFS.910.WHST.2.6, LAFS.910.WHST.3.7, LAFS.910.WHST.3.8, LAFS.910.WHST.4.10, LAFS.1112.RST.1.3, LAFS.1112.WHST.2.6, LAFS.1112.WHST.3.7, LAFS.1112.WHST.3.8, LAFS.1112.WHST.4.10

crop which can also be harvested. The legume nature of the crop is good for fixing nitrogen in the soil as well as preventing soil erosion.

Most seeds will not germinate if the seed coat is scratched or damaged. Entry of disease-causing bacteria or fungi may make the seed unviable. However, there are a few kinds of seeds, like Morning Glory, a flowering plant, that require seed coat scratching in order for water to enter the seed. This is called scarification.

Citrus is budded using scion wood from trees that already produce high quality fruit. This allows for genetically identical fruit on the new tree as on the initial tree. Root stock is chosen based on disease resistance and strong adaptation to Florida soils. Budding also shortens time-until-fruit from eight to 10 years from a seeded tree to two to three years on a budded tree.

Orchids and hibiscus are cloned by tissue culture using a medium of nutrients. Once a beautiful flower is bred or the plant is genetically modified for a trait, tissue culture allows clones, or genetically identical plants, to be produced from a few cells of the initial plant on a large scale.

Leaf and rooting cuttings is also a method of producing genetically identical plants by asexual propagation. This may be done to avoid the lengthy process of pollination, fruit/seed produc-



tion and then seedling. This may be done to clone plants, or may be done just to reproduce plants more rapidly.

Lychee trees are predominantly air-layered. This method produces genetically identical, great tasting fruit from the parent plant. Air-layering is also used for shrubs that do not root easily from cuttings.

For more information on different propagation methods check out the following websites: <https://ag.arizona.edu/pubs/garden/mg/propagation/asexual.html>, <http://aggie-horticulture.tamu.edu/ornamental/a-reference-guide-to-plant-care-handling-and-merchandising/propagating-foilage-flowering-plants/>

Introduction:

1. Show the PowerPoint (found at www.faitc.org/STEMming-Up), using embedded notes as a guide. Be sure to play the YouTube video links. Using Safesharetv.com will remove all comments and screen pictures except for the desired video. (Instructions for this are on slide three of the PowerPoint.)

Activity 1:

1. Explain that presenting posters is an important way that scientists communicate their research at national and international conferences. Scientific posters contain the steps of the scientific procedure for an experiment, just like they may have seen at science fairs.
2. Although this assignment does not have an experiment, designing a poster will be a great exercise in scientific communication.
3. Divide students into groups and assign each group a method of plant propagation. If using the *Worksheet Evaluation: Propagation Industry Research*, give each group a copy. There is an example poster at the end of the lesson that you can show students. Students should research on the internet examples of how plant propagation is used in industry. For example:
 - Grafting roses
 - Budding citrus
 - Tissue culture of orchids
 - Rooting cuttings such as geranium, coleus, and woody ornamentals, such as crape myrtle.
 - Air layering of lychee, house plants or ficus trees
 - Transplant vegetables (tomatoes)
4. As a group students will design a presentation on poster board using the information from *Worksheet Evaluation: Propagation Industry Research* provided.
5. Students present their poster to the class as a group.

Activity 2:

1. Research all the different propagation techniques and decide which one will be appropriate for your classroom setting and demonstrate each of them for the students or have students research the methods and design a demonstration.
2. In groups students will create a step-by-step procedure manual for the propagation techniques demonstrated by the teacher. Example procedure manuals are included at the end of the lesson.
3. Groups will then switch manuals with another group and follow the step-by-step instructions and propagate a plant.
4. Make weekly observations of plant propagations to determine plant growth and find out which method works best for the classroom environment.

Alternative or Extensions:

1. Tissue culture is a difficult propagation method to attempt in a classroom, especially if you do not have a way to create a sterile environment. You can have students get into groups and complete the Plant Tissue Culture (found at www.faitc.org/STEMming-Up) activity that has information, step-by-step procedures and questions.

Evaluation:

1. Grade group scientific poster for neatness, completeness and teamwork on the use of each plant propagation technique in industry.
2. Create a rubric for the procedure manual describing the steps of each technique, along with hand drawn pictures. See example assignments provided. This will be an excellent opportunity for students to write a step-by-step procedure, such as used in scientific writing. If accommodation is needed, written steps can be printed out and students could add drawings.
3. Grade students on the cooperative effort in the manual writing and the plant propagation.
4. Have students draw pictures on the step-by-step manual to show how well they understand how the method works.

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Worksheet Evaluation: Propagation Industry Research

Method of propagation: _____

Plant industry studied: _____

Statistics:

How many plants sold annually in the US? _____

What is the dollar value? _____

How many plants sold worldwide? _____

What is the dollar value? _____

History of industry: _____

Three to five interesting facts about the plant industry: _____

Three companies in industry: _____

Description/ Procedure of technique/ Materials used: _____

What are the growth requirements for a plant? Go from initial propagation to store: _____

Names of group members: _____

References (use at least three to five): _____

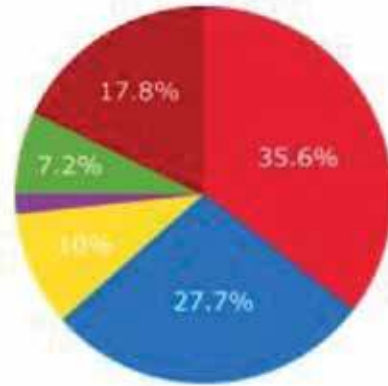
Picture of plant:

Example of Student Poster Presentation:

Grafting Roses



By Jen, Joe, and Juan



Statistics:

US production number and dollars

Worldwide production number and dollars

3 Companies:



Four Interesting Facts:

- 1.
- 2.
- 3.
- 4.

References

- 1.
- 2.
- 3.

Grafting Procedure



To graft a tree, the first step is ...



To get to market:

Greenhouse grown until size.....

How to Root a Cutting

Name: _____

1. Pick a plant. Cut off a branch.
Make sure there are four to five nodes.
2. Cut off some of the leaf.
3. Dip the bottom of the cutting into rotting hormone.
4. Plant bottom two nodes in soil.
5. Keep misted or under clear plastic to trap humidity.
6. Check for roots after 10 days.
7. When there are good roots, the plant doesn't have to be misted or kept under plastic.

How to Scarify Seeds

Name: _____

1. Research on the internet if seeds need scarification.

2. Obtain seeds and choose method:
 - a. Sandpaper

 - b. Metal file

 - c. Nail clipper

 - d. Other (such as boiling in water briefly)

3. Plant seeds in potting soil.

How to Bud onto a Rootstock

Name: _____

1. Obtain certified bud wood from the state of Florida.
-Or-
Go outside in the school yard and choose a woody plant.
* Using a schoolyard plant is just for practice.
2. Pick a place where the branch wood is young, but mature.
It may be green with a little browning, but NOT tender.
3. Using a budding knife, slice the lateral bud off, cutting away from yourself.
4. In the rootstock (or the same shrub in the schoolyard), cut a “T” in the bark and peel the bark back. It may help to water the plant the day before.
5. Tuck the bud in the “T” slit.
6. Wrap with budding tape.
7. Check the bud in two weeks, and if not healed, re-wrap.
If the bud is healed, prune the rootstock branch and bend back.

How to Graft a Tomato

Name: _____

1. Get six egg cartons and cut a small slit in the bottom of each egg holder.
2. Get three packets of tomato seeds.
3. Plant ten seeds every two days for eight days. This is to get plants of different sizes so they can be matched up to fit each other.
4. After seedlings are three to four inches tall, choose a seedling to be the bottom rootstock. Cut off the leaves from the stem.
5. Choose a different variety seedling to be the top scion of the graft. It should have the same diameter stem as the rootstock. Cut the stem to obtain the leaves.
6. Place the top tomato on the cut of the bottom tomato, and attach with a grafting clip.
7. Keep the plant misted or under clear plastic to collect humidity.
8. Check the graft after 10 days for healing.

How to Air Layer

Name: _____

1. Choose a woody plant. Choose a branch of mature wood. A few branches may be attempted, using older wood and newer wood.
2. Cut the bark in a one-inch-thick band and strip away the bark.
3. Soak a clump of Spanish moss in water and squeeze out the excess water.
4. Place the moss around the one-inch band of stripped bark.
5. Wrap tightly with plastic wrap.
6. Cover with aluminum foil to keep out light and encourage root growth.
7. Check for root growth after four weeks. Repot in a container for further growth.

Plant Propagation

Sample Pre-Post Test Assessment

Directions: Answer each question to the best of your ability.

1. What does it mean to propagate a plant?
2. Name two different methods used to propagate a plant.
3. Why would a grower pre-treat seeds before planting?
4. What is the benefit of transplanting a seedling versus planting a seed directly into the garden?