Chapter Outcomes

After studying this chapter, you will be able to:

• Discuss the uses of layering in propagation.
• Describe the layering techniques used by growers.
• Describe the different types of natural layering.
• Explain the process of crown division.
• Identify types of geophytes and summarize their propagation methods.
• List careers related to layering and division.

Words to Know

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<th>air layering</th>
<th>mound (stool) layering</th>
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Before You Read

After reading each section (separated by main headings), stop and write a three- to four-sentence summary of what you just read. Be sure to paraphrase and use your own words.
While studying this chapter, look for the activity icon to:

- **Practice** vocabulary terms with e-flash cards and matching activities.
- **Expand** learning with the Corner Questions and interactive activities.
- **Reinforce** what you learn by completing the end-of-chapter questions.

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Have you ever walked by a neighbor’s yard and noticed something odd about the rose bushes? Do some of the stems seem to be growing into the ground away from the plant and then out again? Your neighbor is probably using a traditional gardening technique to grow more roses. This propagation method is called layering.

Layering consists of several techniques used to propagate plants. Some layering techniques are intensive and must be done in very specific ways at certain times of year. However, layering may also occur naturally, as is the case for several types of plants, such as strawberries and mint. Orchids also propagate naturally this way, Figure 15-1.

Another type of propagation is division. In the division method, one plant is divided to create multiple plants. This technique is commonly used for perennials such as bulbs, corms, and tubers. Crown division is used for some types of plants, whereas physical separation of geophytes is used for others. If you have ever removed a clove of garlic from a garlic bulb, then you have seen at least one step of geophyte separation.

Layering in Propagation

Layering is a vegetative or asexual propagation technique that allows stems that are still attached to the parent plant to form roots. While the stem is initiating adventitious roots, it is simultaneously pulling in water, nutrients, sugars, and plant hormones, limiting any risk of water stress. The rooted stem is considered a layer following detachment (removal) from the parent plant. Some plants naturally layer, but most plants require specific layering techniques for roots to form.

The practice of layering is most successful when the following elements are considered:

- Attachment of stem to parent plant.
- Accumulation of sugars and auxin to rooting area.
- Exclusion of light in the rooting area.
- Stock plant invigoration.
- Seasonal timing.

The attachment of the stem to the mother plant provides a continual supply of carbohydrates from photosynthesis, water and minerals pulled from the soil solution, and the plant hormone, auxin, Figure 15-2. The accumulation of the sugars and auxin to the rooting area fosters root initiation. Girdling (making incisions or bending the stem) further encourages root formation. To girdle the plant, a sharp knife is pressed against the bark to remove a portion that exposes the cambial layers underneath. This triggers the release of hormones that encourage root formation. Auxin may be added as indole-3-butyric acid (IBA) to the girdled or cut area to enhance rooting.
Most layers are covered with rooting medium, most often field or garden soil. This creates an environment devoid of light, which has been found to stimulate rooting.

Many commercially propagated layers come from stock plants. Growers will cut back stock plants to encourage the growth of vigorous new shoots in a process called invigoration. The newly sheared stock plants are covered in rooting medium and watered to provide a dark, moist environment favorable for rooting the newly emerged shoots. The timing of layering depends on the plant species. For most plants, using dormant stems and layering in the spring will take advantage of stored carbohydrates and foster root growth.

Commercial propagators who use layering will establish propagation beds that may last up to 20 years, Figure 15-3. Sites should have soil that is well drained and that provides adequate aeration. Access to continuous moisture should be provided, and temperature extremes should be avoided, perhaps through insulation. Field sites should be free of plant pathogens, insects, and weeds. Layering is labor intensive and expensive, but it may be the only propagation method available for species that are hard to propagate.

“Earth laughs in a flower.”
—Ralph Waldo Emerson
Layering Techniques

There are a number of layering techniques, and their use depends on the plant species and the given situation. Types of artificial layering that growers use include:

- Simple layering.
- Compound layering.
- Air layering.
- Mound layering.
- Trench layering.

Simple Layering

In simple layering, a flexible, low-growing stem is bent to the ground. Part of it is covered with soil with 6” to 12” of the tip remaining above the soil, Figure 15-4. The portion where the stem is bent will form adventitious roots. In many cases, wounding the underside of the stem can further enhance rooting. Many low-growing shrubs can be layered. Forsythia, azalea, and honeysuckle are examples of shrubs that can be layered. Commercial propagation of filberts or hazelnuts is done using simple layering.

The simple layering technique is typically done in early spring to allow the layer to grow through the season. It is then removed in the fall or spring before growth starts anew. Other simple layering will make use of mature branches in the late summer. The layer will be removed in the spring before growth begins or permitted to grow to the end of the season. Growers should occasionally check to ensure adequate moisture. Once roots have developed, the layer is removed from the parent plant and treated as a rooted cutting.

Compound Layering

The compound layering method can produce several layers (rather than just one) from a single stem. In compound layering, a long stem is bent and laid down horizontally. It is held in place with wire pegs and fully covered with soil, Figure 15-5.
Once new shoots begin to grow to at least 4” (10 cm), a shallow trench is dug. The stem is laid in the trench and the shoots are held by pegs. As the shoots continue to grow, soil is filled in around them until they are rooted and can be cut.

A variation of compound layering is called **serpentine layering**. Shoots are laid horizontally to the ground. Some buds are exposed while others are covered with soil in an alternating pattern, Figure 15-6. Serpentine layering works well for vine-like plants.

**Air Layering**

*Air layering* involves wrapping a girdled stem with rooting medium and allowing adventitious roots to form. This layering practice has been used for centuries. It is useful for propagating houseplants, such as rubber plant, croton, monstera, philodendron, and dieffenbachia, Figure 15-7. Air layering can also help propagate woody ornamentals, including camellia and magnolia. Air layering helps propagate tropical fruits, such as lychee (*Litchi chinesis*), longan (*Dimocarpus longan*), and key lime (*Citrus aurantifolia*). For the best results, air layers are made in the spring on younger shoots. Growers have less success in rooting older stems.

To make the air layer, choose an area on the stem that is about 12” (30 cm) from the tip of the shoot and just below a node. Ensure there are no leaves on the stem 3”–4” in either direction. Girdle the stem, Figure 15-8. Expose the inner, woody tissue, and scrape it to eliminate the cambial tissue and prevent healing.
Application of IBA to the wound can be beneficial. This technique is used primarily on dicots. With monocots, propagators make a slanting upward 1”–1 1/2” (2.5 cm–4 cm) cut. The cut is held open with sphagnum moss.

For both methods, the exposed stem is surrounded with about two handfuls of soaked sphagnum moss. The moss is then securely wrapped with plastic. The moss retains moisture and prevents water from entering, Figure 15-9. Aluminum foil can also be used. It reflects sunlight and modifies temperatures.

Adventitious roots will begin to initiate. After the sphagnum moss fills with corky, thick early roots and fibrous secondary roots, the stem can be severed from the parent plant. Rooting generally occurs in two to three months or less. Spring and early summer layers can be harvested as the shoots become dormant in the fall. Removal of the air layer is most often successful when the plant is not actively growing. Transplanted layers should be acclimated with high humidity and low light conditions.

Did You Know?
The air layering technique was perfected in China. This technique is more than 4000 years old.

Mound Layering

Mound (stool) layering is a method in which soil is piled on the crown of the plant. The new shoots form adventitious roots that can be severed and transplanted. This layering technique is the most commercially important method of layering. It is used to produce millions of apple, pear, and other fruit tree rootstocks each year. Propagators cut back dormant stock plants severely to only 1” (2.5 cm) above the soil surface. As the stock plant begins to grow, soil, sawdust, bark, or a soil-sawdust mixture is mounded over the new shoots, Figure 15-10. Hilling is the piling of soil onto plants to promote desired growth. As shoots continue to grow, a second hilling of rooting medium covers the shoots to one-half of its height. A third and final hilling covers the shoots in mid-season when most shoots reach about 18” (45 cm). These shoots have been covered to a depth of 6”–8” (16 cm–20 cm). Layers are removed once the plant is inactive, after roots have formed. Apple rootstock, quince, currant, gooseberry, spirea, quince, magnolia, and cotoneaster respond well to mounding.
Trench Layering

For woody plant material that is difficult to root, trench layering may be the only technique that will produce clones. In trench layering, the mother plant is planted in a sloping position (30° to 45°) that allows shoots to be layered horizontally and pegged down in the base of a trench. Loose rooting medium, such as soil, bark, or sawdust, is filled around the new shoots as they develop. The rooting material excludes light, which causes the new shoots to etiolate, or elongate. Research suggests the etiolation is critical for initiating roots in species that are hard to propagate. Trench layering can be used with quince, apple, mulberry, walnut, and cherry plants.

Natural Layering

Many plants have modifications of their plant parts or growth habits that enable them to create layers through their natural biology. Tip layers, runners, stolons, offsets, and suckers are examples of natural layering.

Tip Layers

Blackberries, dewberries, and black raspberries have trailing growth habits and exhibit natural tip layering. When the shoot tip of new growth is inserted into the soil, it grows downward. The tip curves upward where roots will then form to become a new plant. The newly rooted tip layer is tender and prone to drying out. It should be dug and replanted immediately. The best time to replant is generally in late fall or early spring.

Runners

Runners are specialized stems that grow or “run” horizontally above the ground and form new plants. Strawberries have a runner growth habit. Stems arise from the axil of a leaf at the crown of the plant, and new plantlets (young or small plants) form along the nodes of the running stem, Figure 15-11.

Thinking Green

Garbage Can Garden

Many leftover scraps from the kitchen can actually be turned into a garbage can garden. If the remains of a ginger rhizome has a node, plant it in potting medium. Likewise twist the top of a pineapple and tuck it into a pot filled with moistened medium. If the leafy remnants of carrots, beets, and turnips still have a small piece of root attached, place it on top of pebbles in a bowl with a little water and watch new leaves emerge. Avocado, mango and papaya seeds can easily sprout. If you have nearly rotting potatoes, stick them in a pot, and watch them grow!
Other running plants include bugleweed (Ajuga), spider plant (Chlorophytum comosum), Boston fern, and the orchid genus Dendrobium.

In strawberries, runners begin to grow as temperature and day length increases (12 to 14 hours or more of light per day). Plantlets produced along the runner develop roots and remain attached to the mother plant. In turn, they send out their own runners to form more plantlets. As the weather turns cold, the runner stems die, and the plants are disconnected from each other. Each new plant can be dug when it is well rooted and transplanted.

**Stolons**

Similar to runners, stolons are horizontal stems, but they grow below the ground and produce plants or tubers. Tuberous plants are swollen, underground stems that are storage organs for the plant. Potatoes are an example of a plant that produces tubers. The stolon can be considered a naturally rooted layer and can be severed from the parent plant and transplanted. Many plants that form stolons are considered weeds or a nuisance because of their prolific nature. Bermuda grass, mint, and lamb’s ear are examples of plants that form stolons, Figure 15-12.

**Offsets**

Offsets are a type of lateral shoot or branch that forms at the base of a main stem. Offsets only occur in some plants, primarily in monocots. Agave is a monocot that commonly forms small plantlets (called pups) at the base of the parent plant. Similarly, the banana, pineapple, and date palm will form offsets, or offshoots, that can be cut from the main stem with a sharp knife, Figure 15-13. In many cases, the offsets will have sufficient roots and will only need to be transplanted and given care like a rooted cutting. If an offset does not have roots or has minimal roots, it can be propagated like a stem cutting. It should be placed in rooting medium in high humidity. Intermittent misting and possibly bottom heat should be applied.

**Suckers**

A sucker is a shoot that grows from an adventitious bud on a root. In horticultural practice, a sucker is widely considered to be any shoot that grows near the base of a plant whether it is from a root or a stem. Best practices in pruning call for the removal of suckers, a process called suckering. In propagation, however, root suckers are rooted layers and can be dug and cut.
from the parent plant during dormancy. Pineapples form both offsets and suckers, Figure 15-14.

**Crown Division**

The base of a plant where shoots arise is called the crown. In herbaceous perennials, the old stem from the previous season’s growth dies after blooming. New lateral shoots initiate, and adventitious roots form along the base of the new shoots. As this process unfolds each season, the crown may expand significantly, and the base of the plant may become crowded. The crown of the plant can be divided to prevent such overcrowding. Some multibranched woody shrubs have a similar habit. New shoots grow from the crown. Although older shoots do not die, younger, more vigorous shoots may crowd them out.

Crown division is the process of dividing the crown of herbaceous perennials or woody, multibranched shrubs. Perennials that flower in the spring and summer are generally divided in the fall. Perennials that bloom in late summer and autumn should be divided in the early spring. Plants are dug from the soil. Using a sharp knife, ax, or handsaw, the crown is cut into sections and transplanted to new locations, Figure 15-15. A similar method can be used for potted plants. In some cases, the old section of the crown may not be very vigorous and may be discarded rather than replanted. Crown division is slow and little used by commercial growers, but it is a common practice for home gardeners.

**Division and Separation of Geophytes**

Underground storage structures in plants are called *geophytes*. They include many commonly known modified plant parts, including bulbs, corms, tubers, rhizomes, and pseudobulbs. Most of these geophytes belong to herbaceous plants and have developed as a means for storing food, nutrients, and water. They also provide a means of vegetative or asexual reproduction, providing clonal regeneration of the plant species. Some of the geophyte structures, such as bulbs and corms, only need to be separated. Other structures, such as tubers and rhizomes, must be divided (cut into sections). Each structure has a specific propagation technique.
Bulbs

A bulb is a modified stem that contains a short, fleshy basal plate at the bottom from which roots grow. A bulb contains fleshy scales (primary storage tissue and modified leaves) and the shoot (consisting of developing flowers and leaf buds). Lateral buds in the fleshy scales develop into bulblets (a small bulb attached to the main bulb, which serves as a means of reproduction for the plant), Figure 15-16. The bulblets will increase in size until they become small bulbs that can be separated. Separation is a specific propagation term used to define plants that produce bulbs or corms multiply and can be easily pulled apart. These small bulbs are planted and grown for several seasons until they flower and produce offset bulbs. Offset bulbs are daughter bulbs that are still attached to the parent bulb. If left undisturbed, they may remain attached for several years. The offset bulb is the commercial means of propagating new plant material. These bulbs are removed to replant into nursery rows where they grow into bulbs of sufficient size to produce flowers.

Most bulbs are monocots and have specialized to provide a storage function as well as a means of asexual reproduction. There are two kinds of bulbs: tunicate and nontunicate.

Tunicate Bulbs

Think of the papery husk of a garlic bulb or the brown skin of a tulip bulb. These types of bulbs are tunicate, or laminate, bulbs that have outer bulb scales that are dry. Tunicate bulbs include onion, garlic, daffodils, tulips, and hyacinths. Plants in the Amaryllidaceae family are all tunicate bulbs, Figure 15-17. The papery covering or tunic protects the bulb from drying out and minimizes physical injury. The bulb scales are almost solid, concentric layers. They have adventitious root initials that will begin to grow when the environmental conditions and timing are right.

Nontunicate Bulbs

Nontunicate, or scaly, bulbs do not have a dry covering, but they have separate scales that are attached to the basal plate as
shown in the lily bulb depicted in Figure 15-18. Without the covering, nontunicate bulbs can damage easily. They should be kept moist to prevent injury. Many bulbs have contractile roots that will physical pull the bulb to position it at a certain point in the ground.

Propagagation

General propagation of bulbs begins with digging the bulb after the foliage has died back and dormancy is present. The bulb parts are separated, and the new bulbs are graded by size and stored at 65°F–68°F (18°C–20°C) until planting. Bulbs are planted according to size to help manage the harvest. For example, small tulip bulbs, less than 2” (5 cm), will need at least three seasons to grow to a marketable size. A large bulb, 3.2” (8 cm) may only need a single growing season to reach flowering size. The minimum size for tulip bulbs is 3.6”–4” (9 cm–10 cm). This process is similar for most bulbs, with specific timing depending on plant species.

Lilies will increase naturally, but this takes considerable time. Commercial propagators of Easter lily (Lilium longiflorum) harvest underground stem bulblets in the late summer and plant them in the fall. The plants are allowed to grow for a season. After a single growing season, they are dug and replanted for one more year. Then they are harvested to be sold as commercial bulbs. Scaling is another method of propagation for lilies. With scaling, the individual bulb scales are removed and placed in a rooting medium in order for adventitious bulblets to form from each scale, Figure 15-19.

Hyacinth is one of the slowest bulbs to increase. A technique called basal cuttage was developed to hasten the development of bulblets. Using a scoring method, three deep, straight cuts are made across the basal plate of a mature bulb to reach the growing point. Bulblets form from the axils of the bulb scales. In another method, the entire basal plate is scooped out with a scalpel to stimulate adventitious bulblets to form on the exposed bulb scales. The bulbs are then placed in darkened conditions at 70°F (21°C) and later increased to 85°F–90°F (29.5°C–32°C) for two weeks. Humidity should be at 85% for two to three months. The mother bulb is then planted in the field in the fall. By spring, bulblets begin to rapidly develop. The bulblets are harvested and replanted to grow to marketable size.

Other methods of propagation that are less common but important for certain species include leaf cuttings and bulb cuttings. In bulb cuttings, the bulb is cut into 8 to 10 sections with basal plate attached. The sections contain three to four bulb scales. They are planted in rooting medium and warm temperatures to encourage adventitious bulblet formation.
Corms

Gladiolus, freesia, and crocus are among the more commonly known plants with corms, Figure 15-20. A corm is a modified, enlarged stem that serves as a storage organ and method of reproduction. Corms are swollen stems that are surrounded by dry, scale-like leaves called the tunic. Corms have observable nodes and internodes and are composed of solid storage tissue. Corms naturally produce new corms as a means of reproduction for the plant and a source of propagation material for growers.

After flowering, the plant is dug. The mother corm, new corms, and cormels are separated. Cormels are small corms that are produced from a stolon on the base of the corm. The cormels are grown for one year until they produce a new corm. The new corms are planted for further growth for one to two seasons until they reach flowering size. Some large corms can be cut into sections with each section containing at least one bud. The section will develop a new corm.

Tubers

Tubers are modified, enlarged stems that have become specialized to be underground storage organs. Potato (Solanum tuberosum), caladium (Caladium hortulanum), and Jerusalem artichoke (Helianthus tuberosus) are all tubers. If you imagine a typical potato that has stayed too long in the pantry, the nodes (also called eyes) begin to develop shoots. The role of the tuber is to serve as a source of stored food to drive the development of shoots in the spring, Figure 15-21. After emergence and growth of shoots, the old tuber dies. As the primary shoots form, adventitious roots develop as well as lateral shoots or stolons. These shoots run underground and will eventually tuberize, or develop new tubers.

In potatoes, propagation occurs with a tuber being cut into sections that each contain one or more eyes, Figure 15-22. Generally referred to as seed potatoes, these pieces require warm temperatures and high humidity to allow the cut surfaces to heal and suberize. Suberize means to form a waxy substance (called suberin) that protects plants from desiccation and pathogens. Potatoes are then planted in the field.

Caladium tubers are also cut into segments with two buds per piece. They are planted in field nurseries until tubers are ready to be harvested. Harvested tubers are dried and stored at 60°F (16°C) until ready for market or planting.

Tubercles are small aerial tubers produced in the axils of leaves of hardy begonia (Begonia grandis subsp. evansiaina) and cinnamon vine (Dioscorea batatas). The tubercles can be collected in the fall and planted in the spring.

Figure 15-20. Freesias develop storage organs known as corms.

Figure 15-21. The edible portion of the potato is called a tuber, which develops from underground stolons.

Figure 15-22. Potatoes are propagated by taking a tuber and cutting it into sections, with each piece containing an eye. These are then planted in the field and develop into shoots that form new stolons and tubers.
Tuberous stems, rather than tubers, are produced by the enlargement of the hypocotyl of a seedling and may include the first nodes of the epicotyl and the upper section of the primary root. Tuberous begonias and cyclamens are tuberous stems, Figure 15-23. In cyclamens, an upper portion of the tuberous stem can be cut and planted for adventitious root formation. Tuberous begonias are propagated most successfully as stem or leaf cuttings.

**Tuberous Roots**

Tuberous roots are enlarged secondary roots and include sweet potato, dahlia, and cassava, Figure 15-24. Most tuberous roots are biennial, growing storage roots in the first season. After a dormant state, they begin to grow again in the spring, with shoots emerging from the root and using stored nutrients and sugars. The old root disintegrates, and new tuberous roots form to perpetuate the cycle.

To propagate dahlia, the crown is divided with each section containing a bud. In commercial sweet potato production, the roots are bedded in the field and covered with plastic to provide moisture and warm temperatures of 80°F (27°C) to encourage sprouting. The emerging sprouts are called slips. Slips can be hilled with more soil to encourage adventitious roots to form. Many slip producers simply cut the slips and plant them in the field where they will form roots.

**Rhizome**

Iris, bamboo, sugar cane, banana, many grasses, ginger, and lily of the valley are important rhizomes. A *rhizome* is a modified stem structure that grows horizontally at or near the soil’s surface. Rhizomes produce roots on the bottom and shoots on the top, Figure 15-25. The stem has nodes and internodes with a leaf-like sheath that surrounds the stem at each node. This sheath can become a leaf.

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**Figure 15-23.** Cyclamens have tuberous stems that are commonly used in propagating new plants.

**Figure 15-24.** Dahlias form tuberous roots that are the primary plant part for commercial propagation.
Rhizomes are typically propagated by division. A plant is dug from the garden, the soil removed, and the rhizome cut into sections with each containing one or more buds. Adventitious roots and shoots will develop from the buds. Iris is a good example of this kind of plant. Plants are divided after flowering, usually in late summer. Some rhizomatous plants, such as bamboo, form above-ground shoots called culms, Figure 15-26. Culms may be cut and laid horizontally in the soil and covered. New shoots will emerge from the nodes.

**Pseudobulb**

Many orchid species will develop a swollen, fleshy stem structure called a *pseudobulb* (meaning false bulb). Serving as a specialized storage organ, the pseudobulb accumulates sugars, nutrients, and water, which enable survival during dormancy, Figure 15-27. Pseudobulb structures vary by species. In *Dendrobium*, the pseudobulb consists of many nodes that develop offshoots that form adventitious roots and can be cut and potted. *Cattleya*, *Laelia*, *Miltonia*, and *Odontoglossum* species have rhizomes that have pseudobulbs. Sections of rhizome are cut to include four to five pseudobulbs and planted in growing medium. New growth comes from the base of the pseudobulbs and nodes.

**Careers in Layering and Division**

Layering and division techniques may be intensive and expensive for home gardeners. Professional propagators are skilled in managing the growth, health, and propagation of plants and trees. These professionals are key to ensuring healthy plants are sold commercially.

**Fruit Nursery Propagator**

All commercial apple rootstocks are grown through the process of mound layering, and many other fruits are grown through various layering processes. Responsibilities for a propagator for a fruit tree nursery may include managing the stock plants for quality and vigor and going through the appropriate propagation processes for each fruit type. The propagator is responsible for not only the propagating but care and maintenance of rooted propagules. Propagators need to keep detailed records and have a minimum of a high school diploma with experience in propagation.

**Orchard Manager**

Orchard managers play a key role in making decisions and managing the health of the fruit trees and orchard ecosystem. Managers are responsible for organization and supervision of pruning, planting, fertilizing, spraying, thinning, mowing, harvesting, and storage of fruit. Managers recruit, train, supervise, and evaluate the orchard employees and communicate with orchard owners. The position requires a bachelor’s degree in agriculture or related field and/or at least five years of related horticultural and construction work experience.
Chapter Summary

- Layering is vegetative or asexual propagation technique that allows stems that are still attached to the parent plant to form adventitious roots.
- With simple layering, a flexible, low-growing stem is bent to the ground and covered with soil. The bent portion of the stem will form adventitious roots.
- Compound and serpentine layering produce multiple layers from a single stem by covering multiple buds and stimulating multiple shoots to grow and initiate roots.
- Air layering is a technique in which the stem is girdled and the wood is covered with rooting medium for adventitious roots to grow into.
- Mound (stool) layering is a method in which soil is piled on the crown of the plant. The new shoots form adventitious roots that can be severed and transplanted.
- In trench layering, shoots are layered horizontally and pegged down in the base of a trench. Loose rooting medium is filled around the new shoots as they develop.
- Some plants have modifications that enable them to create rooted layers through their natural biology. This is called natural layering and includes tip layers, runners, stolons, offsets, and suckers.
- Crown division is the process of dividing the crown of an herbaceous perennial or multibranched woody shrub into multiple sections for replanting.
- Underground storage structures in plants are called geophytes. They include many commonly known modified plant parts, including bulbs, corms, tubers, rhizomes, and pseudobulbs. Plants with these parts are propagated by separation or division.
- There are two types of bulbs, tunicate and nontunicate. Both form little bulblets that in turn can produce bulbs that are grown to larger sizes for commercial use.
Words to Know

Match the key terms from the chapter to the correct definition.

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1. A modified, enlarged stem that serves as a storage organ and method of reproduction.
2. A propagation method that involves wounding the stem and wrapping it in rooting medium to encourage adventitious root formation.
3. A young, small corm produced from a stolon on the base of a mature corm.
4. The piling of soil onto plants to promote desired growth, as in the case of potatoes to produce more tubers.
5. A type of lateral shoot or branch that forms at the base of a main stem, which occurs only in some plants, primarily in monocots.
6. A storage organ that develops in some orchids and can be cut and potted to grow new plants.
7. To form a waxy substance (called suberin) that protects plants from desiccation and pathogens.
8. A modified stem structure that grows horizontally at or near the soil’s surface, producing roots on the bottom and shoots on the top.
9. A propagation method in which soil is piled on the crown of the plant, and the new shoots form adventitious roots that can be severed and transplanted.
10. A modified stem that contains a short, fleshy basal plate at the bottom from which roots grow and which holds fleshy scales and the shoot.
11. A small bulb attached to the main bulb, which serves as a means of reproduction for the plant.
12. A swollen, underground stem that is a storage organ for the plant.
13. A small, aerial tuber produced in the axil of a leaf.
14. A variation of compound layering in which shoots are laid horizontally to the ground and some buds are exposed while others are covered with soil in an alternating pattern.
15. A specialized stem that grows horizontally above ground and forms a new plant.
16. A type of bulb that has fleshy scales and does not have a dry covering, such as a lily bulb.
17. A general term for vegetative propagation techniques in which plants initiate roots while still attached to a parent plant.
18. An underground storage structure in a plant, such as a bulb, corm, or tuber.
19. A type of bulb that has a dry, papery covering or tunic.
20. A shoot that grows from an adventitious bud on a root or any shoot that grows near the base of a plant.
21. Horizontal stems that grow below ground and produce plants or tubers.
22. Wounding of a stem by cutting or bending the stem for the purposes of propagation.
23. The process of developing new tubers, which are swollen, underground stems that are storage organs for the plant.
24. A propagation term used to define plants that produce bulbs or corms that can be easily pulled apart.

Know and Understand

Answer the following questions using the information provided in this chapter.

1. Why is layering a successful asexual propagation technique for certain species?
2. Describe the conditions growers use to propagate layers from stock plants.
3. Identify the different types of artificial layering
4. List five examples of shrubs that can be propagated using simple layering.
5. What time of year is simple layering typically done?
6. How does serpentine layering differ from regular compound layering?
7. Describe the specific steps to air layering of a dicot.
8. Which method of layering is the most commercially important?
9. Explain the role of hilling in mound layering.
10. Why would a grower use the trench layering method and how is it done?
11. What are five examples of natural layering?
12. What are three plants that exhibit natural tip layering?
13. What types of stems are runners? How are they a source of new plants?
14. What types of stems are stolons? How are they a source of new plants?
15. What type of plants (monocots or dicots) generally form offsets? What are four examples of plants that form offsets?
16. When are perennial crowns divided? Describe the process of crown division.
17. What are two types of geophytes that can be separated and used to grow new plants?
18. What is the role of the tunic on a tunicate bulb?
19. What is the function of contractile roots for bulbs?
20. What are some plants that have rhizomes?
Thinking Critically

1. You are trying to propagate a woody specimen by simple layering, and the layers are not rooting. What do you think is happening? Create a list of five possible reasons why the layers are not rooting.

2. A gardening friend approaches you with a propagation question and would like an answer. She has had an agave and would like more, but the plant is not forming any offsets. What questions would you ask your friend to determine the answer to the problem?

STEM and Academic Activities

1. **Science.** Research recent hyacinth cultivars. Choose five cultivars, and write a two-page report comparing the differences and similarities of the new varieties.

2. **Science.** Find out more about adventitious root formation. Why do some plants more readily initiate these types of roots? Write a report summarizing your findings.

3. **Math.** You are a wholesale greenhouse producer of lilies. You have a customer who would like to order 100 lily bulbs. What do you need to know about lily propagation to determine a cost that you can share with your customer?

4. **Social Science.** Role-play a situation in which you are working at your school’s plant sale. How would you relay information to a homeowner about how you propagated many of the plants through layering? How would you convey the value of these plants?

5. **Language Arts.** Using the knowledge you acquired from this chapter, create an informational poster about plants that can be propagated through layering. Include the different types of layering techniques and give examples of each.

Communicating about Agriculture

1. **Writing and Speaking.** As gardener for a public garden, create an informational pamphlet on the ways to propagate common garden plants. Include images in your pamphlet. Present the information you have written in the form of a presentation to your class and hand out the pamphlets as resources.

2. **Reading and Speaking.** In small groups, discuss the photographs and illustrations in chapters. Describe, in your own words, what is being shown in each image. Discuss the effectiveness of the illustrations compared to the text description.

3. **Listening and Speaking.** Interview a commercial propagator. Ask the person to describe a typical day at work. Here are some questions you might ask: What is the work environment like? What are the job duties? What kinds of management problems do you have to deal with? What other types of professionals do you work with? Report your findings to the class, giving reasons why you would or would not want to pursue a career similar to that of the person you interviewed.
SAE Opportunities

1. **Experimental.** Obtain some potatoes and cut them into sections for seed potatoes. Try planting them with and without suberization. What happens? Keep a record of your findings.

2. **Exploratory.** Create a propagation calendar for each of the different types of geophytes discussed in this chapter. When should you take cuttings? How should you prepare the cuttings? Include timing, depth, length, and other important details for each plant. Why do you think growers keep records of their propagation activities?

3. **Exploratory.** Create a list of fruit plants that grow on the campus of your school that could be sold in your school’s plant sale. Determine which method of propagation is best suited for each fruit. Determine a time frame, how many layers from each plant you will need, and what the costs associated with this project will be.

4. **Exploratory.** Job shadow someone who professionally practices layering techniques. What kind of organization does she or he work for? How often does this person use layering in her or his work?

5. **Entrepreneurship.** Propagate bulbs, tubers, and corms in your school’s garden and greenhouse and sell them to customers.