

Basic Plant Propagation



THE GARDEN CLUB of AMERICA

GCA Horticulture Committee

The GCA Horticulture Committee seeks to nurture the knowledge and love of gardening, promote useful and valuable plants, and conserve those at risk. It supports GCA clubs in their efforts to educate their communities in responsible ways to plant, propagate, grow, and show.

We hope this online publication will encourage you to start propagating plants for yourself, your garden and the greater community.





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WHY PROPAGATE PLANTS?

General Rules of Propagating

Variety—Anything Is Possible!

Growing your own expands your choices. You can choose flowers for cutting, heirloom varieties of flowers or vegetables, or native plants to provide habitat and food for insects and birds.

Preservation

With an old or rare plant, taking cuttings is a way to perpetuate the plant. A plant grown from a cutting will be a clone, a new plant with identical characteristics. Because most garden centers offer “popular plants” that sell in large quantities, propagating from seeds and cuttings provides a chance to grow uncommon plants, varieties that commercial growers and garden centers do not find profitable.

Club and Zone Plant Exchanges or Challenge Classes at a Flower Show

Learn these skills so you can participate in plant exchanges and the propagation classes for flower shows. This is a fun skill to acquire and share with other club members, your children or grandchildren.

You Control Chemical Usage

Most commercial growers use chemicals to control insects and disease and chemical growth regulators to keep the plants short. When growing your own plants, you control any use of chemicals and can grow a sturdy, “green” plant.

Fun

Growing from seed or cuttings is a great learning experience; you will have great success, and probably a few failures. You will have many plants to share with friends! Your gardening skills will improve as you work with seedlings and newly rooted cuttings, learning when to water and to recognize the signs of pests or disease.

Research

A little time spent researching the plant species before you start will result in much higher success rates and the Internet makes this easy. A quick on-line search, using Google or another search engine, will save time and



anguish. Just type in: “propagating” followed by the name of the plant. Some seeds need a cold treatment, some plants are almost impossible to propagate from stem cuttings or from seed, but can easily be grown from a root cutting or a simple layer.

Cleanliness

Disease organisms can survive in the bits of soil in used pots; plant viruses can be spread from an infected plant to a healthy plant on your hands or by a knife or scissors.

- ☀Be sure your hands, gloves, containers and tools are clean!
- ☀Wash with soap and water, then disinfect tools and containers with 1 TBSP bleach/ 1gallon of warm water.
- ☀Use new, sterile, soilless mix; this is not the time to re-use the soilless mix from last summer’s container.

Use Healthy, Well-Watered Plants for Cuttings, New or Well-Stored Seeds

Many seeds will remain viable for years if stored in a plastic container in a refrigerator; some seeds must be fresh. (Research your plant species,

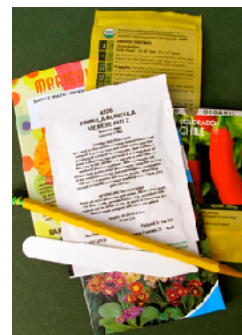
and for information on testing for viability.)

Water

Warm water is best. Cold water will lower the soil temperature, slowing germination or root formation. Water processed through a water softener has toxic amounts of sodium, which will kill plants. In a home with softened water, use untreated water, water from a rain barrel or an outside tap (that does not connect to the water softener).

Timing

Seed packets (or on-line sites, reference books) will give number of days to germinate, and number of



weeks before planting. Check the “last frost” date for your area, and then count backwards on a calendar. **Do not start too early!** Seedlings will grow

quickly, especially during the longer, sunnier days of April and May. For most annuals, 6–8 weeks after germination will produce a healthy, well-rooted plant.

☀**Tip: Plants will be much healthier in your garden if planted before they come into bloom. You may not get the instant satisfaction on the day you plant, but a stocky “green” plant will reward you with better garden performance all summer.**

Supplies

Basic Tools and Equipment



1. **Sterile growing medium**—A good quality commercial soilless mix works well for almost all seeds and cuttings; these are sterile, consistent, and available. (A local nursery growing their own plants often offers a quality soilless mix for sale, or Google a brand name to find a local source.) Avoid mixes with “continuous feeding.” Soilless mixes with up to 40% hardwood bark will help suppress disease organisms in the soil. By using the same mix, you will learn to judge when to water.
2. **Shallow containers 2"–3" deep with drainage holes:** Bedding plant flats and inserts are useful; shallow pots also work. Deeper containers remain too wet (no air spaces). New roots will rot.
3. **Use warm water:**
 - a. Spray bottle to spritz (mist).
 - b. Watering can with a rain-nozzle, or water-dispersing nozzle, so the water doesn't create gullies but is gently spread across the surface.
4. **Light:** If you will be growing the young seedlings for more than two weeks before planting outdoors, supplemental lighting is useful. Fluorescent lights are ideal (you do not need specialty grow-lights). Fluorescent lights 16 hours per day, (with an 8-hour dark period) are helpful for most plants.
5. **Temperature control:** You can go hi-tech, or improvise. There are specialty heat mats; or you may have a warm spot above a radiator, or on top of a refrigerator. A string of tiny Christmas lights under a Pyrex baking dish will create bottom heat. (LED lights will not work; use an old string of incandescent bulbs that give off heat.)
6. **Labels, #2 lead pencil, notebook to record.**
7. **Plastic for tenting:** Ziploc bag or a dry-cleaner bag, plus supports (almost anything works: wire hangers, popsicle sticks, bamboo stakes, plastic straws) to keep plastic about 4" above seeds or cuttings. Self-watering trays have a lid that serves this function.
8. **Tool** for marking rows, transplanting the rooted seedlings or cuttings—a butterknife, dibble, pencil.
9. **Plastic pill container:** for working with tiny seeds
10. **Fertilizer:** use only when seedlings or cuttings are well established; liquid fertilizers, timed-release, or organic forms —e.g. diluted sea weed emulsion.
11. **Small fan or cold frame:** useful options to help harden off seedlings or cuttings.

SOWING SEEDS

Growing from Seed—Why it is Essential

When you grow a plant from seed you are insuring genetic diversity. Genetically diverse populations of plants are stronger, more resilient and less susceptible to disease and natural disasters. When you choose to propagate a plant by sowing its seeds you are continuing nature's way of ensuring viability and sustainability on a most basic and important level.

This is a basic step-by-step recipe for germinating seeds; once you have mastered this method you may want to experiment with variations.

Plants need both air and water in the growing medium, the soilless mix. A good soilless mix retains moisture but also has tiny air pockets. Over-watering fills the air pockets and the roots drown; too little water and the roots dry out and die. Because the roots on newly germinated seeds are so tiny, maintaining the proper balance of water and air is critical. (See article by Sara Mauritz, *The Real Dirt*, Fall 2010, Issue #16, for more information on this.)

☀**Tip:** *Rushing to start seeds before the soilless mix is thoroughly moist and drained will lead to failure; water your containers early, or even the day before you sow seeds.*

1. Get specific instructions from the seed packet or on-line. Seed-bearing plants evolved in jungles, deserts, prairies and tundra; germination requirements vary.
2. Pour or scoop soilless mix to fill a seed flat or shallow pot; do not tamp down (that removes air spaces).
3. Water thoroughly with warm water; (if the soilless mix is old and has dried out, it may need repeated watering). Sub-irrigate (placing your container into a larger dishpan) or water with a watering can with a water-dispersing nozzle.
4. Let the water drain—mix must be thoroughly moist but not soggy.
5. Lift your container! Feel the weight when thoroughly watered. Knowing how heavy it is when watered will help you judge when the mix is dry.
6. For larger seeds (large enough to pick up individually):
 - a. Create shallow, parallel furrows in your container (about as deep as the seed).
 - b. Drop seeds into these furrows (furrows are used to prevent spread of damping off); sow seeds sparsely! Once they germinate, crowded seedlings will compete for light, grow tall and spindly.
- c. Cover the seeds very lightly with sand, vermiculite or soilless mix. (Some seeds require light to germinate, and should not be covered. Most tiny seeds do not need to be covered; larger seeds usually do. The covering helps maintain critical moisture around the emerging root.) Read instructions on the seed packet, or check on-line.
- d. Water gently—a water-dispersing nozzle is ideal, or sub-irrigate (place tray in dishpan with water to soak up). This is needed to moisten the seed, and to make sure it is in contact with the mix. (If you sub-irrigate—don't forget to remove it from the water—you could drown the seeds!).
- e. Label—seed variety and date (prepare the labels in advance, so they are ready to insert).
- f. Tent with plastic to maintain humidity. This can be a dry cleaner bag or a Ziploc bag placed over the top (zip side at the bottom). Use tags, plastic straws, wire coat hanger, etc. to hold bag 4–6" above soil surface.

7. **For very tiny seeds**, save a small plastic pill container, fill half-way with sand, vermiculite, or talcum powder, add the tiny seeds, put the lid on and shake to mix. Then pour slowly in rows onto the surface of the soilless mix (this helps prevent all the seeds from landing in one spot). Tiny seeds do not need furrows, or to be covered with sand or soilless mix. Water gently but thoroughly (as above), label, and tent.

8. **For very large seeds (e.g. palms, conifers)**, soak for a few hours, place on a tray between layers of wet paper towels. Keep warm (75°) and check daily for the root (radicle) to emerge. Transplant into individual 3"–4" pots.

☀**Tip:** Many tree and perennial species grow with a taproot, examples include conifers, oaks and buckeyes. These seeds should be planted in deeper pots from the start or germinated before planting. Most plants with taproots resent transplanting so it is very important to make sure the root has adequate

9. Most seeds prefer soil temperatures between 70° and 75° for germination. The moisture in the soil makes it cooler than ambient air temperature. Providing bottom

heat (heating mat, a string of Christmas lights under your tray, or a spot on top of a refrigerator or a high shelf) can provide the needed warmth.

10. High humidity (90+%) aids germination; the plastic tent holds moisture in. You may need to spritz 2–3 times a week to keep humidity high. You want to see drops of moisture on the inside of the plastic tent. If water is accumulating on the soil surface, open tent a little; you want very humid conditions, but not “raining.”

11. **Watering:** Since the soil was thoroughly moist before planting and the plastic tent holds in humidity, you should not need to water for at least a week. Lift the container (checking the weight) to know if the soilless mix needs water. If the container is still heavy, but the surface is dry—spritz the surface; if the container is light, the soilless mix has dried out, place it in a pan of water, allowing the container to absorb water from the bottom, to moisten thoroughly, then drain, re-tent.

12. **Light:** some seeds require light to germinate. Fluorescent bulbs 4"–6" above the tented container is the goal, but seeds will germinate even if lights are further away. For seeds that need darkness—a trash bag or large pot over the plastic tent works.

☀**Tip:** Above 80° is too hot for most seeds—they cook! If the soil temperature is below 70°, germination is slower, and disease organisms grow quickly. Your seedlings will sprout and then be killed off. Check seed packet or reference for specific requirements.

13. **Check daily;** germination will be staggered over days. Once seedlings begin to emerge, loosen the tent to allow more air, less humidity. (And remove the “darkness” cover, if used.) Maintaining bottom heat will encourage the slower germinating seeds to emerge. After a couple of days, remove the plastic tent.



Catalpa speciosa seedlings showing their first true leaves. Few things are as magical as watching a seed germinate.

Pretreatment

Scarification and Cold Stratification

Special Seed Pretreatment



Home gardeners should be aware of seed provenance, or the geographic area where their perennial or woody plant seed comes from. Some species have very wide growing ranges. To insure future success, always try to purchase seed from plants growing in similar conditions to your own.

The seeds of some species evolved to remain dormant through cold winters or with a hard, protective coating; seeds from these species need special treatment. If the seed packet states “no pretreatment” or “direct sow” follow the directions above for Sowing Seeds. If the seed packet says pretreatment is required for germination, such as scarification (the breaking down of the impermeable outer layer of the seed coat to allow water to reach the seed), cold stratification (after-ripening of the seed embryo brought on by a cold, moist period), and occasionally double dormancy (multiple cold and warm stratification periods), follow the directions on this page for success.

Scarification

Hard seed coats, a protective mechanism of many species, must be degraded to allow water to reach the seed allowing it to then germinate. This can be done either by nature with an outdoor planting in fall or mechanically (files, acid, or prolonged water soaks). Acid treatments and machines are used by professionals to break down the hard outer coat of large numbers of seed, but this is not safe or practical for home growers. Soaking the seed in a small dish of warm or sometimes boiling water for a 12 to 24 hour period is an effective alternative.

Follow the directions on the seed packet for exact soaking times and water temperatures. Very hard seed coats may also need to be filed, abraded with sand paper or cracked (not shattered) in a vise or with a hammer. Following the scarification process, research whether your seed can then be directly sown or needs a period of cold stratification before being put in a warm environment.

Cold Stratification

Cold stratification, the after-ripening of the seed embryo, is achieved by replicating a cold, wet winter. This can occur by placing potted seeds in a well-insulated cold frame outdoors during winter or indoors in a refrigerator. If done indoors, seeds sown in pots should then be enclosed in a plastic bag before being

placed in the refrigerator. Remember to label. To save space, seed can also be placed in a labeled plastic bag filled with moist, not wet, vermiculite or sphagnum moss. This is especially effective if cold stratifying large seed or large quantities of seed.

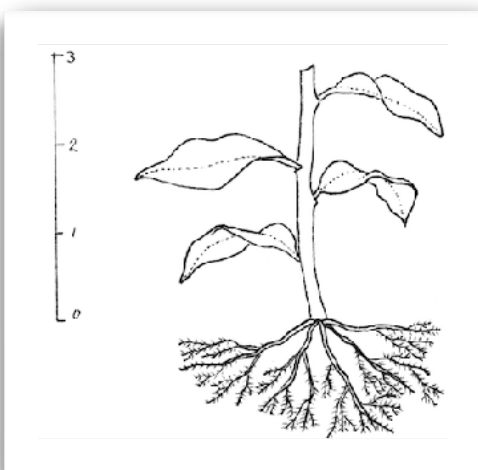
After a period of cold (again, read up on the seeds particular requirements—times vary from 1 to 6 months) the potted seeds may be moved to a warm location. Leave the pots in the plastic bag until germination occurs. If the seeds were cold stratified in a plastic bag in vermiculite, you will now need to pot them up, as above. Be aware that some seeds do not like to have warm bottom heat and some species require double dormancy. Again, read up on the plant’s specific germination requirements.



Locally collected *Quercus rubra* seeds after a 3 month cold stratification in the refrigerator showing the radicle, or embryonic root, of a red oak tree. These acorns are ready to plant.

SEEDLINGS — CRITICAL FIRST WEEK(S)

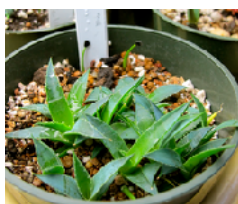
Plants need water, light, moderate temperature and carbon dioxide for photosynthesis to take place (which is how they grow). There is plenty of carbon dioxide in the air. As the grower, your job is to provide the right amounts of water, light and warmth.



The tiny root hairs of seedling plants should always be handled with care. Drawing by Martha Kemp.

Water

Once the seeds have germinated, it is essential to allow the mix to dry a little between waterings. Not too wet, not too dry—proper watering is the key! Water is absorbed through tiny root hairs, and passes through the cell walls by osmosis.



It moves by osmosis from these root hairs into the roots, and then stem, leaves and flowers. If the soilless mix is constantly wet, these root hairs will rot. Once the root hairs are damaged, water cannot transfer into the plant; there may be plenty of water in the soil, but the plant cannot use it.

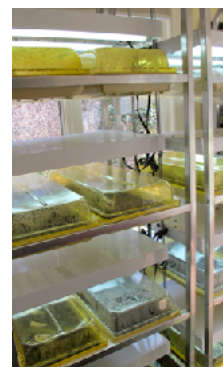
1. For the first week after sowing, spritz heavily at soil level if the top 1/2" is dry. You want droplets of water to soak into that top level, to water the tiny roots.
2. As seeds sprout, open or remove plastic tent for an hour or two, then gradually longer periods over the first week. For germination the seeds needed 90% humidity, but now humidity levels of 50%–70% are ideal. Higher humidity levels encourage fungus and disease organisms.
3. As the seedlings grow and roots elongate, use bottom watering (or water with water-dispersing nozzle). If the soilless mix in the top inch of the container is always moist, the roots will stay in the top. Permit the soilless mix to dry out between waterings, forcing roots to grow down into the bottom of your container for moisture.
4. Light: fluorescent lights are ideal. The temperatures in a windowsill vary too much for

tiny seedlings—too hot on a sunny day and too cold at night.

Light

Unless you have a greenhouse, it is difficult to grow sturdy, healthy seedlings indoors without providing supplemental light.

1. Fluorescent lights 16 hours per day (with an 8-hour dark period) work



best, with the lights 4"–6" above the top leaves. Fluorescent light fixtures on chains make it easy to move the lights up as the plants grow. Or improvise, using inverted pots to lift tiny plants closer to the lights.

2. Light filtered through a window is simply not strong enough or long enough (16 hours a day, every day is ideal). Plants will stretch for the light, and become weak and spindly.

Temperature

Most young plants grow best if the soil temperature is maintained between 68–75°. The temperatures in a windowsill vary too much for tiny seedlings—too hot on a sunny day and too cold at night.



Newly emerging *Sassafras albidum* seedlings growing on heat mats.

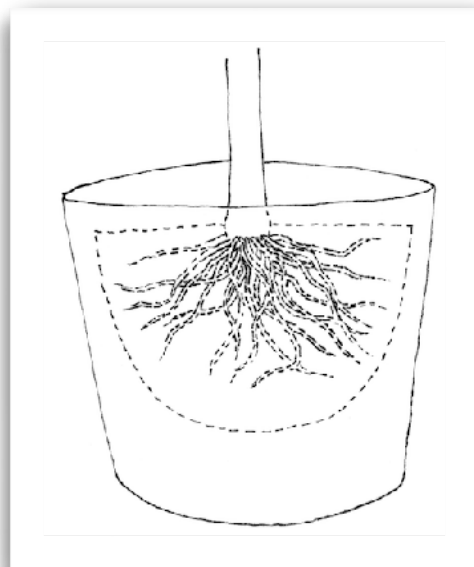
PRICKING OUT: TRANSPLANTING TO INDIVIDUAL CONTAINER

When a seed germinates, the first set of leaves are the cotyledons, which were actually inside the seed. The next set of leaves are the first true leaves. Ideally, seedlings should be transplanted after these first true leaves develop. The longer multiple seedlings continue to grow in the same container, the more difficult transplanting will become as the roots intermingle, and crowded seedlings stretch for the light. If seeds are sown very sparsely, or in individual containers, then you can delay transplant until the plant has two or three sets of true leaves.

☀**Tip:** Calculate how much well-lit space you have under fluorescent lights or in bright windows. Depending on your plants, each seedling should have a minimum of 2" x 2", (6 plants per foot), with larger plants requiring 4" x 4". It is hard to throw away healthy seedlings, but transplanting too many and crowding them will yield spindly, weak plants. If you have a cold frame, frost-resistant varieties (perennials, some annuals) can be moved into that, providing room in your sunny window or under lights for tender seedlings. (See article by Mercer O'Hara, *The Real Dirt*, Fall 2005, Issue #4, "Cold Frames and Holding Beds.")

1. Fill container with soilless mix; water thoroughly (using water-dispersing nozzle) or sub-irrigate. Drain. Final soil level should be just below rim of container.
2. If seedlings are spaced closely, use a wooden label (or butter knife) to dig up a clump, drop on a table to break apart, or gently pry them apart. If seedlings are spaced, dig each one up individually.
3. These are fragile and need a delicate touch. Pick up seedling by its leaves, or under the root ball (not by stem!). If seedlings are hard to separate, some growers plant a small clump—and then snip off all but one.
4. Make a shallow hole in the soilless mix, no deeper than the length of the roots. (Plant label, pencil, butter knife all work—or your finger.)
5. Tuck the seedling in carefully, and firm mix around it. Be aware of where the stem emerges from the roots. Do not plant too deeply! (There are a few exceptions: tomatoes, marigolds may be planted deep and will form roots along their stems.)
6. Water thoroughly, using a watering can with a dispersing nozzle, or bottom watering. This brings moist mix in contact with the roots.
7. The first few days after transplant are critical; inevitably roots were bruised or broken. Warm temperature in your soilless mix will help plant roots to grow, misting to add to humidity will help prevent desiccation. Keep out of direct sun for 2–3 days.

☀**Tip:** Use a container in proportion to your plant and the size of the root at transplant; for small plants, the inserts used for bedding plants work well; for larger plants, a 3"–4" pot. A tiny root ball in a 3" pot is inviting root rot. It is much better to transplant a second time to a larger pot after it has healthy roots in a 1" container.



The proper size pot for this root ball. Drawing by Martha Kemp.

Pricking Out and Potting Up

How to Repot Seedlings



1 A pot of seedlings in need of repotting.



2 Pricking out: using a pencil or other device, gently lever out the seedlings.



3 Disturbance to roots should be minimal using this method.



4 Another method to separate seedlings.



5 Remove entire root mass from pot and gently drop on a hard surface.



6 Tease tender young plants and roots apart very carefully.



7 Always hold seedling by leaf, never by stem.



8 Repot and firm in gently. Do not bury the stem. Water carefully.



9 Make a new plant label with the name of the plant and date of repotting.

GROWING ON

Key factors remain water, air, light and temperature.

☀**Tip:** *Tough Love for your small plants! Your goal is to have a healthy root system, and sturdy, stocky plant. You have been nurturing these baby plants and it takes willpower not to water frequently. Remember that if there is always plenty of water in the top inch of the soilless mix, roots will remain near the surface.*



Seeds were collected and propagated from a cultivated variety of canna with a dwarf habit, red leaves and coral-red flowers (Canna 'Red Futurity' - large plant in back). The seedlings (in front) exhibited characteristics from the parent's hybrid past including red leaf color and dwarf habit but neither exhibited the hybrid's flower color. Seeds collected from hybrids usually do not come true to type but it is an interesting experiment to see what does come up and clearly shows the great genetic variety that can be found when you grow plants from seed.

1. Once the seedlings perk up after transplanting (2–3 days), begin to ration watering. Water thoroughly, but only when the area around the roots has dried; the plant will have to send roots down into the soilless mix for water creating a strong root ball. Once the plant is well-rooted, allow it to wilt a little between waterings. Lift your container before watering. You can judge from the weight whether the soil is dry.
2. Fluorescent lights, or bright windows provide the necessary light.
3. After 4 weeks if the seedlings are healthy and growing, water with a weak solution of either an organic or chemical fertilizer that offers approximately equal amounts of nitrogen, potassium and phosphorus (the numbers on the package).

☀**Tip:** *Commercial soilless mixes all have a “starter charge” of fertilizer that is plenty for the first month. When you fertilize a plant, the fertilizer dissolves in water, creating either an acid or base. This is absorbed through the roots. Excess fertilizer burns the roots. Think of putting your hands in Clorox! The roots on new seedlings are tiny—almost any quantity of fertilizer is too much. (See The Real Dirt, Fall 2010, Issue #16, Fertilizing Indoor Plants.)*

Read the package instructions, and use at half strength; if it suggests 2 TBSP per gallon of water, use 1 TBSP per gallon. Then use fertilizer for alternate waterings. Or use a timed-release fertilizer, a few granules in each container.

☀**Tip:** *If hardening the plants outdoors is impossible, a small fan directed at the seedlings for several hours each day will simulate wind. You don't want a hurricane, but a steady breeze will produce shorter, sturdier plants. Brushing your hand gently across the tops of the plants a couple of times a day also helps.*

4. Ideally, seedlings should be hardened off by placing the containers outside, out of direct sunlight and protected from high winds. This will acclimate them to the real world, but you may need to bring them back inside on chilly nights. A cold frame is perfect for this, since you can open it in the daytime and close at night. If you cannot harden off the plants, wait to plant outside until predicted night temperatures are mild. (Temperatures below 45° will set seedlings pampered with house temperatures back; ideally nighttime temperatures should be above 50°.)

Glossary

Adventitious Roots: roots that form in parts of the plant (stems or leaves) during vegetative propagation. In a growing plant, cells will differentiate to become root cells, stem, leaf or flower cells. When a cutting is taken, new cells in the stem or leaf areas can become root cells, forming new roots. Rooting compounds are used to encourage the development of these new roots.

Cambium: the green, or growing layer immediately under the bark, which carries water and nutrients to the entire plant.

Dampening-off/Damp off: Fungal diseases that may attack seedlings.

Distal End: Refers to the root area furthest from the crown of the parent plant (opposite of Proximal End).

Double Dormancy: Multiple cold and warm stratification periods.

In Situ: Literally “in place”; here refers to planting directly in the ground where the plant is intended to grow.

Node: Area on stem where a leaf or leaves have been attached.

Polarity: This is very important with vegetative propagation. Always mark and be aware of which part of the root, cutting or leaf cutting was growing closest to the crown of the plant or the roots; this will determine which end is up when you stick your cutting.

Petiole: The small stalk attaching the leaf blade to the stem.

Proximal End: Refers to the root area nearest the crown of the parent plant (opposite of Distal End).

Radicle Root: The first part of a seedling to emerge from the seed during the process of germination. It is the initial root of the plant.

Scarification: Breaking down of the impermeable outer layer of the seed coat to allow water to reach the seed.

Scion: a hardwood tip cutting containing growing points (buds) from a plant with desirable characteristics which is grafted onto the under-stock.

Stratification: The after-ripening of a seed—can be warm or cold, to mimic the seed’s natural environment and cause germination. **Cold Stratification:** After-ripening of the seed embryo brought on by a cold, moist period.

Websites:

The internet offers many other sites to learn about plant propagation. In addition, Master Gardeners all over the country have excellent online resources to help you learn more about propagating in your area of the country.

GCA Online Links:

GCA Seed Share, GOT SEEDS? WANT SEEDS? Visit the Seed Share Database to shop for seeds for yourself, or for a club project. Add your own collected seeds to the database and share the wealth!

<https://www.gcamerica.org/index.cfm/members:seeds/list>

The Real Dirt, GCA Horticulture Committee Online Publication.

Read these great propagation articles, written by fellow GCA club members in **The Real Dirt** archives!

Growing Ferns from Spores

Shirley Meneice, Carmel-by-the-Sea GC

<https://www.gcamerica.org/uploads/filemanager/publicationsresource/TRD3SPRING2005.pdf>

Taking the Plunge: Holding Beds that Work

By Susan Deeks, GC of Morristown

<https://www.gcamerica.org/uploads/filemanager/publicationsresource/TRD15Spring2010.pdf>

A Cold Frame for Winter Storage of Cuttings and Marginally Hardy Plants

By Mercer O'Hara, GC of Englewood

<https://www.gcamerica.org/uploads/filemanager/publicationsresource/TRD4FALL2005.pdf>

Camellia Grafting

Barbara Tuffli, Past President of the American Camellia Society, Woodside-Atherton GC

<https://www.gcamerica.org/uploads/filemanager/publicationsresource/TRD15Spring2010.pdf>

Make the Cut with This Easy Workshop

Priscilla Twombly, Sasqua GC

<https://www.gcamerica.org/uploads/filemanager/publicationsresource/TRD3SPRING2005.pdf>

Air Layering

Sandra Kouwenhoven, Amateur GC

<https://www.gcamerica.org/uploads/filemanager/publicationsresource/TRD3SPRING2005.pdf>

Further Reading:

Ashworth, Suzanne, *Seed to Seed: Seed-Saving Techniques for Vegetable Gardeners*, 2nd rev. ed.

Bir, Richard. E., *Growing and Propagating Showy Native Woody Plants*. Chapel Hill (NC) and London (GB): University of North Carolina Press. ISBN 0807843660

Bubel, Nancy, *The New Seed Starters Handbook*. Emmaus (PA): Rodale Press, 1988. ISBN 9780878577521

Capon, Brian, *Botany for Gardeners, An Introduction and Guide*. Portland (OR): Timber Press, 1990. ISBN 0881921637

Cullina, William, *Native Trees, Shrubs and Vines: A Guide to Using, Growing, and Propagating North American Woody Plants*. Boston (MA): Houghton Mifflin Harcourt, 2002. ISBN 0618098585

Cullina, William, *The New England Wild Flower Society Guide to Growing and Propagating Wildflowers of the United States and Canada*. Boston (MA): Houghton Mifflin Co., 2000. ISBN 9780395966099

For advanced information on germination: Deno, Norman C., *Seed Germination Theory and Practice*, second edition, 5th printing, 1994. Plus First and Second Supplements to the Second Edition. Self-published and has been available through author at 139 Lenor Dr., State College, PA 16801.

Dirr, Michael and Heuser, Charles, Jr. *The Reference Manual of Woody Plant Propagation: From Seed to Tissue Culture: A Practical Working Guide to the Propagation of Over 1100 Species*. Cary (NC): Varsity Press, 2006, second edition. ISBN 97809423775008. Also second edition: Portland (OR): Timber Press, 2009. ISBN 1604690046

Druse, Ken, *Making More Plants, The Science, Art, and Joy of Propagation*. New York (NY): Clarkson Potter, 2000. ISBN 051770787X

Emery, Dara, *Seed Propagation of Native California Plants*, 3rd printing. Santa Barbara (CA): Santa Barbara Botanic Garden, 1995. ISBN 0916436039

Gardiner, Jim, *The Royal Horticultural Society, A Wisley Handbook, Propagation from Seed*. London (GB): Cassell, 1997. ISBN 0304320625

Hartmann, H. T., Kester, D. E., Davies, F. T., Geneve, R. L., *Hartmann and Kester's Plant Propagation: Principles and Practices*, Upper Saddle River (NJ): Pearson / Prentice Hall, 2010. ISBN 0135014492

Further Reading (continued):

Koch, Henry, with Aird, Paul; Amrose John; and Waldron, Gerald, *Growing Trees from Seed. A Practical Guide to Growing Native Trees, Vines and Shrubs*. Ontario (Canada): Firefly Books, 2008. ISBN 9781554073634

Loewer, Peter, *SEEDS: The Definitive Guide to Growing, History & Lore*. Portland (OR): Timber Press, 2005. ISBN 9780881926828

McClure, Susan, *Smith & Hawken: Hands On Gardener: Seeds and Propagation*. New York (NY): Workman Publishing Co., 1997. ISBN 0761107339

McVicar, Jekka, *Seeds: The Ultimate Guide to Growing Successfully from Seed*. Guilford (CT): Globe Pequot, 2003. ISBN 9781585748747

Midgley, Jan A. W., *Native Plant Propagation*. Self-published, 2006: 234 Oak Tree Trail, Wilsonville (AL) 35186. Telephone: (205) 669-4097; email: jwilfflowr@aol.com

Schmidt, Marjorie G., *Growing California Native Plants*. Berkeley (CA): University of California Press, 1980. ISBN 0520037626.

Toogood, Alan, Editor-in-chief (United States editor Ray Rogers), *American Horticulture Society Plant Propagation, The Fully Illustrated Plant-by-Plant Manual of Practical Techniques*. New York (NY): Dorling Kindersley Publishing, Inc., 1999. ISBN 0789441160

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THE GARDEN CLUB *of* AMERICA

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GCA HORTICULTURE COMMITTEE

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