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Table of Contents

How to Grow Your Own Sweet Potato Slips

By Aledor Support | March 2023-Vol. 9, No.3

Sweet potatoes are not usually planted the same way as are white potatoes. If a whole sweet potato is placed in the ground in early spring — when white potatoes are usually planted — the cold weather will inhibit its growth and it might rot. For this reason, the recommended propagation technique for sweet potatoes is to plant "slips" after the last frost date. **Slips are the rooted sprouts that grow out of the sweet potato tuber.** They can be purchased from a reputable seed company, or you can grow them yourself, which is much more fun! It also works as an interesting and engaging garden activity for children.

Sprouts or "slips" beginning to grow out of the potato halves. Photo: Barbara Gardino

One potato tuber will often produce more than a handful of sprouts or slips. These slips are removed from the original tuber by a careful twist, or, by keeping them attached to the tuber and slicing them off. Each of those slips can grow into a plant that can produce about 6 sweet potatoes. It generally will take about 6 weeks for the sprouts to be ready to slip off the tubers. Planting time in Central Virginia is after the last frost date (I plant in the third week of May to be safe). That means that the **slips should be started the first week in April, so they'll be ready to plant in the garden in the third week of May.**

To begin the process, have these materials available:

- organic (if possible) sweet potatoes; whether store bought or purchased as "seed" potatoes from a seed company
- a strong knife to slice each tuber in half
- a cutting board or piece of wood (my photo shows a section of 2 by 4 that just happenend to be in our greenhouse!)
- at least one aluminum baking tray with a cover (I buy them at a grocery store in the baking section)
- organic seed starter mix that you have pre-moistened ; enough to fill the tray and cover the potatoes

For the past 10 years, I have been using the following procedures to grow Japanese sweet potato slips. But any kind of sweet potato can be used. We grow the Japanese variety only because we love the less sweet flavor, and the drier texture. During the first week of April:

1. Fill a tray with a moistened organic growing medium
2. Place a potato on a cutting board and slice lengthwise in half
3. Position each half with the cut side down on the planting medium
4. Push the potato into the mixture and cover with a little more of the mix
5. Cover the tray with a plastic top in a way that allows for some air circulation
6. Keep the tray under grow lights or florescent shop lights and do not let the soil dry out
7. You can also place the tray by a sunny window
8. To speed up the process, you can place the tray on a heating

Materials needed for slips. Photo: Barbara Gardino

mat for plants. This is an optional step

After 2-3 weeks, you will begin to see reddish sprouts emerging from the sides and the tops of the tubers. At this time, you can remove the plastic cover and continue to keep the tray of sprouting tubers moist. Soon, these stiff sprouts will begin to leaf out and grow roots. The roots will be attached to the seed potato.

The sprouts will continue growing roots underneath the sliced tuber. **When there are several green leaves and some roots attached to each sprout, they are ready to be "slipped" off the tuber.** This can be accomplished with a twist of the sprout. I prefer to slice the potato, in between the sprouts. Using this method, each sprout and some root will be attched to a small piece of potato. I do this because if I try to pull or "slip" it off the potato, sometimes it breaks. That is also a good reason to plan on having some extra by using one more seed potato than you think you need.

Now that the slips are off the potato, if the last frost date has passed, they can be planted into the previously prepared garden bed. Otherwise, they can be planted in small pots, and kept indoors under grow lights until after the last frost date passes.

Slips growing in small pots. Photo: Barbara Gardino

I like to grow the slips in pots for about 2 weeks, even if the last frost date has passed. This extra step gives the slips a chance to develop larger leaves and a stronger root system. It takes a bit more time and energy but using this method, I have never lost a single plant in the row.

Determine how many slips and potatoes are needed.

I have always been able to count on at least 6 healthy slips from each tuber. Oftentimes, there will be more. Each of those slips will mature into a plant that produces, on average, 6 tubers. And each plant is spaced about a foot apart in the garden. So if I want to be sure I will harvest a certain number of potatoes, some simple math is helpful.

I like to consume 2 potatoes per week : 2 times 52 weeks equals 104 tubers.

— 104 divided by 6 potatoes from each plant equals 18 plants, rounded up. I will need 18 slips.

–18 slips divided by 6 slips per seed potato equals 3 seed potatoes (remember they are sliced in half to grow the slips).

Determine the amount of space needed

I choose an area in my garden where the vines will be free to extend at least 4 feet from the main plant in every direction. This is because of the extensive vining habit of sweet potato plants. Since the correct plant spacing in the garden is 1 foot between plants, I will need an 18-foot row, or 2 or 3 smaller rows.

Below is a photo of the slips that have been growing in small pots. They are all lined up and ready to be transplanted into my row. One year, we had squirrels burrowing into the row, nibbling on all the potatoes! Ever since then, we cover the row with black landscape fabric, which lets in the water and keeps out the squirrels. It also prevents weeds from growing in between the vines.

As the vines begin to grow, the soil will soon be blanketed by them. The vines will “take over ” a wide space, growing 3 -4 feet in every direction! It’s a good idea to place an 18-inch stake in the ground in front or behind each plant. If you don’t mark each spot, as the vines grow, it becomes difficult to know exactly where to water. Placing the stakes also helps to identify the location of each plant later in the fall, when all the vines have to be cut off the plants.

Ready for planting in the garden row. Photo: Barbara Gardino

Prepare the area for harvesting

After growing in the ground from mid-May until mid-October — definitely before the first frost — it will be time to prepare the area for harvest. Because of the thick tangle of vines, we follow these steps; making the entire process quite easy and enjoyable.

1. Starting about a foot away from each rooted plant, cut away the vines. We use a garden shear.

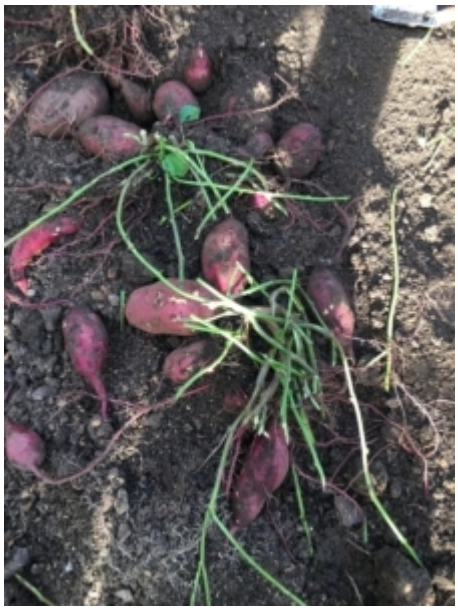
2. Pull them to the sides of the row so you can easily access the tubers.

3. Whatever bit of vine remains attached to the tops of the plants can now be cut away.

The vines having been cut and pulled to one side. Photo: Barbara Gardino

Begin harvesting

With a trowel, gently dig around the plant in a wide circle, taking care not to cut into any potatoes. I scrape some soil away from the main plant as I also tug on the remaining stalks. In a few minutes, there they are! You’ve been waiting all season and at long last, they are ready. They grow as a cluster, attached to the main stem of the plant. With your trowel, lift them out one by one, or, if your soil is loose, you can pull on the main stalk and they will come out of the ground, all at once, still connected.



These potatoes are all attached to the plant. Photo: Barbara Gardino

Gently removing potatoes from soil.
Photo: Barbara Gardino

At this point, the potato skins are easily scratched. To harden the skins, leave the potatoes in the row for a few hours to begin to dry. The next step is to gently rub off the soil, and it is best to do this with a soft cloth or with your hands.

Rubbing the soil off the tubers in preparation for curing.
Photo: Barbara Gardino

Cure the potatoes for winter storage.

If the potateos are not properly cured, they will become soft before you can eat all of them! Sweet potatoes cure best in a constant temperature between 75° and 80° for about 10 days. One way to acheive this is to place the potatoes on a table in a room with an electric heater. After this curing period is over, they can remain in a basement or other room that maintains a temperature of about 60° – 65°F.

Now you can enjoy your harvest!

Helpful resources for all aspects of growing sweet potatoes:

https://extension.umd.edu/resource/growing-sweet-potatoes-home-garden

https://pmgarchives.com › article › sweet-p...

https://extension.illinois.edu/blogs/good-growing/2020-04-22-how-grow-sweet-potatoes

Ten Common Flower Garden Insect or Insect-Like Pests

By Patsy Chadwick | March 2023-Vol. 9, No.3

It's a given that insects will always be with us. They fly, crawl, hop, chew, suck, bore, and mine. If their damage is minor, then it's generally OK to adopt a "live and let live" attitude toward them in our flower gardens. But when they consume our coneflower petals, deposit clusters of unappetizing "spit" in the yarrow, or chew huge holes in the hostas, that's when we are forced to declare war!

The iconic book *Good Bug, Bad Bug* explains that 90% of all insects are either benign or beneficial. Of the remaining 10% of insects, the damage they inflict depends on whether they are **chewers** or **piercers/suckers**. It also depends in many cases on whether the insect is in the larval, nymph, or adult stage of their development. This article provides examples of insect pests belonging to both categories, the type of damage they inflict, and recommendations for managing them.

The non-chemical management controls described are meant to be as non-toxic and environmentally friendly as possible. But if chemical controls are indicated, then refer to the Virginia Cooperative Extension's (VCE) *2022 Pest Management Guide* and the plant fact sheets listed under Resources at the end of this article for information on pesticides and additional controls. To avoid inadvertently harming beneficial insects or doing damage to the environment, comply fully with directions on pesticide labels.

CHEWING INSECTS

Chewing insects have mouthparts that allow them to feed on all parts of a plant. They chew and swallow bits and pieces of plant tissue, leaving an unsightly, ragged leaf or flower margin. Here are some clues that

indicate the culprit is a chewing insect:

1. Leaves or entire plants are defoliated.
2. Leaves are “skeletonized” (nibbled between the veins).
3. The outer edge of a leaf or flower is devoured.
4. The outer layer of plant cells is nibbled, causing the chewed areas to turn brown and unsightly.
5. Tiny holes in leaves resulting in a “shot hole” effect.
6. Plant dieback or loss of vigor due to consumed roots or stems.

Four examples of chewing insect pests include blister beetle, iris borer, earwig, and leaf miner.

BLISTER BEETLE

Of the blister beetle family of insects, the **black blister beetle (*Epicauta pennsylvanica*)** is commonly found in gardens east of the Rockies. This **chewing** insect has a slender, elongated body and soft wing covers that don’t cover the tip of the abdomen. Blister beetles produce cantharidin, a defensive oil that can irritate skin and cause blisters – hence the common name of this insect. The adult beetles feed on leaves and flowers of a wide range of plants, including aster, calendula, chrysanthemum, dahlia, dianthus, delphinium, goldenrod, Japanese anemone, lupine, phlox and zinnia. In large numbers, these insects can quickly defoliate a plant. The larvae are predaceous; that is, they feed on the eggs of grasshoppers as well as wild bee larvae.

Signs of Blister Beetle Damage:

- Defoliation of leaves and flowers, particularly at the top of the plant.
- Dark, irregular fecal spots on remaining leaves and stems.

Blister Beetle Management Control:

- Pick off and squish by hand (**be sure to wear gloves**).
- Knock them into a container of soapy water. If they fall to the ground, they will pretend to be dead. So make sure they fall into the soapy water.
- Keep ragweed (*Ambrosia* spp.) and pigweed (*Amaranthus* spp.) under control. Both weeds attract the beetles.
- Manage grasshopper populations as a preventative measure. Blister beetle larvae consume grasshopper eggs. Blister beetle populations may be high in areas where grasshoppers were dense during the previous year.

Blister beetle damage on hosta foliage. Photo: Missouri Botanical Garden

IRIS BORER

Not all insect pests limit themselves to chewing leaves and stems. Some, like the larval form of the iris borer moth (*Macronoctua onusta*), do their dirty work underground and out of sight. Using its **chewing** mouthparts, the caterpillar tunnels down into the underground iris rhizome and consumes it undetected. Unfortunately, iris borer damage can set the stage for bacterial soft rot, which typically spoils the rhizome and often spreads to other nearby iris rhizomes. By the time borer damage becomes noticeable, it is generally too late to save the affected portion of the plant.

Signs of Iris borer damage:

- Tan or water-soaked streaks in young iris leaves in late spring or early summer.
- Brown tips on iris leaves.
- Small holes or notches in the iris leaf, which are the points of entry for the borer.
- Partially or completely eaten rhizomes.
- A foul-smelling odor from bacterial soft rot, which causes the leaves to yellow and collapse.

Iris Borer Management Controls:

- Remove weeds, as a preventative action.
- Cut affected iris foliage off at the base.
- Remove plant stalks at the base in fall to prevent overwintering eggs or pupae.
- Burn or place affected foliage in trash. Do not add to compost pile.
- For suspected borer damage to rhizomes, dig them up in July and inspect for borer damage. If damage is minor, cut out the affected parts, soak roots in a 10% bleach to water solution, and replant in a different location. If damage is significant, destroy the rhizomes.

Bacterial soft spot in iris rhizome as result of damage done by tunneling iris borer. Photo: Missouri Botanical Garden

EUROPEAN EARWIG

The European earwig (*Forficula auricularia*) is a **chewing** insect that is both a pest AND a beneficial insect. It is a pest because both adults and nymphs significantly damage the foliage and flowers of a wide variety of plants. It is beneficial because it preys on other insects such as aphids, armyworms, maggots, mites, slugs, and snails. It also eats dead or decaying flower and vegetable plant matter. It is easily identified by the fierce looking large pincers on the hind end. Earwigs are nocturnal and feed on a variety of plants including dahlia, chrysanthemum, clematis, and zinnia plus a variety of fruits and vegetables. During the day, these insects hide in dark, cool places. Their populations can explode during periods of wet, warm weather.

Signs of earwig damage:

- Numerous large, ragged holes in leaves.
- Chewed flowers.
- Chewed leaf margins.

Earwig Management Controls:

- Encourage natural predators such as toads, birds and predator insects such as assassin bugs, praying mantis, and tachinid flies.
- Remove debris from the garden that might harbor earwigs.
- Trap them in shallow containers of vegetable oil.
- Roll several layers of newspaper into a loose tube. The earwigs will crawl into the tube and can then be easily shaken out into a container of soapy water.

Male earwig insect. Photo: Pixabay, Franco Patrizia

AGROMYZID LEAFMINER

In its larval form, the Agromyzid Leafminer fly differs from other **chewing** insects by feeding **within leaves**. In spring, the flies lay their eggs on the underside of leaves. After the maggots hatch, they burrow between the upper and lower surfaces of the leaves to feed on ornamental plant species such as columbine, chrysanthemum, butterfly weed, daylily, mist flower, and verbena. The tunnels increase in size as the maggot grows, significantly affecting the appearance of the plant. This is not a serious pest. Their damage is more cosmetic in nature than harmful to the plant.

Signs of leafminer damage:

- Unsightly long-winding light-colored tunnels in leaves.
- Blotches in leaves where tunnels have coalesced.

Management controls for leafminer insects:

- Encourage predator insects such as parasitic wasps.
- Either ignore minor damage or simply snip off and destroy any infested leaves.
- Clean up and destroy debris from infested plants in fall.

Leafminer damage on Golden Ragwort (Packera aurea) foliage. Photo: Pat Chadwick

PIERCING/SUCKING INSECTS

Insects belonging to this group are known as **true bugs**. They are members of the **Hemiptera** order of insects, which comprises roughly 80,000 species including aphids, assassin bugs, cicadas, leaf hoppers,

planthoppers, and shield bugs. A true bug has a rigid beak (also called a proboscis) that is designed to pierce and suck fluids from plant cells. Some insects such as bees or butterflies, which belong to the **Hymenoptera** family of insects, also have a beak-like proboscis. However, their proboscis is retractable whereas a true bug's proboscis is non-retractable.

Here are some clues that indicate a pest may be a piercing/sucking insect:

1. Affected leaves or stems are yellowed (chlorotic), twisted, or curled.
2. Leaves have tiny white or yellow speckles (stippling effect).
3. Leaves have large, darkened spots.
4. Leaves are covered with black sooty mold growing on honeydew deposits.
5. Stunted growth on plants.
6. Abnormally developed new leaves.

Four examples of piercing/sucking insect pests include four-lined plant bug, milkweed bug, phlox bug and spittle bug.

FOUR-LINED PLANT BUG

The **piercing/sucking** four-lined plant bug (*Poecilocapsus lineatus*) pierces plant cells in a destructive manner called "lacerate-flush." After it sucks out the juices from the cells, it flushes the damaged area with digestive enzymes, which result in localized areas of dead cells. The bright red and black nymphs hatch out around midspring and mature into their adult form around July. The adult is greenish-yellow with four black lines that extend the length of the wing covers. They are shy and difficult to spot but their damage gives away their presence. This insect feeds on over 250 herbaceous plants including chrysanthemum, lavender, Russian sage, and shasta daisy.

Signs of four-lined plant bug damage:

- Round brown or gray pockmarks on leaves, which become transparent as the plant cells die.
- Small round holes on leaves where the plant cells have died.
- Distortion of developing leaves, buds, and flowers, which may be mistaken for a plant disease.
- Bud drop.
- Feeding damage generally concentrated on the upper parts of the plant.

Four-Lined Plant Bug Management Control:

- Encourage natural predators such as assassin bugs, damsel bugs, praying mantis, or spiders.
- Handpick nymphs and adults and either squish them or drop them into soapy water.
- In midsummer, after the insects disappear, cut back the damaged plant to a point below the damage to remove any eggs laid inside stems.
- In fall, clean up and destroy all stems and leaf litter from the damaged plant.

Four-lined Plant bug on oregano leaf. Photo: Missouri Botanical Garden

MILKWEED BUG

In addition to aphids, milkweed species (*Asclepias)* are also affected by milkweed bugs (*Oncopeltus fasciatus*). The nymphs and adults of this **piercing/sucking** insect species can be found feeding on milkweed leaves, stems, and seeds in mid to late summer. They usually appear in summer after milkweed seed pods form. Their bodies contain toxic compounds from the sap they suck, which means birds and predators don't typically bother them. Also, their colorful markings warn predators to stay away.

Signs of Milkweed bug damage:

- Deformed seed pods but little damage to plants otherwise.
- If the infestation is particularly heavy, **they may crowd out Monarch butterfly populations**.

Milkweed Bug Management Control:

- If infestation is minor, no management controls are necessary.
- Hand pick and drop them into a container of soapy water.
- Dislodge with a strong spray of water from a hose.
- Remove leaf litter and spent stalks in fall to eliminate overwintering sites.

Milkweed bugs in several stages of development. Photo: Missouri Botanical Garden

PHLOX BUG

The colorful black and reddish-orange phlox bug (*Lopidea davisi*) is a **piercing/sucking** insect that can inflict significant damage to both cultivated and wild phlox species. It feeds on leaves, stems, flowers and seeds but may be hard to detect because it hides out on the underside of leaves.

Signs of Phlox bug damage:

- Bleached looking white or light green stippled spots on leaves.
- Leaves turn brown, curl up, die and fall off.
- Plant may appear stunted and die.

Phlox Bug Management Control:

- Cut back infested phlox stems and leaves and destroy.
- Remove stem and leaf litter from flower beds in fall to eliminate overwintering phlox bug eggs.

Extensive damage to phlox foliage due to phlox bug.
Photo: Missouri Botanical Garden

SPITTLEBUG

Both adults and nymphs of this aptly named **piercing/sucking** species (*Philaenus spumarius*) feed on a wide variety of herbaceous and woody plants as well as edible crops. The adults are small, hopping insects that resemble leafhoppers. The nymphs create white, sticky, frothy masses, which hide them from predators such as birds, protect them from extremes in temperature, and prevent dehydration in a low humidity environment. The masses appear on the stems of plants where the nymph pierces the stem and sucks the plant juices. They are often seen on ornamental plants such as roses, shasta daisies, goldenrod, lavender, and grasses. Fortunately, spittlebugs don't typically do much damage to annuals and perennials, but they can be a problem on woody plants and their feeding can affect yields on food crops. As an aside, the spittle comes not from the bug's mouth but from the other end.

Signs of Spittlebug Damage:

- Unsightly "spittle" masses on plants.
- Leaf spotting and sometimes death of grass blades caused by spittlebug saliva.
- In an extreme infestation, spittlebug feeding can stunt or weaken plants.

Spittlebug Management Control:

- Direct a strong spray of water to dislodge the nymphs and their frothy masses.
- Control weeds in and around gardens to eliminate them as a food source for spittlebugs.
- If evidence of spittlebugs is minor, then no action is needed.

Spittlebug larva camouflaged in spittle on lavender stem. Photo: Missouri Botanical Garden

INSECT-LIKE PESTS THAT DESERVE MENTION

A few insect-like species are included here because the damage they do is consistent with that of many insect pests. Equipped with either chewing or piercing/sucking mouthparts, the damage they inflict can be significant.

SLUGS AND SNAILS

These nocturnal creatures are not insects. They are members of the mollusk family and have more in common with clams and mussels. They can inflict significant damage on ornamental plants with their **chewing** mouthparts. They need moist conditions to stay alive, so they stay hidden in dark, damp sites during the heat of the day and emerge after dark to feed. Because they are nocturnal, their slimy trails are often the only indication of their presence besides the obvious damage they do. Best known for their damage to hostas, they are attracted to many other mature perennials and annuals but avoid plants with highly fragrant or fuzzy leaves, such as salvias, lavender, lamb's ear, and most herbs.

Signs of slug and snail damage:

- Small, tender leaves are consumed whole.
- Edges of leaves chewed.
- Irregular damaged areas on foliage.
- Slime trails, which indicate where they have been active.

Slug and Snail Management Controls:

- Encourage natural predators such as birds, frogs, toads, turtles, garter snakes, salamanders, and predacious beetles and their larvae.
- Modify or eliminate the dark, moist conditions by removing decaying plant matter, eliminating weeds, and trimming grass around landscaped areas.
- Handpick (using gloves) and drop into a container of soapy water. The best time to look for slugs and snails is by flashlight about two hours after sunset.
- Trap by placing an overturned flowerpot, board, brick, piece of cardboard, or inverted grapefruit

half in the garden. It will provide the dark, moist retreat that slugs and snails prefer for daytime shelter. Then lift the shelter, hand pick the slugs or snails and drop them into soapy water.

Extensive slug damage on a woodland plant. Photo: Missouri Botanical Garden

SPIDER MITES

Related to spiders and ticks, adult spider mites have eight legs rather than six. The twospotted spider mite (*Tetranychus urticae*) is perhaps the best known of the mite species and is the most common mite pest of houseplants. Because they are so small, they are often difficult to spot, but they make their presence known through the damage they do to plants with their **piercing/sucking** mouth parts. The damage is most noticeable during hot, dry weather when plants are stressed. In addition to houseplants, spider mites feed on a wide range of other ornamental plant species including salvia, daylily, marigold, phlox, pansies, and verbena.

Signs of Spider Mite Damage:

- Mottled foliage or fine stippling at feeding sites caused by the loss of fluids.
- Lighter green or yellowed foliage.
- Fine silk webbing, particularly at the site where leaves attach to plant stems.
- A generalized bronzing or reddish discoloration of foliage caused by heavy infestations.
- Premature leaf drop on heavily infested plants.
- Reduced plant vigor.

Spider Mite Management Controls:

- Encourage predator insects such as big-eyed bugs, damsel bugs, lacewings, ladybugs, and minute pirate bugs.
- Dislodge mites from plants with a sharp spray of water.
- Keep plants watered during hot, dry weather.
- Mulch around susceptible plants to reduce loss of moisture in the soil.
- Raise humidity levels around susceptible houseplants.

Spider mite stippling damage on boxwood leaves.
Photo: Missouri Botanical Garden

IN CONCLUSION

While most insects in the flower garden are beneficial, a few species can cause significant damage to plants. Recognizing the signs of chewing versus piercing/sucking insects is important to determining the best course of action to take. If damage is minor or merely cosmetic, a "live and let live" approach may be the wisest choice. A diverse garden filled with pollinator-friendly plants will attract natural predator species that can help keep pest infestations under control for you. Otherwise, use non-toxic control methods to the extent possible to manage pests while protecting beneficial insect species. For further reading on additional insect pests such as Japanese beetles and aphids and their controls, see Eleven Common Garden Pests — Identification and Management, which appeared in the June 2022 issue of *The Garden Shed*.

Feature photo of chewing insect damage to Japanese Anemone foliage. Photo: Pat Chadwick

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Flower Garden Pests, Purdue University Extension Publication E-70-W

Flower Insects, University of Maryland Extension

Four-Lined Plant Bug, North Carolina State Extension Fact Sheet

Iris Borer, VCE Publication

Leafminers, VCE Publication

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Phlox Bugs, Missouri Botanical Garden

Problems Common to Many Perennials and Annuals, Missouri Botanical Garden

Slugs and Snails on Flowers, University of Maryland Extension

Spider Mites, VCE Publication

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The Edible Garden in March

By Ralph Morini | March 2023-Vol. 9, No.3

March is the beginning of our outdoor gardening season. If you started cool weather crops indoors in February, you can begin transplanting into the outdoor garden in the middle of March. Alternatively, garden centers will begin selling transplants of cabbage family crops and lettuces to be planted on the same schedule. Lots of plants can be direct seeded into the ground as well.

Fruit growers should aim to get pruning done early in the month before serious new growth starts. It is also time to fertilize and plant bramble fruits and blueberries.

Let's review some tips for getting things going.

Manage Your Soil for Best Growing Results

Soil test steps. Photo: VCE

If you haven't had a **soil test** for three years or more, consider a new test. They are a valuable tool for maintaining optimum soil fertility and pH levels. Soil sampling kits and instructions are available at your local Virginia Cooperative Extension office. In Charlottesville/Albemarle, test kits are available at the Albemarle County Office Building off 5th Street Extended. Kits are located at both the Stagecoach Road and Fifth Street entrances, in marked plastic bins. Be sure to take boxes and the appropriate instruction sheet for home gardeners versus commercial growers. Samples should be mailed with payment directly to the Virginia Tech lab and results will be issued directly to the sender. Call the Extension office at 434-872-4580 with questions. For additional information on soil testing, check out VCE publication 452-129: Soil Sampling for the Home Garden.

Compost delivery. Photo: R Morini

Regardless of your soil's condition, adding organic matter to your soil will improve it, and fully-decomposed compost is a great way to do it. It improves soil structure and water infiltration, while absorbing and holding moisture longer, a real benefit during our hot, dry summers. Compost can be purchased but can also be made at home using yard and organic kitchen wastes. Instructions for home composting can be found in the VCE publication Backyard Composting. If you start a compost batch now, it should be ready for fall planting.

If you have a heavy clay soil in your garden and you aren't sure how to best manage it, take a look at the Garden Shed article Gardening in Clay. Surprise: the secret is adding decomposed organic matter!

When adding compost to beds, spread a couple of inches on the surface. For new beds to be planted this spring, it can be tilled in. For established beds, we recommend scratching it into the soil surface and letting soil organisms carry it deeper.

A broadfork at work, from the video, "The broadfork – Jean-Martin Fortier – The Market Gardener's Toolkit,"

Rather than tilling to loosen soil, insert a broadfork or digging fork as deeply into the bed as possible and rock it back and forth to aerate the soil without destroying the soil structure. Work your way across the beds, advancing several inches with each fork insertion. It is also an effective way to integrate compost below the soil surface without upsetting soil structure.

Weed Management

Occultation. Photo: R Morini

Best practices for preparing soil for planting now emphasize minimum tilling. Tilling breaks up soil structure and the aeration increases carbon dioxide emissions. Pulverizing soil aggregates leads to increased compaction over the course of the growing season. The biggest issue no-till raises is probably how to manage weeds. Hopefully, most home gardeners are not using glyphosate products to kill garden weeds. Old time mechanical methods of weed hoeing and pulling are great but a lot of work. An organic practice that works is called **occultation**. It involves covering beds for 4 weeks or longer with a black tarp or plastic sheet, secured around its edges. This denies light, smothering weeds and speeding decomposition of trimmed cover crop remains. Growers report season-long weed stifling benefits. When the tarp is removed, residue can be left as mulch or composted. The post Black Covers Can Put Weeds to Bed . . . for Good from the Maryland Extension provides explanation and guidance.

Cover Crop Removal

If you have a cover crop growing, the best time to remove it is after plants flower but before they go to seed. Use a string trimmer to cut it as close to the ground as possible. [Leave the residue for a couple of weeks.] While residue and plant crowns can be removed and composted, a more common practice, when practical, is to leave the residue on the ground to act as a mulch and organic matter addition. Aerate the soil with a broadfork to reduce compaction and smooth the bed with a rake if needed for seed bed preparation.

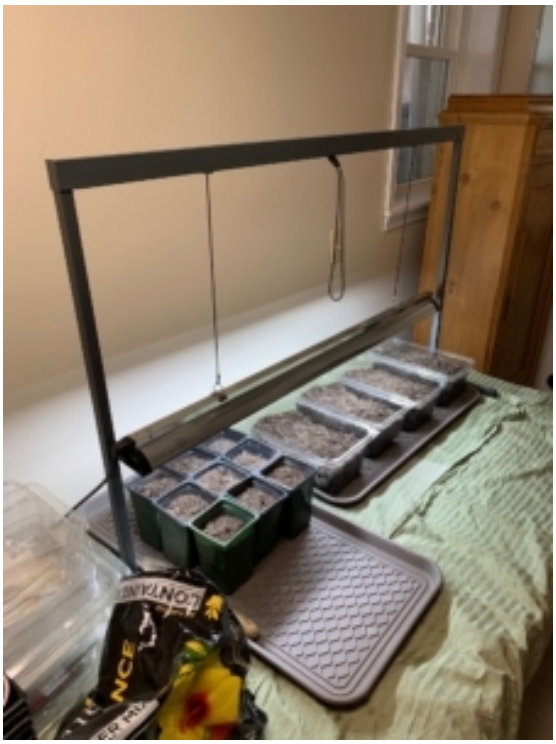
It's Time to Plant

According to *Virginia's Home Garden Vegetable Planting Guide* from the VA Cooperative Extension, March is the time for outdoor seeding of cool weather vegetables, including beets, carrots, kale, collards, mustard greens, lettuces, peas, radishes, spinach, and turnips. Home-started or purchased transplants that can be planted in the garden this month include broccoli, cabbage, cauliflower, leeks, onion sets, and new asparagus plantings.

Soil thermometer. Photo: R Morini

Soil temperature is an important factor in successful outdoor seed germination. Soil thermometers are readily available at prices starting at about $15. Consider stem length if you purchase one. For soil, home gardeners only need a short stem; even 4 inches will suffice for seed germination. However, if you get one with a stem of 12 inches or more it can be useful to monitor compost temperature, where batches are typically 3 or 4 feet deep and the thermometer needs to probe deeply to get a good reading.

Cool weather crops like spinach and lettuce will germinate at temperatures in the 45-50° range, tomatoes need 60-65° soil, and squash and melons need about 70°. A complete guide is available in the Oregon State Extension publication Soil Temperature Conditions for Vegetable Seed Germination.



If you started seeds indoors in February and are moving them to the garden in March, remember to harden them off by putting them outside for progressively longer periods over one to two weeks once temperatures are above 50°F.

As you move early transplants outside, replace them with warm weather crops that should be transplanted after our last frost. For example, tomato seeds planted indoors in mid-March should be ready to transplant outside in about 6 weeks, around May 1. This matches up with our average last frost in Zone 7a of April 15-25. But remember that we had a frost in 2020 on May 9, so pay attention to current weather forecasts.

You can find lots of good advice for seed starting and transplanting in the VCE publication Plant Propagation from Seed and *The Garden Shed* article How to Start Your Garden Seeds.

Fruit Growing

If you are a fruit grower, fertilize fruit trees 3-4 weeks before active growth begins. Scatter fertilizer evenly under the tree, starting about 2 feet from the trunk and extending just beyond the drip line or end of the furthest branches. A soil test should be performed prior to applying fertilizer. For additional information on fruit trees, visit VCE Publication 426-841, "Tree Fruit in the Home Garden."

Fruit trees are pruned before growth starts in late winter or early spring to remove dead and

diseased branches, remove vertical shoots, open the structure for light penetration, and to shape the tree. Further pruning can be done in summer to "dwarf" a tree, if desirable. Pruning allows the tree to direct nutrients to branches that will bear high quality fruit. The article Pruning Fruit Trees from the University of Nebraska Extension is a helpful resource. For more detail on the effects of pruning try VCE Publication 422-025, "Physiology of Pruning Fruit Trees."

Bramble fruits such as raspberries and blackberries may be planted in mid-to-late March. Plant in moist, well-drained soil containing large amounts of humus or organic matter. For weed control, mulch around newly planted brambles with an organic mulch. For additional information on how to grow bramble fruit, review VCE Publication "Small Fruit in the Home Garden".

Now is the time to plant **blueberry** bushes. Different varieties of blueberries have different requirements for "chilling hours" — i.e., the number of days with temperatures between 35° and 45°F. They also require very acidic soil for best growth. It makes sense to make careful choices when acquiring plants. *The Garden Shed* article Blueberry Cultivation in the Home Garden explains further.

If you have established blueberry plantings, the publication Pruning Blueberries from the Maryland Extension offers excellent pruning advice.

I hope this information provides guidance and motivation to help you get things going. It's great to be out in the garden again. See you next month.

Resources:

Featured Photo: Richmond Farm School, CC BY-NC-ND 2.0.

Virginia's Home Garden Vegetable Planting Guide and Recommended Planting Dates," Va. Coop. Ext. Publication 426-331, http://pubs.ext.vt.edu/426/426-331/426-331.html

"Tree Fruit in the Home Garden," VA Coop. Ext, Publication 426-841, https://www.pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/426/426-841/426-841_pdf.pdf

Soil Temperature for Vegetable Seed Germination, Oregon State Extension, Soil Temperature Conditions for Vegetable Seed Germination | OSU Extension Service (oregonstate.edu)

The Ornamental Garden in March

By Cathy Caldwell | March 2023-Vol. 9, No.3

March marks the beginning of spring, but it can be a fickle month! The weather can be mild and pleasant one day and then cold and blustery the next. Until the weather becomes consistently milder, be patient and use this time to organize your thoughts on what you want to accomplish in your ornamental garden this spring. Start by checking the **Monthly Gardening Tips** section now located under Gardening Resources on the main page of the PMG website: pmgarchives.com/Gardening Resources/Monthly Gardening Tips/#March. You just might find other useful information in the Gardening Resources section, too.

The soil in March is generally too cold and wet to work in. Just walking on soggy soil compresses the soil aggregates and particles. The resulting compaction affects drainage and rain infiltration and prevents plant roots from penetrating very deeply. Soil compaction also reduces the amount of open pore spaces, which makes it difficult for plant roots to absorb oxygen and water.

Here's how to tell whether your soil is dry enough to work in: Dig up a small amount of soil and squeeze it in your hand. If the soil stays in a solid muddy ball and does not fall apart, it's too wet to work in. If the soil crumbles through your fingers when you squeeze it, then it's ready to be worked.

Once the soil in ornamental garden beds is dry enough to walk on, remove any weeds that have overwintered in your flower beds. It's important to tackle weeds early and stay on top of this task throughout the growing season. For help with identifying weeds, check out Virginia Tech's Weed ID website or the University of Missouri Weed ID Guide.

Don't be too eager to cut back last year's perennial foliage and stems. If possible, hold off on this task until daytime temperatures are consistently above 50°F for at least seven consecutive days. Many beneficial insect species such as small native bees, syrphid flies, and lacewings overwinter in the debris and are merely waiting for warmer weather conditions before emerging. By waiting for the right conditions, you give these insects the chance to emerge safely.

Redefine flower bed edges as needed to give them a neat, crisp appearance. A flat-edged spade is very useful for this task.

Photo: Cathy Caldwell

Direct sow seeds for hardy annuals such as larkspur, sweet peas, and love-in-a-mist. These annual species germinate best when soil temperatures are between 55°F and 65°F, which means they can be planted weeks before the last frost date in spring. On the other hand, **tender annuals** such as begonia, cosmos, zinnia, and vinca can't handle cooler soil and air temperatures and should be planted after the last frost date in spring. As a reminder, the last frost date for the Charlottesville/Albemarle County area of Virginia is around April 15 to April 25 on average. To learn more about hardy annuals, see the University of Missouri Extension's publication on Flowering Annuals.

Assess your emerging perennials to identify any that need to be divided. Guidelines vary on how often to divide perennials but, on average, many of them benefit from being divided about every three to five years. As a general rule, divide spring and early summer-flowering plants in the late summer or fall and fall-blooming plants in the spring**.** And here's another tip: Hostas may be divided just as they emerge in early spring to minimize damage to the leaves. For more insight into how and when to divide perennials, see *Garden Shed* article on Guidelines for Dividing Perennials.

Now is a good time to have the soil tested in your ornamental garden beds to determine the pH and to analyze fertility levels. If it's been a while since you've had your garden soil tested or if you've never had a soil test done before, check out the Virginia Cooperative Extension's (VCE) website, which is http://www.ext.vt.edu and view Publication No. 452-129, Soil Sampling for the Home Gardener. Don't guess! Follow the soil test recommendations for incorporating any amendments into the soil.

Top dress flower beds with one inch of compost to improve the soil structure, add nutrients, and enhance the soil's capacity for holding moisture.

Now is a good time to plant **bare root, dormant roses.** Soak the bare root rose in a bucket of water for at least eight or more hours to rehydrate the roots. Choose a sunny, well-drained location, dig the planting hole wide enough and deep enough to easily accommodate the roots and set the plant so that the graft union is at soil level. Space roses far enough apart to allow good air circulation.

Prune established rose bushes now to improve their health and structure. Make sure your pruners are sharp and clean. Prune canes to an outward-pointing bud and make each cut at a 45° angle just slightly above the bud. Remove any weak or unattractive canes. Cut any damaged wood back about one inch into

healthy wood. Cut any dead canes down to the ground level. If any branches rub together, choose the healthier of the two and remove the other one. If you are pruning a grafted rose, check for suckers below the graft union and remove them. Proper pruning facilitates better air circulation, also allows more sun into the middle of the plant, and results in a healthier, more attractive plant.

Prune subshrubs to shape them or remove dead terminal growth. By definition, a subshrub is a dwarf or low growing shrub or perennial plant that has woody stems at the base but new soft, green terminal growth that typically dies back each year. Some examples of subshrubs include the following:

- Blue Mist Shrub (*Caryopteris*) – Cut back top growth by about a third to neaten the shrub and encourage new growth. To rejuvenate the shrub, cut it back to about 6 inches from the ground.
- Heather (*Calluna vulgaris*) – Prune flower stems back to the base of old flowers. Snip the green part only. Don't cut down to the brown woody portion.
- Lavender (*Lavendula*) – Although Lavender is a subshrub, **it should not be cut back until after it blooms**, at which time, remove only the green part. Do not cut into the brown woody part.
- Lavender cotton (*Santolina chamaecyparissus*) – Cut back to within 6 inches of the crown every 2 to 3 years to keep it vigorous.
- Russian Sage (*Perovskia atriplicifolia*) – Leave the foliage standing over winter to provide interest and help protect the crown. Cut the old foliage back in spring to within 6 inches of the crown.

If deer are a nuisance in your garden, apply repellents or other deterrents as soon as the plant foliage emerges from the soil. The idea is to condition the deer to view your emerging plantings as unpalatable. Generally, no one deterrent, short of a physical barrier, is enough to stop a hungry deer. For lots of good information on how to address the problem of deer in the landscape, see *The Garden Shed's* article Deer, Deer, Deer!, which appeared in the May, 2021 issue. In addition, see VCE Publication HORT-62NP, Deer: A Garden Pest, and VCE Publication 456-018, Pest Management Guide: Home Grounds and Animals (scroll down to "Other Animals" in the menu) for more good information on how to deal with deer problems.

If you plan to **grow annuals or perennials from seed**, check seed packets for guidance on the merits of direct sowing in the garden versus starting seeds indoors. Tip: If you decide to start your seeds indoors, sow them in a fine, soil-less growing medium. Place under cool-white fluorescent lights about 14 to 16 hours per day and position the lights about two inches from the top of the seedlings. Maintain day-time temperatures at 70° to 75° F. and 65° F. at night. Keep the growing medium moist but not wet.

Clean leaves and other debris out of aquatic gardens to help reduce algae growth when temperatures warm up. Tip: If amphibians live in your pond, be careful not to disturb them. If they have already laid their eggs, be very gentle as you work around the eggs to avoid harming them.

Sources vary on **when to fertilize spring-flowering bulbs**, but, as a general rule of thumb, they may be fertilized with a **low-nitrogen fertilizer** or a fertilizer made especially for bulbs as soon as the shoots start to appear in spring. For daffodils, the American Daffodil Society recommends reapplying fertilizer at bloom time as well. Other sources recommend fertilizing daffodils after the bulbs have finished blooming. Regardless of when you fertilize, if you are using a granular fertilizer, avoid getting any on the foliage and be sure to water it in or apply it just before a rain.

Cut back ornamental grasses early in the month before they start to display new spring growth. If you wait too long, you risk cutting the new foliage.

Prune tree and shrub twigs that were affected by winter kill. Cut back to green wood. To determine if

the twig is alive or dead, scratch the bark with your fingernail.

Feed houseplants with a diluted (half-strength) solution of soluble houseplant food this month. This is when houseplants start actively growing.

Once the soil is dry enough, **inspect your lawn for any problems that need to be addressed**. For example, does the soil need to be aerated and de-thatched? Are there drainage issues that need to be addressed to eliminate standing water? Does the lawn have bare spots that need to be seeded?

If you haven't had a soil test done for your lawn recently, have one done to find out what nutrients, if any, may be needed. See VCE Publication 452-129, Soil Sampling for the Home Gardener. Note: if the lawn needs fertilizer, it's generally **best to apply it in the fall** rather than in the spring. For more information on lawn fertilization, see VCE Publication 430-011, Lawn Fertilization in Virginia.

Invasive watch: Look for garlic mustard (*Alliaria petiolata*) in your landscape and eliminate it in spring when the ground is moist and the plant is easy to pull up. This **invasive plant** has displaced native wildflowers such as spring beauty, wild ginger, bloodroot, trillium, and toothworts in many forested areas. Although it is easiest to recognize after it produces white flowers in early April, its foliage is also distinctive, and all parts of the plant emit a strong garlic odor. It is essential to remove garlic mustard before it sets seed. For more information on identification and treatment, see the Blue Ridge PRISM (Partnership for Regional Invasive Species Management) Factsheet/Garlic Mustard.

Take photos of your daffodils, hyacinths and other spring bulbs as they emerge in spring to help you remember where they are planted. Once the foliage dies back in late spring, it's all too easy to forget where the bulbs are located. Your photos will save you much frustration and heartbreak later when you are digging holes for new plants.

Featured Photo: Pat Chadwick

Garlic mustard
Photo: Cathy Caldwell

Upcoming Events

By Cathy Caldwell | March 2023-Vol. 9, No.3

Thursday, March 2 @ 7:00 pm – 8:15 pm

Spring Lecture Series—Michael Carter Jr., "Africulture and Unique Organic Vegetables You'll Want in Your Home Garden"

Zoom session

In this online presentation, Michael Carter Jr. will highlight the many contributions the African continent and people of African descent have made to farming and food traditions in the United States. He will also introduce some of the unique plants he grows organically at his family's farm in Orange County.

Get Tickets $10.00

Tuesday, March 7, 7:00 to 9:00 p.m

Charlottesville Area Tree Stewards

Tree Basics Classes on Zoom: *Select, Plant, and Care for Trees*

Register here

Perfect timing before the April 15th tree sale to learn how to plant a tree on your property that will have the best chance to survive and flourish in the place that you choose for it.

Tim Maywalt, a member of the Charlottesville Area Tree Stewards, will discuss best practices for planting and show you how to care for your newly planted tree and your other landscape trees for the long term.

Thursday, March 9 @ 7:00 pm – 8:15 pm

Spring Lecture Series—Bob Schamerhorn, "Attracting Birds and Other Wildlife to Your Garden with Easy-to-Create Water Features"

Zoom session

Bob Schamerhorn's online multimedia presentation will demonstrate water's powerful attraction to birds and other wildlife in every season and will suggest ways to enhance our enjoyment of nature by bringing water into our backyards. Based in Richmond, Schamerhorn is an is an award-winning nature photographer and a lifelong bird and nature enthusiast. Get Tickets $10.00

Thursday, March 16 @ 7:00 pm – 8:15 pm

Spring Lecture Series—Kim Eierman, "Designing a Pollinator Victory Garden for a Changing Climate"

Zoom session

Kim Eierman, an ecological landscape designer specializing in native plants, will cover the dramatic decline of pollinators due to factors that include climate change and will offer simple strategies gardeners can use to support bees and an array of other pollinator species. Based in Westchester County, New York, Eierman is author of *The Pollinator Victory Garden: Win the War on Pollinator Decline with Ecological Gardening*. Get Tickets $10.00

Tuesday, March 21 @ 7:00 to 9:00 pm.

Identify and Control Non-Native Invasive Plants in Spring/Summer – Part 1 (Zoom)

Register here.

Thursday, March 23 @ 7:00 to 9:00 pm.

Identify and Control Non-Native Invasive Plants in Spring/Summer – Part 2 (Zoom)

Join Tree Steward Tim Maywalt for this informative two-part class by Zoom. This class is focused on which invasives are best tackled in spring/summer (and the best time to treat if not spring/summer). Tim will cover manual and mechanical control methods; best practices for herbicide use including equipment, forest safety, personal protective equipment; reference documents for detailed ID; sources for equipment, supplies and help – from State Foresters, Conservationists and commercial vendors; and restoration guidance for your green spaces after invasive plant removal. **Register here.**

Saturday, March 25 @ 2:00 pm – 3:00 pm

Virginia Festival of the Book: Poet, Essayist and Gardener Ross Gay

Jefferson School African American Heritage Center, 233 4th Street NW, Charlottesville, VA

The Piedmont Master Gardeners are co-sponsoring an appearance by poet, essayist and passionate gardener Ross Gay at this year's Virginia Festival of the Book. The Same Page Community Read event is scheduled for 2 p.m. Saturday, March 25, at the Jefferson School. His essay collection *The Book of Delights* (a *New York Times* best-seller) was chosen for the Same Page Community Read program. As critics observe, this award-winning writer "celebrates the beauty of the natural world–his garden, the flowers peeking out of the sidewalk, the hypnotic movements of a praying mantis."

Saturday, March 25 @ 2:00 pm – 4:00 pm

Garden Basics: Spring Cleanup in the Perennial Garden

Sentara Martha Jefferson Hospital Demonstration Garden, 595 Martha Jefferson Drive, Charlottesville, VA

Waiting until spring to clean up your perennial garden allows plants to overwinter for structural interest, protection for insects, and food sources for birds. Join us for an outdoor Garden Basics class at PMG's demonstration garden at Sentara Martha Jefferson… FREE. RSVP Now

Thursday, March 30 @ 7:00 pm – 8:15 pm

Spring Lecture Series—Elisa Meara and Alex Thompson, "Attractive, Functional, Sustainable Solutions to Managing Stormwater Runoff in the Home Yard and Garden"

Zoom session

In this online presentation, landscape designers Elisa Meara and Alex Thompson will show how smart planting and attractive rain gardens can reduce stormwater runoff and filter pollutants that threaten rivers

and streams feeding the Chesapeake Bay. A graduate of London’s Inchbald School of Design, Meara hails from the Dominican Republic and is owner of the Native Plant Landscape Design Corp. in Falls Church. Thompson is a principal designer for the firm. She grew up in the English countryside and holds a master’s degree in landscape design from The George Washington University.

Get Tickets $10.00

Tree Diseases

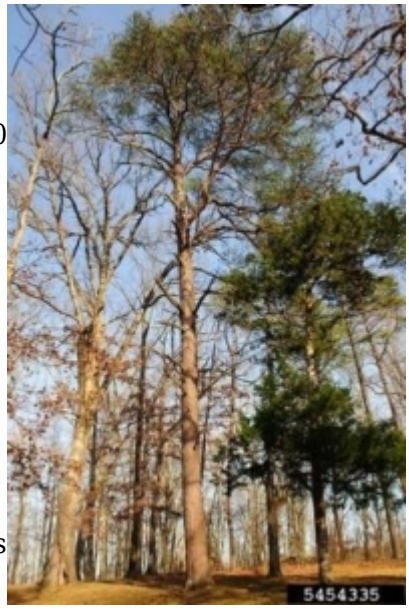
By Charles D'Aniello | March 2023-Vol. 9, No.3

Can a Tree Live Forever?

Trees are by nature healthy and resilient. They can "potentially" live a long time. A 2021 *Scientific American* piece by Robin Lloyd declares "Trees Have the Potential to Live Indefinitely." It summarizes the findings of an article entitled "On Tree Longevity" by Gianluca Piovesan and Franco Biondi in the August 2020 *New Phytologist*. Lloyd quotes Biondi, "Trees can indeed live indefinitely, but this does not happen." Eventually a living (biotic) or non-living (abiotic) thing ultimately kills them. Sad for the planet, since an older tree stores more carbon than a younger tree. Piovesan and Biondi observe that there is "no genetic evidence of aging in extremely old trees' meristem." The meristem is tissue whose cells divide, thus generating new cells and, therefore, growth. Apical meristems are located at the tips of branches and roots and in buds. The vascular cambium is a meristem and produces the diameter growth of the trunk, branches, and roots.

Slash pine (Pinus elliottii) estimated to be about 50 years old and about 80 feet tall. Photo: David Stephens,

One study of the lifespan of street trees indicates that the ideal life span of a white oak is 600 years, and that the average life of a red maple in Illinois forests is 75 to 150 years. It suggests that trees planted in groupings in the landscape may survive 50 years longer than those planted in a pit beside a sidewalk. In fact, the United States Department of Agriculture study found that the average urban tree lives between 19 and 28 years. For a documented list of very old trees see the *Wikipedia* article "List of oldest trees" and the Virginia Big Tree Program's *Lifespans of Common Trees in Virginia*. Clearly, trees do not live forever and different trees have different lifespans.



Virginia pine (Pinus virginiana) is the

Bugwood.org, CC BY-NC 3.0 US.

The focus of this article is disease, but below we will also explore factors that can compromise any tree's longevity potential. Often alone, without companions, and not always in a setting they would naturally choose, it is important to appreciate that sometimes our plantings compel trees to live a life for which they did not evolve.

tallest tree in the image's center. Photo: Vern Wilkins, Indiana University, Bugwood.org, CC BY NC 3.0 US.

History Shows Us Just How Stressful a Tree's Life Can Be

All living things, including trees, contract diseases. Stress in its many forms sets the stage for a tree's decline. Trees become ill because of the intersection of specific vulnerability, environmental factors, and the existence of a pathogen. More on this later. Sometimes all factors come perfectly together to create an arboreal nightmare on a grand scale. Among recent history's most interesting and instructive tree tragedies are the tribulations of *Hevea brasiliensis*, the rubber tree, and *Castanea dentata*, the American chestnut.

Henry Ford wanted to own the production of one of the most critical materials for his vehicles: rubber. He hoped to do some social good as well for Amazon residents. He established two plantations in the Amazon – Fordlândia (1928) and Belterra (1934) — with mass plantings and superb supporting facilities. But once the rubber trees had taken hold they were attacked by a diversity of challenges. In his *Business History Review* article "Rubber in Brazil: Dominance and Collapse, 1876-1945" Randolph R. Resor writes, "Caterpillars and sauba ants, red mires, black crust, yellow scale, lace bugs (a pest unknown in Amazonia before the start of the Ford plantation) and South American leaf blight [the fungus *Microcyclus ulei*] weakened and killed many trees." (p. 364) The dangers of monoculture were apparent: "When trees were scattered through the Amazon rain forest, a pest that would attack one tree would not necessarily attack another. But in close proximity on the Ford plantation, the . . . trees provided an easy target." (p. 364) The disease causes leaves to spot, and as the spots increase in number, leaves wither and fall. Although Ford's effort faced many challenges, the greatest challenge was nature. After substantial investment, the land was sold back symbolically to the Brazilian government in 1945 for only $244,700. Today most rubber is grown in Southeast Asia. If the South American leaf blight (SALB) travels there, there will be an existential natural rubber crisis. Natural rubber remains in demand. Perhaps there are some resistant trees in the Amazon or a resistant variety might be developed.

Until the early 20th century, many of America's forests were dominated by the American chestnut. Chestnuts fed animals and people, the wood was durable, fine grained and easily worked, and its bark was used in the tanning industry. Before the 20th century, perhaps as many as one out of four trees in the eastern United States was a chestnut. Some mature trees were known to reach heights exceeding 100 feet, with diameters of more than 10 feet. As early as 1893 the tree came under attack by the fungus. Limbs, branches, and twigs were killed by sunken or open cankers, which began as reddish brown bark patches. Leaves on affected branches withered and turned brown. The fungus was observed in 1904 and was described and named in a scientific bulletin two years later. The disease spread rapidly across all ranges. By 1911 much had been learned. Today we know the parasitic fungus as *Cryphonectria parasitica*, formerly *Endotria parasitica*, and in 1905 as *Diaporthe parasitica*. Then as now, the fungus emitted both summer and winter spores. Sticky summer spores attached themselves to animals and birds, people, and things and were carried from tree to tree. Diseased lumber

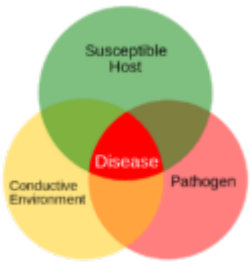
spread the disease. And the wind carried winter spores great distances. Virginia forests were hit hard. To find a home, the spores needed only to find a microscopic break in a tree's bark caused by insects, woodpeckers, or natural occurrences. Richard Powers' novel *The Overstory* describes the chestnut's plight. This remarkable book was awarded the Pulitzer Prize for Fiction in 2019, was shortlisted for the Man Booker Prize, and received the William Dean Howells Medal.

Diffuse canker (the fungus Cryphonectria parasitica) of chestnut blight on chestnut. Photo: George Hudler, Cornell University, Bugwood.org, CC BY-NC 3;0 US.

Pennsylvania was the first state to fight the chestnut blight. In 1911, it was the site of a large conference focused on how to repel the invader. The argument that any action was hopeless — the correct conclusion — was not accepted, and instead, the trees were attacked with saws to prevent spread. It was soon discovered that the blight had entered the United States on Japanese chestnut tree nursery stock. Unfortunately, what was not a tree killer in Asia was a killer in America. Early on, it was observed that Chinese and Japanese varieties survived the blight, and breeding became a reasonable response. The backcrossing of resistant Chinese trees with the American chestnut, rather than the eradication of struggling and ultimately doomed survivors, is now pursued. There are also genetic engineering efforts underway. Once again, nature has proved to be a formidable foe. Fungi, bacteria, and viruses and their vectors are, after all, just doing what comes naturally. To understand this crisis is greater detail, see especially George H. Hepting's *Journal of Forest History* article "Death of the American Chestnut," *Chestnuts and the Introduction of Chestnut Blight*, Forest Pathology's *Chestnut Blight* and *A New Hope*, and the Virginia chapter of The American Chestnut Foundation's Warren Laws' presentation *The American Chestnut: The Tree that Made America.*

High profile challenges remain. Insects alone can wreak devastation and death. Currently, the North American ash is under attack by two wood-boring insects, the emerald ash borer and the Asian longhorned beetle. Dutch elm disease continues with us, the fungus having entered the country during World War I from Europe, but probably originating in Asia. Vectors are the European elm bark beetle and the American elm bark beetle. And climate change is expected to impact forest health in the future. Large and localized change will have an impact, one paper contends: disease outbreaks will become more difficult, host resistance to pathogens may be overcome, and warmer winters may allow pathogens and insects to overwinter more successfully. A warmer/wetter climate will encourage foliar and rust diseases in particular. With climate change, some diseases may travel north and/or to higher elevations.

Why Trees Get Sick



Plant Disease Triangle. Johannes Rossel via Wikimedia Commons, CC BY-SA 3.0.

For a tree to contract a disease, an intersection of factors must come together: the environment must be conducive to disease, there must be a pathogen (disease-causing organism) present, and the species must be susceptible. This is known as the disease triangle. For an insightful and concise discussion of the disease triangle, see Leonard J. Franci's consideration. If one element is missing or removed, a tree will neither contract nor sustain a disease. Of course, there must be a way for the pathogen to infect the tree. The pathogen can be carried by a living organism, a vector, or carried by wind, water, or another means. Insects are the usual vectors (and sometimes pathogens can grow within them), although their role may be simply to make a hole in the tree's defenses, allowing the pathogen entry through other means. Pathogens are bacteria, fungi, viruses, mycoplasmas and spiroplasmas (bacteria), and parasitic plants as well as nematodes.

Bacteria are one-celled microorganisms; they cannot reproduce on their own, but grow by cell division. A cell grows to twice its initial size and then divides in two. Bacteria can be spread by every imaginable means. **Fungi** are microscopic and are neither plants nor animals. They belong to the kingdom Fungi. Mold is a

microscopic fungal growth that spreads on damp or decaying organic matter. Fungi reproduce by spores and gather nutrients from their host plant. They can lay dormant in adversity waiting for the return of favorable conditions. Even smaller than bacteria and fungi, **viruses** are submicroscopic and depend on living organisms for food and reproduction. They replicate only within an organism's cells. Among their modes of spread are fungi, insects, nematodes, seed, and soil. Finally, plant-feeding **nematodes** are microscopic worms and one of the planet's most abundant creatures. Nematodes puncture cell walls to feed and parasitize a tree's roots. **The vast majority of plant diseases — including tree diseases — are fungal.**

The other two sides or factors of the disease triangle are the **host** and the **environment. Hosts** can vary in their susceptibilities. A pathogen that will impact one tree will often have no effect whatsoever on another. For a disease to be contracted, the environment must be conducive to its development. Temperature and moisture extremes as well as nutritional deficiencies can create a conducive **environment**. Air quality can also be an issue as well as air movement. Injuries the tree has sustained can be determinative as well as planting practices, such as monoculture, as in the case of the rubber tree, which is discussed above. Finally, the duration of alignment between pathogen, host, and environment can be critical. Variations in the intensity of the factors represented by the triangle's sides, and duration of alignment, will determine the severity of an infection. Stress caused by biotic and abiotic factors weaken a tree's response to infection.

Recognizing a Sick Tree

Does my tree have a disease? In most instances, you will recognize relatively quickly that something is wrong. A definition of "disease" suggests how easy this should be: "Any harmful deviation from the normal structural or functional state of an organism, generally associated with certain signs and symptoms and differing in nature from physical injury. A diseased organism commonly exhibits signs or symptoms indicative of its abnormal state." (Burrows, William and Dante G. Scarpelli "disease". *Encyclopaedia Britannica*.) In other words, look for the unusual or atypical. Of course, to recognize an abnormality, one must be familiar with a tree's normal appearance.

Branch canker of thousand canker disease (the fungus Geosmithia morbida working with the walnut twig beetle) that developed around twig beetle galleries. Photo: Ned Tisserat, Colorado State University, Bugwood.org, CC BY 3.0 US.

Sick Trees Usually Look Sick

The light green spots are oak leaf blister, and the brown spots indicate the invasion of Monochaelia spp. Photo: Mary Ann Hansen, Virginia Polytechnic Institute and State University, Bugwood.org, CC BY 3.0 US.

Mushrooms growing at the tree's base indicate decay, as does crumbling or soft wood. Fungal infections present as unusual patches on leaves that look powdery, furry, or fuzzy. Fungal infections can also cause wilting: foliage will yellow, plant parts will droop, and defoliation will occur early. Sometimes an infected tree will produce an excessive crop of seeds and have small leaves. Fungal and bacterial diseases present as spots on bark and leaves. Leaf and growing tip damage that appears suddenly is an indication of disease. Branches that are drooping, dead, or dying can be the result of a tree's struggle with a disease. Wilting leaves can be an indicator of disease — not drought related, — if they appear on only a portion of a tree. Fungi can cause root rot, affecting both hardwoods and conifers, presenting as yellow leaves, dead branches, stunted growth, and droop and wilt. Fungi can also result in cankers on both hardwoods and conifers, presenting as deep lesions on woody parts. In advanced stages twigs or branches can be girdled, leaves will drop, wilt, and the portion of the branch farthest from the trunk may die. See Sharon M. Douglas' *Recognizing Tree Diseases and Stress Factors*.

For a cornucopia of ailing tree images, there is no better place to search than the *Bugwood Image Database System*. Here you'll find leaves, trunks, branches, and stems in all stages of despair. *Bugwood* is a grant-funded effort, started in 1994 by the University of Georgia's Center for Invasive Species and Ecosystem Health. One of its components is devoted to forestry. As a whole, the system holds more than 318,161 high quality images and is superbly searchable. Excellent images are also available in *Tree and Forest Health Guide: A Handbook for the Diagnosis of Urban and Rural Forest Disturbances*.

Trees Are Not Defenseless

While your tree may be sick, it likely is fighting back. Its struggle will not always end in success, but it will literally not go down without a fight. Like all living things, trees store and use energy and they have special reserves to deal with illness. A tree's first line of defense is the bark on its trunk and branches and the waxy cuticle on its leaves. Breaching or compromising these is a serious matter. Pathogens can enter through cracks or wounds as well as through the pores on the epidermis of leaves and stems (these pores are known as **stomata,** and are required for photosynthesis).

Trees engage in chemical warfare. Their defensive chemicals have antibiotic qualities; they inhibit the attacker's growth or prevent it entirely by making plant tissue inedible. This is also a response to insect feeding. Plant cells recognize the invader by its molecular pattern and then respond on a cellular level. Chemicals are produced that make the cell environment toxic, and alkalization occurs, creating flavonoids or alkaloids, which are antimicrobial. When the sapwood (the soft outer layers of recently-formed wood containing functional vascular tissue), located between the bark and heartwood (the dense inner part of a tree trunk), is attacked, the tree begins to grow rapidly to close the wound. This process can be characterized as a balancing act or hedging between defense and regeneration. The pathogen may have entered through damage incurred from engagement with something as mundane as wind, pruning (do not cut into the fungicide producing branch collar, cut outside of it), or an insect. These events are evident in structures on the tree's limbs and trunk and are remembered with knots and blemishes in lumber. Once the decayed area is closed, the tree saturates the isolated area from the inside and kills the fungus. This process

is known as “compartmentalization of decay in trees” or CODIT.

Compartmentalization of Decay In Trees (CODIT). USDA Forest Service – Northeast Area, USDA Forest Service, Bugwood.org, CC BY 3.0 US.

At CODIT’s core is the fact that while trees cannot repair cells, they have a prodigious ability to generate new ones. Discussions of the process are plentiful and available in various levels of detail, basic discussions are provided by Paul Hetzler’s *How trees protect themselves from wounds, disease and pests (including us)* and Matt Candeias’ *How Trees Fight Disease*; but a thorough discussion, with excellent graphics, is found in Alex L. Shigo’s “Compartmentalization of Decay in Trees.” As noted, the process begins with the tree walling off the decaying area; the tree then chemically changes the structure of the diseased cells, and new walls of more resistant cells are built around the diseased area. Four chemical walls are constructed: two circular, one radial, and one horizontally flat. Simultaneously, the tree continues to grow, the disease tissue is isolated and starved, and then chemically attacked. Note that the healing cover by itself does not determine the resulting level of decay. Hetzler points out that CODIT responses vary by species: poplars and willows have a very weak response, red oak and soft maple a middling response, but hard maple and white oak respond vigorously. Because of a diversity of stress factors, landscape trees — especially urban trees — respond with less vigor than forest trees. Scientists also think that trees can warn one another of approaching insect and disease challenges, enabling them to ramp up their defense. Unfortunately, if the fungus has moved through the sapwood into the heartwood, the battle is eventually lost. Even then, the tree can live on for a long time. Peter Wohlleben explains how in *The Hidden Life of Trees:*

> *“But even if the fungus lives and makes itself at home inside the tree, all is not lost. True, the fungus can get stuck into the wood without further hindrance, but it takes its time. A whole century can pass before everything is consumed and turned to mush. Even this won’t make the tree the slightest bit less stable, because the fungus cannot expand into the wetter outer rings of living sapwood. In extreme cases, the tree gets hollowed out like a stovepipe. And just like a pipe, the tree remains stable . . . The outer growth rings, which are still active, transport water up the trunk and, therefore, are much too wet for fungi.” (pp. 160-161)*

In the simplest terms, a tree dies when it can no longer feed itself — absorb and use water/moisture, nutrients, and sunlight in sufficient quantity — and/or when its structural integrity is “morbidly” compromised. Remember though, trees are tough: they can generally live with a pathogen or recover from a disease.

Know the Patient

So far we’ve approached the topic largely conceptually. Now for the practical. If your tree looks sick it is

best to identify the tree. This will allow you to visit reference sources that will suggest a choice of probable problems and corresponding responses. As a practical matter, you should know the identity of the plants for which you are responsible. It facilitates caring for them. Tree identification can proceed through a diversity of channels: books, websites, and apps.

Beech snap in a stand affected with beech bark disease (the insect-fungus complex Nectria coccinea). Photo: Joseph O'Brien, USDA Forest Service, Bugwood.org. CC BY 3.0 US.

The best book for identifying Virginia trees is *Common Native Trees of Virginia: Identification Guide (*Virginia Department of Forestry, 2020). It is available in print and free online. On a computer, you can try *Tree Identification*, Virginia Tech. On your phone, load and use the excellent app *Virginia Tech Tree Identification.* There is also the *Purdue Tree Doctor* app, which briefly suggests management options. Among other approaches are the excellent Virginia Tech "factsheets." Using information from the Virginia Department of Forestry and the Virginia Tech Dendrology Department (dendrology is the scientific study of trees), the Charlottesville Area Tree Stewards (CATS) have prepared the excellent introduction to tree identification *Getting to Know Trees*. The organization also regularly holds tree identification Zoom classes as well as walks. Slides from the recent winter tree identification presentation are available online. They will instruct you in tree identification strategies.

Help Can Be On the Way

The Virginia Department of Forestry's *Help with Sick Trees* is a guide to identifying what ails your tree. Recommended steps or options are sending a "sample" to the Department, contacting your local Department forester, or consultation of the excellent *Tree and Forest Health Guide: A Handbook for the Diagnosis of Urban and Rural Forest Disturbances*. This is the place to begin. This guide is beautifully illustrated and is organized first by biotic pests: insects, animals, and diseases. Under diseases will be found subcategories for rust, root issues, cankers, foliage, and vascular issues. For each type of problem, there is a list of host trees, signs and symptoms, timing, management, and other specifically applicable information. Abiotic issues are also covered: separate sections cover such issues as girdling roots, wind, air pollution, and soil pH. These abiotic considerations are important because they can weaken a tree, making it susceptible to biotic challenges. Once you identify the tree under consideration, you can use the "Host Tree Species Index" to find the pests and diseases potentially affecting the tree.

The standard treatment for many years has been chemicals. For guidance on chemical use, refer to VCE's *Home Grounds & Animals: 2023 Pest Management Guide*. It covers insects and diseases. This guide is an expansive, detailed, and practical collection of information. It is the place to turn first for information on all aspects of chemical application as well as storage and disposal of pesticides. In the section titled "Diseases of Landscape Trees", Table 4.3 lists the tree, and beneath it, potential diseases with corresponding pesticides (by common name), and then recommendations for chemical control, cultural control, and precautions and remarks. A cultural control includes such things as the recommendation to burn or bury fallen leaves or to prune affected branches below a canker and then remove the branches from the area. In some of the tree sections, extensive guidance is given. The introduction to the section is very useful.

If you'd like to address the problem more holistically, an Integrated Pest Management (IPM) approach is recommended. Elements of this approach for trees focused explicitly on disease will include correct pruning, inspection for bark injuries, protecting trunks from mower and trimmer damage, removing debris beneath

trees, appropriate mulching materials and application, irrigation as needed, preventing soil erosion or compaction, regular and through monitoring and record keeping, the biological control or elimination of harmful insects, and the use of organic pesticides. Critical to any IPM program is the reduction of pesticide use. In addition, mycomhizal fungus might be added to improve both mineral nutrient and water absorption and, if appropriate, protective wrap might even be considered at time of planting. The selection of problem-free trees as new additions is also wise and is considered below. For more about IPM, consider the Piedmont Master Gardener *Garden Shed* article "Integrated Pest Management." See also Virginia Cooperative Extension's *An Introduction to Integrated Pest Management.* Whether or not pursuing an IPM approach, the *Garden Shed* article "Pesticide Storage and Disposal" deserves review. Finally, the VCE *Pest Management Guide* includes a concise and very useful IPM section.

At any point in the process of recognizing a problem and identifying its cause, you may wish to contact an arborist. Size alone suggests that dealing with a tree disease is far more challenging than combating pests or diseases plaguing a rose bush. Begin by visiting the Department of Forestry's page *Hire a Certified Arborist*. One criteria for selecting an arborist is to be certain the person you've selected is certified by the International Society of Arboriculture (ISA). To find a certified arborist, search under the ISA website's utility *Find an Arborist*. (Located at the bottom of the page.)

An Ounce of Prevention is Worth a Pound of Cure

"Hindsight is always 20/20": but it is generally true that "An ounce of prevention is worth a pound of cure." A thriving healthy tree, planted correctly and in an appropriate setting, is most likely to be resilient, defending itself well from all insults. A piece by the University of Illinois Extension advises planting the right tree in the right place, not planting trees too deep, correct pruning, appropriate mulching, reducing girdling roots, spacing trees for their mature size, and staking only when necessary. After considering these key points, the Department of Forestry's *Tree Care* is a good first overview.

To start from the beginning, which may well not be where you are, select a tree for planting that will enjoy its environment, "right tree, right place." See the Charlottesville Area Tree Stewards' (CATS) *Right Tree/Right Place* and the *Right Tree/Right Place Tree List*. *Problem-free Trees for Virginia Landscapes*, noted above, is helpful as well as *Common Native Trees of Virginia*. Also valuable are the tree sections of *Piedmont Native Plants: A Guide for Landscapes and Gardens*. See also CATS' *Suggested Native Tress for the Piedmont* and *Charlottesville's Tree Packet* as well as the current *Charlottesville Master Tree List*.

Once a tree and site are selected, plant it carefully. Virginia Cooperative Extension's *Planting Trees* is concise but comprehensive and the CATS *Tree Planting Guide* and the video *Planting a Tree Bare Root* should be consulted. Also, check out the Department of Forestry's *Planting Trees*. See also *Say NO to Volcano Mulching!* The moisture trapped by over-mulching encourages bacteria.

One of the most important things you can provide throughout a tree's life is wise pruning. Pruning can play an extremely important role in disease prevention. For instance, rubbing branches, which may quickly damage bark, invite vector and consequently disease infiltration. See the slides from a CATS presentation *How to Prune Landscape Trees* (*Young Landscape Tree Pruning*). Adventitious growth wastes a tree's energy. Lack of airflow may also be an issue. Proper fertilization during a tree's earliest years and fertilization if an appropriately selected tree begins to struggle can also be helpful. See the VCE's *Fertilizing Landscape Trees and Shrubs – Basic*. And while planting masses of the same species is aesthetically pleasing, the dangers inherent in monoculture – at least in extreme cases – may be lurking.

Friends of Trees

A wealth of valuable information is readily available, and there are local and state organizations that will

help you in your tree efforts. Some already mentioned include the Charlottesville Area Tree Stewards (CATS), Piedmont Master Gardeners (PMG), and, of course, the Virginia Department of Forestry (VDOF). Call the PMG help desk (where you can receive guidance regarding a Virginia Tech diagnostic service and the *Plant Disease Diagnostic Form*) or consult Forestry's *Home Owner Assistance for Urban and Community Forestry*. Virginia Tech offers Dr. Dendro ("Dr. Dendro will answer any of your tree related questions."). To contact the Virginia Department of Forestry forester for your area, see *Find a Forester*. And, as previously noted, to hire an arborist, visit Forestry's *Hire a Certified Arborist*.

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Featured Image: Dogwood anthracnose (the fungus *Discula destructiva*), a symptom close-up. Photo: Penn State Department of Plant Pathology & Environmental Microbiology Archives, Penn State University, Bugwood.org, CC BY-NC 3;0 US.

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