LSU AgCenter Research · Extension · Teaching

Horticulture Hints

for NORTHEAST Louisiana

Summer 2021

Lawn irrigation is important during the summer months.

Summer Watering

Watering too frequently can be just as stressful on lawns as heat, humidity and drought. Overwatering can also lead to fungal issues and wasteful runoff. Deep South turfgrasses should be watered less frequently but deeper and for longer periods at a time. This will promote healthy root systems. Water to a depth of 6 to 8 inches once a week. Water just before dawn to allow residual water to evaporate during the day. Southern turfgrasses will let you know if they need a drink. Look for leaf blades curling inward and turning dull gray. Also, if walking across your lawn produces foot imprints that remain, then water is necessary. Less frequent mowing will also help lawns weather the summer months. More shoot system above the ground will mean more healthy roots below ground. Also, these roots will be able to reach water and absorb nutrients more efficiently.

If rains are inconsistent, these hot summer months are also stressful for trees in the landscape. Even the largest trees in the landscape need water. If you water trees, remember that feeder roots are not up close to the trunk of the tree. Rather, they extend out away from the trunk and end approximately where the branches end. This is called the drip line. As with lawns, watering deeply and less frequently will benefit trees if rains are several weeks apart. Water should be applied slowly and should reach a depth of 12 to 15 inches. Native tree species, like the willow oak (*Quercus phellos*) and southern sugar maple (*Acer barbatum*), will be better adapted to often unpredictable precipitation in our area during these months. Both are Louisiana Super Plants.

Carol Pinnell-Alison
Extension Agent

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Planting in Summer

Two vegetables — fruit, really — that won't slow down during the summer swelter are okra and watermelons!

Okra hits its stride as temperatures rise, and no other vegetable is so … Louisiana! If you're not growing okra, you should be! This member of the hibiscus family LOVES summer heat and produces flowers that have an ornamental quality all their own, calling out to pollinators like a big, bright neon sign. So, consider adding an okra plant here and there to ornamental beds if they get full sun. There are many okra varieties to choose from, and you can't go wrong with any of them. Gold Coast and Louisiana Green Velvet are two LSU varieties developed specifically for our heat and humidity. Clemson Spineless and Emerald Evergreen are also popular. A number of heirloom varieties are available from various catalogs and online sources. Many okra varieties are open-pollinated so their seeds will breed true and can be saved for next season's crop. To save okra seeds, simply let a pod or two mature on the plant, dry out and begin to split

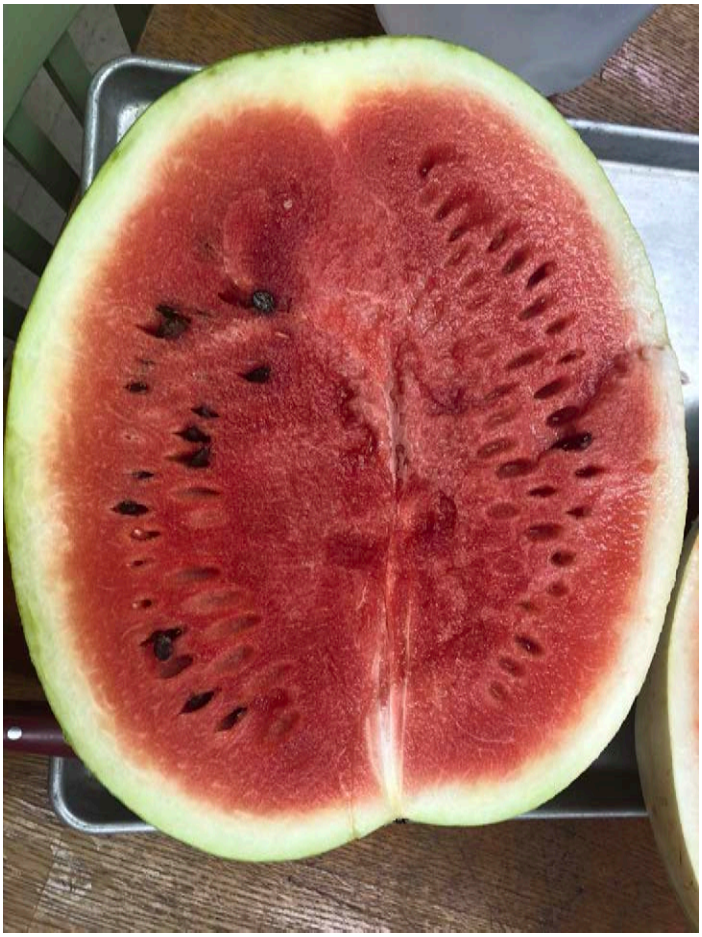
Okra pods should be harvested when tender.

Okra is in the hibiscus family and makes showy flowers.

open. Mature seeds are dark in color and roughly the size of a BB or a little larger. One or two pods should give you all the seeds needed for next year and then some. Keep okra seed viable by storing in a cool, dry and dark place, preferably in an airtight container or jar.

Okra is an LSU AgCenter Group III vegetable and can be planted from April to August. Soak seeds overnight in water to soften the extremely hard seed coat and expedite germination. Okra will grow in most any soil and doesn't need much fertilizer. A preplant fertilizer application of less than one-half of a pound of either 13-13-13 or 8-24-24 per 10-foot row is sufficient. Seeds should be planted between one-quarter and one-half inch deep. Thin seedlings to between 18 and 24 inches apart. Pods of most varieties are tender when they're between 2 and 4 inches long. The so-called Cowhorn varieties produce pods that remain tender up to 10 inches or more long.

No Louisiana summer would be complete without sweet, juicy watermelons! Like okra, it originates in West Africa, so hot, dry summers are not a problem. With less frequent rains, sugars become quite concentrated and that's why we love it! Watermelon seeds should have been started back in March, and vines should be well on their way to producing by now. Side-dress growing vines every three to four weeks with 0.1 cup of calcium nitrate per 10-foot row. Watermelons will need room to sprawl, so an area of



Watermelons grow well in Louisiana and thrive in the summer heat.

no less than 100 square feet will need to be set aside for watermelon vines. A layer of mulch, either plastic or organic, will help keep vines disease-free and help keep weeds suppressed. Transplants set out in August may not have enough time to produce mature melons. Locally grown field watermelons should be coming in by now, and those grown in home vegetable gardens should be ready to harvest soon if not now. A watermelon can be considered ripe and ready for harvest when:

- A hollow sound results when the melon is thumped or patted.
- The belly of the melon (the surface in contact with the ground) has turned yellowish.
- The tendril closest to the melon's stem has turned brown.

Cut ripe watermelons from the vine making sure to leave a 2-to-3-inch stem.

Striped watermelon varieties for our area include Jubilee, Royal Jubilee and any of the summer flavor varieties. Icebox-type watermelons for the Northeast Region are Sugar Baby and Mickylee. Yellow and orange flesh varieties to try are Tendersweet, Desert King and Orange Glo. We are pleased to be reintroducing three watermelon varieties that were developed at the now-closed Louisiana Agricultural Research Station at Calhoun in Ouachita Parish. Calhoun Sweet was released in 1951 and, until last year, has been presumed if not totally extinct, then functionally extinct. Calhoun Gray is the result of a cross made between Calhoun Sweet and Charleston Gray. Red-N-Sweet (also known as Louisiana Sweet) was released in 1987 and is the last watermelon variety released from the Calhoun Station. Productive vines and thin rinds on the melons make Red-N-Sweet a good choice for Louisiana home vegetable gardens.

Carol Pinnell-Alison & Kerry Heafner
Extension Agents

LSU AgCenter agents from the Northeast Region and the parishes they serve:

Kerry Heafner:

Morehouse Parish, Ouachita Parish and Union Parish

Donna Lee:

East Carroll Parish, Madison Parish and West Carroll Parish

Marcie Mathews:

Tensas Parish

Carol Pinnell-Alison:

Caldwell Parish, Catahoula Parish, Concordia Parish, Franklin Parish and Richland Parish

Water-Wise Gardening

Water is our most precious natural resource. Americans use an average of 29 gallons of water per day, according to the Environmental Protection Agency, with 30% or 8.5 billion gallons each day used for gardening and lawn care. With two-thirds of the world's population projected to face water scarcity by 2025, it is time to plan for shortages.

You can make water-wise landscaping decisions and create a functional, easily maintained landscape by following a few guidelines that will help conserve water, money and time.

The EPA recommends these key tips for water-smart landscaping:

- Plan before you plant.
- Make water-wise plant selections.
- Go easy on the turf.
- Water wisely. The timing matters.
- Use automatic irrigation that is efficient and well designed and work with irrigation professionals.
- Use mulches to conserve moisture.
- Harvest rainwater.

Planning before you plant is the first step when making water-wise landscape decisions. Did you know that plants help conserve water and improve water quality by slowing and collecting rain?

Next, select the right plant for the right place based on your regional conditions. Take into account the annual rainfall and average temperatures for your area. To achieve the need for minimum irrigation, choose plants that are adapted to low water environments, such as native plants.

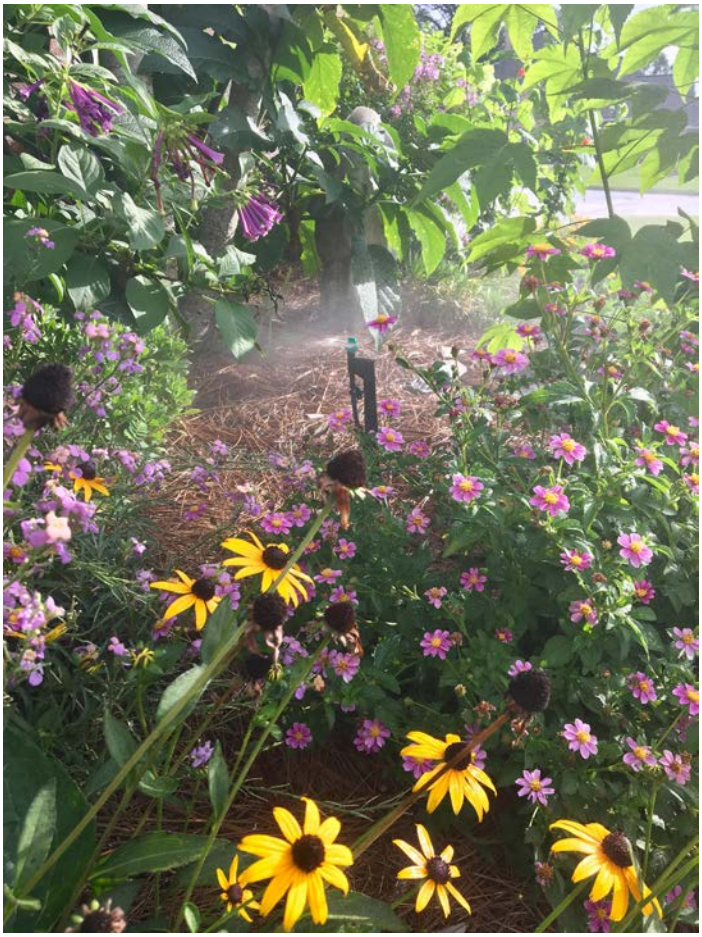
For the most water conservation, limit or eliminate turfgrass in your landscape. This will not only conserve water, but it will also conserve time and money spent on maintaining grass and cut back on watering and mowing tasks — bonus! Keep in mind that some grasses are more drought tolerant than others, such as centipedegrass and zoysia. St. Augustinegrass, bermudagrass and carpetgrass require more water.

Group plants with similar water needs in "hydrozones" that reduce water use according to each zone. Turf and bedding plants will require the most water, whereas well-established shrubs and trees with extensive and deep root systems require less.

Timing matters. Automatic irrigation systems can be a real time saver. It can also help you get a little extra shut eye because the best time to water plants is early in the morning between the times of 2 a.m. and 8 a.m.

Watering during the heat of the day reduces the efficiency because more water is lost to evaporation. Watering in the evening between 6 p.m. to midnight can encourage fungal diseases as plants remain wet for extended periods.

Schedule irrigation according to each hydrozone for particular plant needs and in response to decreased rainfall. In addition to conserving water, adequate irrigation is more effective and efficient, encouraging deeper root growth and creating healthier plants that are more drought tolerant.



Water early in the morning between 2 a.m. and 8 a.m.

Work with irrigation specialists when designing, installing and scheduling irrigation systems. A properly designed irrigation system will conserve water, while an improperly designed and scheduled system will waste water and money.

Use mulch. Mulch covers the soil, conserving water by preventing evaporation and preserving water at the root mass while providing a source of organic matter to landscape beds. Mulch can also help prevent compaction and provide weed control and is also attractive.

Rain barrel

Lastly, harvest rainwater. Louisiana has an average annual rainfall of 60 inches. Harvest rain with equipment such as barrels and cisterns to help supplement your irrigation program.

Do your part to help conserve water for future generations by following these water-wise guidelines. Consult LSU AgCenter publication No. 3062, Introduction to Landscape Irrigation in Louisiana, at lsuagcenter.com for more tips.

Heather Kirk-Ballard, Ph.D.
Consumer Horticulture Specialist

Checklist for June, July, August

June

1. In the lawn: Watch for chinch bugs, which are active from June to September. To prevent damage, ensure a vigorously growing lawn that can defend itself more readily. Use insecticides only if needed.
2. In the landscape beds: Plant ornamental grasses. They add beauty and texture to landscapes and they are low maintenance once established. They thrive in the summer for a beautiful fall flower display. Muhly grass (*Muhlenbergia capillaris*) is the fall selection for 2021 Louisiana Super Plants.
3. Trees and shrubs: Prune hydrangeas and gardenias after they have completed their bloom. Remove suckers from crape myrtles. June begins hurricane season. Check shade trees carefully for dead or unhealthy limbs and remove them ahead of the storms. Take down any large trees that look unhealthy or if they have any rotten or decayed areas.
4. Fruits: Cut back canes of blackberries that have already produced. To keep the rest of the plant compact you can also cut the whole plant back to 3 feet. If drought conditions occur, keep figs well-watered to prevent fruit drop.

July

1. In the lawn: Apply a second application of slow-release fertilizer as the label recommends. Be sure to cut your lawn once a week or every other week depending on growth and rain activity. Cut your lawn at the proper heights for your turfgrass: bermudagrass, 1-1 ½ inches; centipedegrass, 1-2 inches; St. Augustinegrass, 2-3 inches; and zoysia, ½-1 ½ inches.
2. In the landscape beds: Cut back daylilies to around 4 inches to remove spent flower stalks and old foliage. This is a good time to trim leggy annuals.
3. In the landscape beds: You can begin planting warm-season annuals, perennials and caladium bulbs this month. Thin border plants and clumping ground covers, such as monkey grass, liriope, and hostas, this month.
4. Trees and shrubs: Plant palms this summer through late August. Some cold hardy palms to consider for Louisiana are saw palmetto, windmill palm, cabbage palm and needle palm.

Chinch bug damaged lawn.

August

1. In the lawn: Sodding, aerification and dethatching can still be done throughout the month of August. Be on the lookout for large patch. Treat with fungicides containing one of these active ingredients: maneb, myclobutanil, PCNB, propiconazole, thiophanate-methyl or triadimefon.
2. In the landscape beds: Pinch back coleus to prolong foliage and to prevent flower spikes. Divide overcrowded daylilies and Louisiana irises and share with friends and family.
3. Trees and shrubs: Mulch trees. Prune ever-blooming roses back by one-third of their height to encourage a vigorous fall bloom.
4. Fruits: Harvest season for apples, figs, pawpaws and pears. Spray figs with copper-based fungicides after they have finished producing to prevent fig leaf rust.

Heather Kirk-Ballard, Ph.D.
Consumer Horticulture Specialist

Winter in Summer?

Why not plant something new this summer? We have our warm season stand-bys — tomatoes, peppers, okra, cucumbers, melons, squash and others. Tips for these crops are presented at the end of this article. But I challenge you to try and grow pumpkins in Louisiana. Last summer the LSU AgCenter held a statewide pumpkin growing contest for 4-H youth. Over 800 students received seeds of the Cinderella pumpkin variety. Cinderella isn't really a pumpkin. Rather, it is a large winter squash. In Louisiana, pumpkins can be hard to grow, but decorative and winter (edible) squash are easier. Winter squash are beautiful and come in a range of shapes, sizes and colors. They are called "winter" even though they are grown in the summer because they have a thick rind that allows them to keep for many months, unlike summer squash, which have a short shelf life. Some of my favorite winter squash varieties include Cinderella, which can range from a light tan to a deep coral color and anywhere from 6 pounds to 40 pounds depending on how you fertilize and how great

Assortment of winter squash and pumpkins

you are at attracting pollinators. Other fun varieties include Shokichi Shiro, which has a light silver-gray color; Silver Moon, a white squat squash; and Turk's Turban, a beautiful squash that is orange, green and white. There are too many to name and so many you should try growing. If you are interested, here are a few tips.

Winter squash vine out, so be sure to give them plenty of space. In our recent 2020 LSU AgCenter winter squash trial we spaced plants 3 feet apart down each row. Watch out for cucumber beetles, slugs, snails and worms, the major insects that affect this crop. If you must spray to kill these, please do so at dusk. This is because we need bees and other pollinators to bring pollen back and forth from male to female flowers. Fertilize before you plant with a complete fertilizer, such as 13-13-13, and side-dress weekly with nitrogen as flowers begin to develop. Keep an eye out for downy mildew and powdery mildew, two of the most notorious diseases that attack winter squash. To help prevent disease water at the base of the plant, space plants adequately and use a preventative fungicide. Harvest when the rind of the squash is hard enough that your fingernail won't poke through it. The stem of the winter squash should also look thick and corky, not fresh and light green. Why not give it a try? Even just saying winter in summer might cool you off a bit!

General Summer Vegetable Planting Tips

June

- Collard greens, cucumber, watermelon, cantaloupe, okra, southern peas, pumpkin and summer squash can all be direct-seeded into the garden during June. Wait until late June to plant pumpkins if you want them ready for early October and Halloween decorating.
- You can plant sweet potato slips this month.
- In mid-June, plant a summer crop of heat-set tomatoes. Planting heat-set tomatoes is VERY important. These cultivars have been bred to set fruit during high nighttime temperatures, whereas other cultivars will not. If managed correctly, heat-set tomatoes will produce fruit through October. Preferred varieties include Florida 91, Solar Set and Sun Master, Phoenix and Bella Rosa.

Watermelon on the vine, okra and summer squash

July

- Transplant another fall crop of heat-set tomatoes (late July). These will take you through the first freeze. Transplant bell peppers as well.
- Direct-seed okra, southern peas, cucumbers, squash, cantaloupe and watermelons throughout July. Direct-seed pumpkins in early July — the first week of the month for an early October harvest.
- Late July to early August is a good time to start thinking about your fall garden. Order broccoli, Brussels sprouts, cauliflower, Chinese cabbage, cabbage and all your root crop seeds. This is very important because all the good gardeners are also ordering seeds now. And you don't want the leftovers!

Brussels sprouts

August

- Plant bush lima beans in the garden.
- Start seeds of broccoli, Brussels sprouts, cauliflower, Chinese cabbage, cabbage, cucumbers, squash, mustard greens and shallot sets for an early fall garden start in September. Start your seeds on a table outdoors under the shade. Do NOT forget to keep them moist.
- You can transplant broccoli and Brussels sprouts as early as mid-August in the garden but beware of worms. They will get you this time of year. I personally like to wait until mid-September to transplant fall crops. But some people like the thrill of being the first on the block with the fall produce. In a garden rush? At the end of this month, direct-seed beets and lettuce for an early crop.

Irish potatoes

- Late August is the perfect time for a fall crop of Irish potatoes. It is really hard to find them at the hardware store, so many people save the smaller potatoes from their spring harvest for a fall planting. If you are doing this, you do not need to cut the potatoes into pieces. Just plant the small potatoes whole.
- Are your okra and eggplants looking a little spindly? Cut them back about knee height and add a little fertilizer. They will flush out again and produce until the first freeze.

Enjoy the Garden,

Kathryn "Kiki" Fontenot, Ph.D.
Associate Professor, LSU AgCenter School of Plant, Environmental and Soil Sciences

Tips for Summer Care of Turfgrass

Summer is the peak growing season for lawns in Louisiana. If you did not fertilize during the spring, you still have time to fertilize and get your yard in good shape prior to fall. Keep up a good fertility program through early to late August. Remember to apply all granular materials on a dry lawn and water very soon after application. Make sure your lawns are getting adequate amounts of moisture during the summer months, but don't overwater. Water deeply only once or twice per week or as needed, based on the amount of rainfall. The purpose of irrigation is to supplement rainfall. I am not a fan of watering lawns everyday unless we are in severe drought.

Consider aerifying compacted soil. I've seen aerification completely change thin lawns caused by compacted soil into thick and healthy turf. Aerifying helps with water percolation and increases the turf's rooting depth and makes for a more drought-tolerant lawn. Lawn care companies can aerate, or you can rent an aerator from a rental store and do it yourself. If your soil is prone to compaction, consider aerating one to three times this growing season. Aeration may be the game changer that your lawn is missing.

Fertilizing the lawn

St. Augustinegrass and zoysiagrass both respond well to fertilizer applications. St. Augustinegrass may be fertilized up to three times during the growing season — April, June and mid-August. Fertilize zoysiagrass twice per growing season — in April and again in July.

Bermudagrass is an even bigger fertilizer user and can be fertilized from three to five times during the growing season, especially if you like to mow grass. Carpetgrass and centipedegrass are not big fertilizer users. Usually, two applications (April and July) will take care of centipedegrass, and one application will be sufficient for carpetgrass (April).

Centipedegrass should receive its second and final fertilizer application in July. For centipedegrass, apply only one-half pound of actual nitrogen per 1,000 square feet. For example, apply 3 pounds of 17-0-17 per 1,000 square feet or 5 pounds of 10-0-10 per 1,000 square feet. St. Augustinegrass would need 6 and 10 pounds of the aforementioned fertilizers.

If your lawn is not performing well, there could be a nutrient deficiency in the soil. The only surefire way to know what your soil needs is to collect a soil sample and submit it for testing at the LSU AgCenter Soil Testing and Plant Analysis Lab. In order to simplify the soil sampling and submission process, there are pre-addressed submission boxes with sampling instructions at several garden centers throughout the state and at your local parish extension office. Once submitted, the results will be sent to your home mailbox and/or email, usually in less than two weeks. Your parish LSU AgCenter extension agent can help you interpret the results from the soil sample and tell you exactly what's needed nutrient-wise to make your lawn beautiful.

Correct mowing heights are highly important

You may not know this, but there is a correct mowing height for your lawn. St. Augustinegrass is very finicky when it comes to mowing height. Don't cut it too short and don't allow it to get too tall. It likes to be maintained around 3 inches, the tallest mowing height of all the lawns grown in Louisiana. If you cut St. Augustinegrass too short, it becomes stressed and more prone to disease and weed infestations.

Centipedegrass is often maintained too tall. Centipedegrass should be mowed to 1 to 1.5 inches. This helps prevent thatch buildup. Zoysiagrass also likes to be mowed in the 1-to-1.5-inch range. Bermudagrass should be mowed from 1 to 2 inches, shorter mowing heights are better when more frequent mowing is possible. Keep mower blades sharp to ensure a clean cut and good lawn health.

Armyworm defoliating bermudagrass.

Insect pests

Watch for chinch bugs in St. Augustinegrass and bermudagrass lawns and treat with an LSU AgCenter-recommended insecticide such as bifenthrin (Talstar and many other trade names). Chinch bug problems show up as yellowish-brown to straw-colored areas of the lawn during hot, dry weather. These insects extract plant juices from turfgrass stems and crowns while pumping toxic salivary fluids into the lawn. The fluids disrupt the plant's vascular system. The damage actually resembles herbicide damage.

Check for chinch bugs in the lawn by saturating suspected areas with a gallon of water mixed with a few squirts of lemon dishwashing soap. This soapy solution irritates chinch bugs and brings them up near the grass surface so you can see them and determine if the bugs are causing the lawn damage. If it's hot and dry and there are dead spots in your St. Augustinegrass, chinch bugs are the first thing that I would consider.

Additional insect problems that appear during the summer include armyworms and tropical sod webworms. These moth larvae or "worms" can cause severe lawn damage very quickly and will need to be killed with

insecticides to prevent further damage. Tropical sod webworms can devastate St. Augustinegrass and carpetgrass lawns. Tropical sod webworms crushed St. Augustinegrass in 2020. Let's hope that our cold winter reduced moth populations for 2021. Armyworms prefer bermudagrass and can completely defoliate acres of pasture and lawns. Carbaryl, bifenthrin and chlorantraniliprole insecticides are options for tropical sod webworms, armyworms and chinch bugs infesting the lawn.

Be mindful of these pests as you walk through your lawns. Investigate damaged areas and treat accordingly.

Tropical sod webworms feeding on St. Augustinegrass.

Virginia buttonweed and other summer weeds

In late spring to early summer, Virginia buttonweed starts forming mats that can eventually smother out the lawn. Pull up small populations of Virginia buttonweed or carefully treat with herbicides like metsulfuron (MSM Turf and other trade names) or Celsius. These herbicides work well with repeated applications spaced four to six weeks apart. Metsulfuron and Celsius can be safely applied on St. Augustinegrass, centipedegrass, bermudagrass and zoysiagrass during warm weather. Carpetgrass will be damaged by Celsius herbicide. Bahiagrass will not tolerate metsulfuron or Celsius. When it comes to "managing" buttonweed, it is important to start spraying early in the growing season (April) and spray often. Don't wait until September to make your first herbicide application.

Common lespedeza is a mat-forming annual legume that emerges in the spring and lingers deep into fall throughout Louisiana. By late summer, the plant matures and becomes woody-like and tough on lawnmower blades. Metsulfuron works well on this weed but early summer applications are more effective.

Torpedograss is a perennial grass that's mainly a problem in south Louisiana, but I do get calls from north Louisiana as well. There are few lawn problems more devastating than a torpedograss infestation. Torpedograss is extremely tolerant of herbicides and easily outcompetes slow growing grasses like centipedegrass.

Common lespedeza

Viginia buttonweed

The weed often starts from soil brought in during flower bed construction. However, it quickly spreads from the flower bed to the lawn. The ability to suppress torpedograss in lawns depends on the turfgrass species. Selectively removing torpedograss out of lawn grasses and sports fields is rarely completely achievable. Quinclorac (Drive and other trade names) is an herbicide that is somewhat effective in suppressing torpedograss in bermudagrass and zoysia. Unfortunately, you cannot use quinclorac in centipedegrass and St. Augustinegrass.

Sethoxydim (Bonide Grass Beater and other trade names) will temporarily injure torpedograss that is infesting centipedegrass, but it does not provide long-term control. The torpedograss recovers, and the weed re-infests the centipedegrass again. Unfortunately, there are no selective herbicide options for torpedograss that is infesting St. Augustinegrass. Often, complete renovation is necessary when centipedegrass and St. Augustinegrass are severely infested.

If you decide to renovate and install a new lawn, consider sodding the lawn with zoysiagrass (semi-shady or full sun lawns) or bermudagrass (for full sun only). Converting to zoysiagrass or bermudagrass will allow the use of quinclorac, the most effective selective herbicide on torpedograss. Installing zoysia may be the better fit for Louisiana because of its good shade and drought tolerance. Zoysia is not a high maintenance grass when managed properly. Maintain zoysia at 1 to 1.5 inches with a sharp mower blade and fertilize twice per year. There are several sod farmers in Louisiana that grow zoysia, so it is readily available.

Proper lawn maintenance keeps your lawn healthy and reduces the need for the use of pesticides. If it becomes necessary to use a pesticide in the lawn, it is highly important to always read and follow their labels before using. The label will tell you how to use the product safely to achieve satisfactory results. You will find the label attached to the product's container.

Ron Strahan Ph.D.
Associate Professor, LSU AgCenter

Susceptibility to Satsuma Cultivars to Citrus Canker Caused by *Xanthomonas axonopodis* pv. *citri*

Citrus is the most popular fruit tree grown commercially and in home backyards in Louisiana. Satsumas dominated citrus production with 63% of total citrus acreage. In 2018, 183,408 bushels of satsumas were produced in the state with a total gross farm value of $6.2 million, according to the 2018 Louisiana Summary Agriculture and Natural Resources.

Figure 1: Citrus canker lesions present on the upper leaf surface of a grapefruit tree (source of natural citrus canker bacterium).

During the last decade, satsuma production has drastically reduced by 54,526 bushels, which is attributed to diseases and natural disasters. After Hurricane Katrina in 2005, Louisiana lost the majority of its citrus industry, and the total acreage was greatly reduced. In 2008 and 2010, citrus greening and sweet orange scab were confirmed in the state for the first time, respectively (Hummel and Ferrin, 2010; Singh and Ferrin, 2011). In June of 2013, citrus canker (Figure 1) was re-confirmed in the state for a second time in Orleans Parish (Singh, 2013). The disease was first reported in Louisiana in 1914 (Loucks, 1934) and was considered eradicated in 1940 (Dopson, 1964). Since 2013, citrus canker has been rapidly spreading to all commercial and backyard citrus production areas in the state. Currently, citrus canker is reported in 10 Louisiana parishes, including Plaquemines, where the majority of the commercial citrus is grown (Louisiana Department of Agriculture and Forestry Cooperative Agriculture Pest Survey Report 2019).

All citrus varieties are susceptible to citrus canker; however, some varieties are less susceptible than others. Copper-based fungicides may suppress the disease but not control it. No bactericides have been labeled to use on citrus to manage citrus canker in Louisiana. Without effective management options, citrus canker has the potential to adversely affect the survival of Louisiana's valuable citrus industry. Therefore, it is critical to develop alternate methods to mitigate the spread of citrus canker in the state. One of the alternate methods is to discover satsuma cultivars that are highly tolerant and can withstand high disease pressure in our canker-conducive environment.

The results from an annual citrus cooperative agricultural pest survey (CAPS) conducted by the LSU AgCenter and the Louisiana Department of Agriculture and Forestry from 2014-2016, revealed that satsumas are highly tolerant to citrus canker with only 2.5% disease incidence. In some situations, the satsuma samples were collected from trees planted in the same backyard with heavily infested grapefruit, Meyer lemon, navel orange and other citrus varieties. The CAPS lacked data on types of satsuma cultivars that were sampled. The cultivar susceptibility data plays a critical role when promoting different types of satsumas to commercial and backyard growers in canker-infested areas. The objective of this study was to screen susceptibility of satsuma cultivars against citrus canker under natural disease inoculum conditions.

Five cultivars of satsuma, including Brown's Select, Louisiana Early, Miho, Owari and St. Ann were screened along with three citrus varieties with known varying degrees of susceptibility to citrus canker disease ranging from a highly susceptible (HS) Ruby Red grapefruit, a moderately susceptible (MS) Hamlin sweet orange and a least susceptible (LS) sweet kumquat. Trees grown in 3-gallon pots and to 18 months of age were placed under diseased mature grapefruit trees at a public garden in New Orleans and a commercial citrus orchard in Paulina. The study was conducted during 2018 and 2019 growing periods at both experimental sites.

The disease onset among the five satsumas varied at both New Orleans and Paulina sites during 2018 and 2019, but Brown's Select, Miho and Owari satsumas had consistently delayed onset of citrus canker with only 20% of incidence within weeks two and three after experimental tree were placed (Figure 2). Miho had an additional delayed disease onset that extended into week four with only 20% disease incidence in 2019 in Paulina. Similarly, Owari developed canker lesions during week five at the New Orleans site with 20% disease incidence. Louisiana Early and St. Ann satsumas were highly inconsistent in getting infected with citrus canker. The highly susceptible ruby red grapefruit and moderately susceptible Hamlin sweet orange had a large number of trees getting infected early during the screening periods (Figure 2).

In the New Orleans public garden (grapefruits trees planted in a courtyard surrounded by a brick wall), the satsuma cultivars Miho and Brown's Select showed the lowest average number of lesions in both years (Table 1) and a delayed disease onset compared with the other satsuma cultivars (Figure 3). Miho, for instance, never developed citrus canker symptoms after the three week-period in which the experimental trees were placed. In Paulina, in an opened orchard, Miho and St. Ann had the lowest average number of lesions per leaf in the two years of evaluation (Table 1), and Miho exhibited delayed onset of disease (Figure 3). The cultivars Brown's Select and Miho in New Orleans had the smallest number of 3.07 and 0.21 lesions per leaf, respectively. In Paulina the satsuma cultivars with the lowest number of lesions per leaf were observed on St. Ann (0.49 lesions per leaf) and Miho (1.69 lesions per leaf) (Table 1).

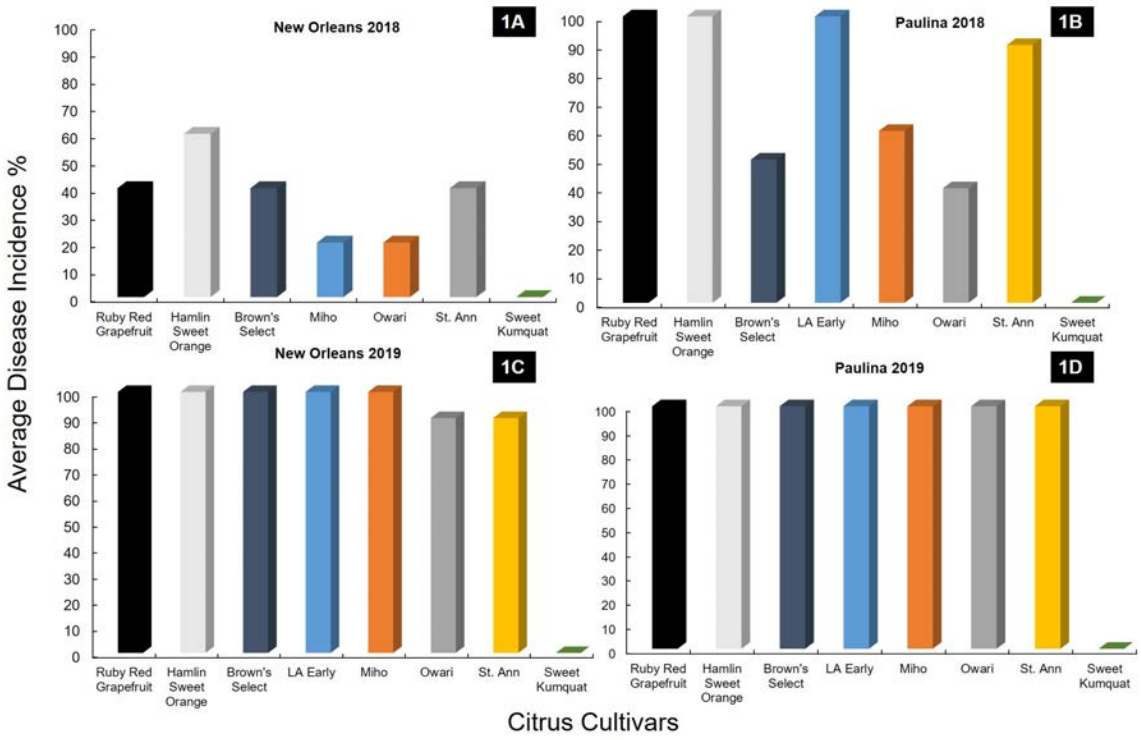


Figure 2: Disease incidence shown as mean percentage of experimental screened citrus cultivar trees infected with citrus canker at the end of the experiment in New Orleans (1A and 1C) and Paulina (1B and 1D) during 2018 and 2019, respectively.

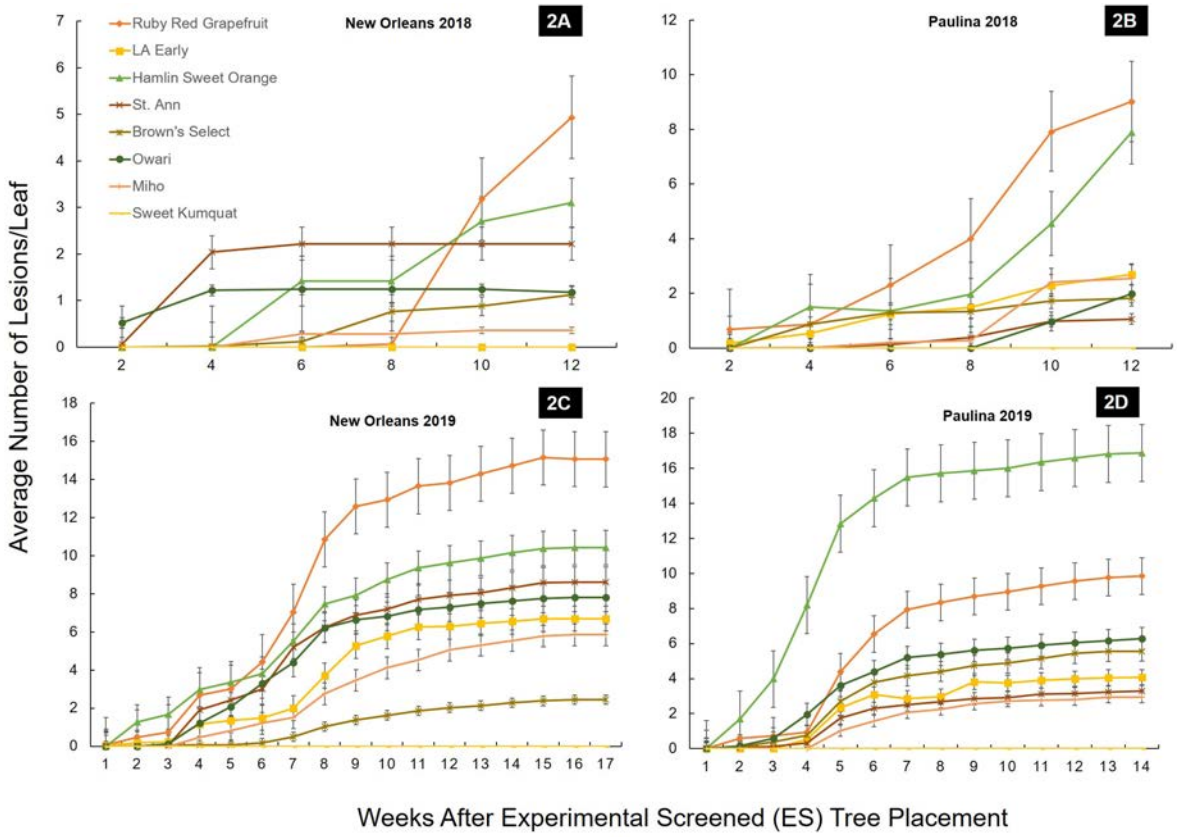


Figure 3: Disease severity expressed as average number of citrus canker lesions per leaf on experimental screened citrus cultivars trees in New Orleans (2A and 2C) and Paulina (2B and 2D) during 2018 and 2019 screening period, respectively.

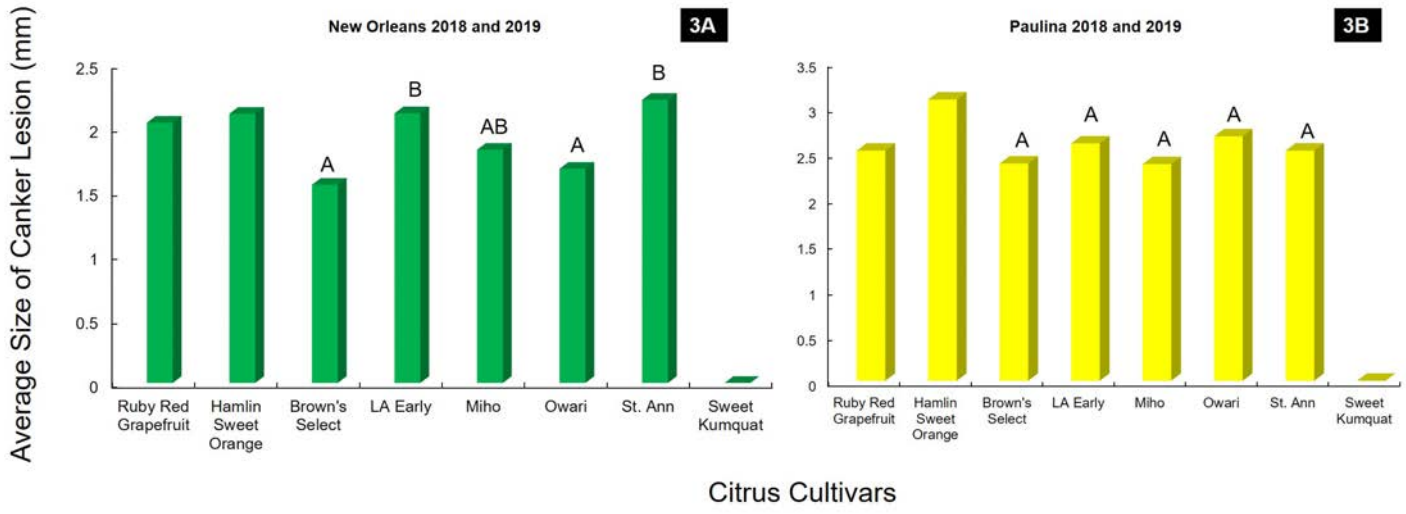


Figure 4: Average diameter (mm) of citrus canker lesions on experimental screened citrus cultivars trees in New Orleans (3A) and Paulina (3B) during 2018 and 2019 screening period, respectively.

The disease pressure on mature grapefruit trees at New Orleans and Paulina was 100% during both years, and the weather conditions were conducive for canker at both sites. Despite the high disease pressure and weather conditions, satsumas Brown's select, Miho and Owari performed the best and had less disease with delayed onset of symptoms.

The size of canker lesions is also an important predictive parameter on canker impact and spread. Lesions on leaves and twigs are probably the most epidemiologically significant inoculum for secondary infections, as canker lesions remain active for many months, and the bacteria produced on lesions are dispersed by water splashes resulting in infection and further production of more canker lesions. In this study difference in canker lesion size among the five satsuma cultivars was observed in New Orleans but not in Paulina (Figure 4).

In Louisiana, environmental conditions are optimal for citrus canker development, and a lack of effective chemicals to manage the disease pose a continuous challenge for citrus growers. The popularity of growing satsumas in Louisiana orchards and backyard gardens may help reduce the disease spread and development. This study provides field-based scientific evidence that Brown's Select, Miho and Owari consistently had less disease severity with delayed incidence and, therefore, categorized as less susceptible to citrus canker compared to Louisiana Early, St. Ann, Hamlin sweet orange and ruby red grapefruit. Additionally, the smaller lesion size on both Brown's Select and Miho may result in lesser canker inoculum production for secondary infections. Louisiana growers must incorporate these satsumas in their future plantings as an alternate citrus canker management strategy.

Furthermore, in addition to the satsuma cultivar susceptibility data, this study provides the field-based data on sweet kumquat resistance to citrus canker. This information can be readily incorporated into citrus hybrids by conventional breeding.

In conclusion, this study provides valuable and reliable field-based scientific information on satsuma susceptibility to citrus canker in Louisiana, which can help the growers select less susceptible cultivar to mitigate this high-impact disease.

Acknowledgments

The project was funded by USDA AMS Specialty Crop Block Grant Program No. AMI7O100XXXXGO24. The authors would like to acknowledge Robert "Butch" Millet and Rene Millet of Paulina, Louisiana, for letting us use their citrus orchard for conducting this study. We would like to extend our sincere thanks to Amy Graham of Longue Vue Gardens for providing us with a second site for comparing our work.

	2018		2019	
	New Orleans	Paulina	New Orleans	Paulina
Ruby Red grapefruit (HS)	1.36	4.14	9.2	6.11
Hamlin sweet orange (MS)	1.44	2.88	6.64	11.64
Brown's Select	0.48 AB	1.17 C	1.20 A	3.41 AB
LA Early	-	1.40 C	3.93 B	2.52 AB
Miho	0.21 A	0.90 B	3.07 AB	1.69 A
Owari	1.10 BC	0.49 A	4.92 B	4.07 B
St. Ann	1.75 D	0.43 A	5.34 B	2.02 A
Sweet kumquat (LS)	0.0	0.0	0.0	0.0

Table 1: Mean number of citrus canker lesions per leaf in ES citrus cultivars trees in New Orleans and Paulina during 2018 and 2019.

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PUB 3655-21-SU-NE (online) 5/21