MASTER GARDENER
COLORADO STATE UNIVERSITY
EXTENSION

Turfgrass Management

Learning Objectives

At the end of class, the student will be able to:

- Describe how lawn management practices influence turf quality and why incorrect management decisions lead to common lawn care problems.
- Describe which grass species are best-adapted for lawn use, and the most important factors to consider when choosing a species for a new lawn (or when renovating an existing lawn)
- Describe how mowing height and frequency affect the aesthetic quality and stress tolerance of turfgrass; why grass clippings should be recycled back to the lawn during mowing.
- Describe why nitrogen is the most important nutrient in a lawn fertilization program, how and when to fertilize a lawn, and how to select the appropriate lawn fertilizer.
- Describe the environmental factors affecting turf water use and how to use that knowledge to most effectively irrigate a lawn (how MUCH water to apply, and how OFTEN?).
- Describe thatch, understand why it forms in the lawn, what common problems its accumulation may cause, and how thatch is most effectively managed.
- Describe the negative effects of soil compaction on turf health and how to improve soil physical conditions by using common cultivation practices.
- Describe how to establish a new lawn, using seed, sod or plugs. What is meant by lawn renovation and how this process can be used to improve the quality of an existing lawn.
- Describe the most common lawn weeds, why weeds occur in the lawn, and how to most effectively manage weeds using cultural practices and, if necessary, herbicides.
- Describe the process of diagnosing common lawn problems and know where to find the most useful resources (books, websites) to assist in the diagnostic process

- CMG volunteers approach diagnostic situations as a process. Students will be able to:
    - Describe concepts of *Plant Health Care* (PHC; IPM as it applies to lawn care)
    - Outline the life cycle of a lawn and describe how lawn/turf needs change with the age of the lawn
    - List steps in the diagnostic process
    - Using the diagnostic process, diagnose routine lawn pest problems

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References

Colorado State University Extension

Grass Species Selection for the Home Lawn

CMG GardenNotes

- Best Turf Varieties: Variety Recommendations for Bluegrasses, Tall Fescues, Fine Fescues Ryegrasses, and Buffalograss – #562
- Buffalograss Lawns – #565
- Fine Fescue Lawns – #564
- Hybrid (Kentucky X Texas) Bluegrasses for Turf Use in Colorado – #563
- Native Grass Lawns – #567
- Sources of Grass Seed, Sod and Plugs for Colorado Lawns – #566
- Turfgrass Species Selection Guidelines – #561

Mowing

Extension Fact Sheets

- Lawn Care - #7.202
- Eliminate Grass Clipping Collection - #7.007

Lawn Fertilization

Extension Fact Sheets

- Lawn Care - #7.202
- Nitrogen Sources and Transformations – #0.550
- Organic Materials as Nitrogen Fertilizers – #0.546
- Soil Testing – #0.501
- Soil Testing – Selecting an Analytical Laboratory – #0.520
- Soil Testing – Soil Test Explanation – #0.502
- Soil Testing – Soil, water and plant testing – #0.507

Lawn Irrigation

Extension Fact Sheets

- Lawn Care - #7.202
- Irrigation: Inspecting and Correcting Turf Irrigation Systems - #4.722
- Watering Established Lawns - #7.199
- Operating and Maintaining a Home Irrigation System - #7.239

Thatch and Compaction Management

- Lawn Care - #7.202

Lawn Establishment and Renovation

Extension Fact Sheets

- Lawn Care - #7.202

- Renovating the Home Lawn - #7.241

CSU TurfNotes

- Lawn Renovation: Terminology and Guidelines - #820

Turf Weed Management

Extension Fact Sheets

- Lawn Care – #7.202
- Control of Weedy Grasses in Home Lawns – #3.101

Books

- ***Integrated Turfgrass Management for the Northern Great Plains***. 1997. Baxendale, F.P. and Gaussoin, R.E. (eds.) University of Nebraska. Publication EC97-1557. 236 pages.
- ***Fundamentals of Turfgrass Management***. 2003. Christians, N.E. John Wiley & Sons. 368 pages. 2nd edition.
- ***Identifying Turf and Weedy Grasses of the Northern United States***. 2005. Pederson, D. and Voigt, T. University of Illinois Extension. 63 pages. Publication C1393. http://www.pubsplus.uiuc.edu
- ***Lawns: Your Guide to a Beautiful Yard.*** (2002 and 2007). Christians, N., Ritchie, A. and Mellor, D. Meredith Publishing. 1st edition ISBN 0696212706; 2nd edition ISBN 9780696229695.
- ***Weeds of the West***. 1991. The University of Wyoming. 630 pages.

Review Questions

Turfgrass Species/Variety Selection

1. What is the best grass to plant in Colorado lawns?
2. What is the best grass to plant if you don't want to water a lawn?
3. What grass can grow with only a "little" irrigation?
4. Can zoysiagrass grow in Colorado? What will happen if I plant it anyway?
5. What is the best grass for a shady lawn?
6. Which grass grows best in salty soil?
7. What is the best grass to plant over my septic leach field?
8. What grass can I plant if I don't want to mow my lawn very often?
9. I would like to have a backyard putting green. What kind of grass is used?

Mowing the Lawn

1. What is the best mowing height for lawns?
2. My neighbor mows their lawn 2 or 3 times a week. I mow only on Saturday morning. Who is right?
3. Should I mow higher or lower during the summer?
4. Will I have less turf disease if I mow my lawn shorter in the fall, just before winter?

5. Shouldn't grass clippings be collected because they create thatch in lawns?

6. My lawn gets a brownish cast after I mow. What is the problem?

7. I see wheel marks in my lawn after it is mowed. What causes this to happen?

8. How should I mow my lawn when it gets very tall?

9. Do I have to buy a mulching mower to return my grass clippings?

10. What is the best mower? Rotary or reel?

11. Can I compost my grass clippings, or use them as mulch, in my gardens?

Lawn Fertilization

1. What is the best fertilizer for my lawn?

2. How often should I fertilize my lawn?

3. How important is it to use a "complete" lawn fertilizer?

4. Is liquid lawn care better (or worse?) than dry/granular lawn care?

5. How do I know if I am applying the correct amount of fertilizer to my lawn?

6. Should I "winterize" my lawn? What does that mean, and what does it do for my lawn?

7. Is it OK to fertilize after aerifying my lawn?

8. Isn't organic fertilizer better for my lawn than synthetic fertilizer?

9. Will I have to fertilize more or less if I leave my grass clippings on the lawn?

10. Should the fertilizer that I use have iron in it?

11. Should sulfur be used to lower a lawn's pH?

Lawn Irrigation

1. Doesn't Kentucky bluegrass need more water than all other lawn grasses?
2. For how long should I run my sprinkler system?
3. Is it OK to water my lawn every 3-5 days, even though my neighbors water their lawns every day?
4. Is it bad to water my lawn every day?
5. Will I get "fungus" if I water at night?
6. At what time of the day is it best to water my lawn?
7. Should I water my lawn in the winter?
8. I have brown spots in my lawn, even though I water every other day. What is causing these dry spots?
9. My new tall fescue lawn (which is supposed to save water) seems to need as much water as my old bluegrass lawn. What is the problem?
10. How should I water my newly seeded/sodded lawn?
11. Should I water my lawn after I fertilize it?
12. Should I ever water my buffalograss lawn?

Thatch and Compaction Management

1. What is thatch?
2. Why do my neighbors' lawns NEVER seem to get thatchy, while mine always seems to be that way?
3. Can I topdress my lawn to get rid of thatch?
4. Do power rakes (dethatchers) work well?
5. Are there any liquid or granular "dethatching" products that work? How about ones which claim to relieve soil compaction?
6. What are some symptoms of soil compaction in a lawn?
7. What is the best time of the year to aerate a lawn?
8. How many times per year should a lawn be aerified?
9. How deep should the aeration core holes be?
10. What should I do with all of those plugs that the aerifier pulls out?
11. Should I topdress the lawn with something to fill in the aerification holes?
12. Does wearing golf spikes aerify my lawn? What about "lawn aeration sandals"?

Lawn Establishment and Renovation

1. Is it better to seed or sod a new lawn?
2. What time of the year can lawns be sodded?
3. When is the best time to seed a lawn?
4. Does soil really need to be tilled before planting a new lawn?
5. Should I bring in topsoil before I plant my new lawn?
6. Before planting my new lawn, how much sand should I add to my soil to loosen it up and improve its drainage?
7. How important is it to amend soil before planting a lawn?
8. What is the best soil amendment?
9. Is hydroseeding a good way to start a lawn?
10. Is "plugging" a good way to start a buffalograss lawn? How does it work?
11. Does "overseeding" help a lawn in any way?
12. When is the best time to overseed a lawn?
13. Is there a way to start a new lawn without going through the process of removing old sod and tilling the soil?

14. How does lawn renovation differ from starting a new lawn from scratch?

Weed Management in Lawns

1. Where do lawn weeds come from? How do they get into a lawn?
2. How do I get rid of the crabgrass in my lawn?
3. Is it important to identify lawn weeds before spraying them with a herbicide? Why?
4. I used a preemergence herbicide this spring and I still have weeds. What went wrong?
5. Can I aerify or dethatch my lawn after I apply my preemergence herbicide?
6. What is the best way to get rid of dandelions? Can I use a preemergence herbicide for dandelions?
7. Is it OK to pull weeds?
8. Do "weed-and-feed" products work well?
9. Are there any "organic" or "natural" weed control products that work?
10. What is the best way to control weeds in my newly seeded lawn?
11. Weeds have come up in the "seams" in my new lawn. Should the sod company replace the sod?
12. What is the best time of the year to spray for weeds?
13. What is the best herbicide to spray for dandelions and other broadleaf weeds?
14. Is it better to spray the entire lawn, or just spot-treat individual weeds? Won't I miss some weeds if I spot-treat?
15. Is it OK to spray lawn weeds growing under my trees? Will the trees be OK?

Miscellaneous Lawn Questions

1. How do I take care of "dog spots" in my lawn?
2. I have high and low spots in my lawn. How can I level them out?
3. Will my lawn care companies mowers and aerifiers bring diseases into my lawn from other lawns?
4. When should I do soil testing on my lawn?
5. If I want to expand my garden areas, what is the best way to kill off areas of my lawn?
6. Is it OK to flood a part of my lawn to make a skating/hockey rink for my children?
7. Can I empty the water from my swimming pool onto my lawn without killing the grass?
8. How long can grass seed last if I don't use all of it?
9. What kind of grass do I have growing in my lawn? How can I find out?
10. My lawn is "lumpy", but my neighbor's is not. What causes the lumps, and why do I have them?

Plant Health Care and the Diagnostic Process

1. Define IPM and PHC.
2. Describe concepts central to PHC?
3. Give examples of common PHC tools used in home lawn care.
4. What is the PIC cycle? What does it explain about lawn problems?
5. In diagnosing *contributing* disorders, why is it important to also identify the *predisposing* and *inciting* factors to the extent possible?
6. List the four steps in the diagnostic process.
7. Give examples of BIOTIC (living) factors that cause turf problems.
8. Give examples of non-living (abiotic) factors that cause lawn problems.
9. Why is it important to correctly identify the turf species in a lawn that is having problems?

10. Define *symptom* and *sign*. Give examples of each.

11. Explain why it is important to understand what is normal versus abnormal when dealing with lawn problems?

12. Why is it important to know the AGE of a lawn as part of the diagnostic process?

13. Why is it important to "start from scratch" with every diagnostic situation?

Diagnosing Abiotic Lawn Disorders

1. Explain how knowing the context of the situation helps in diagnosing the disorder.

2. Explain how painting a mental picture of a lawn problem helps in diagnosing a disorder.

3. Explain how repeating back the details in your own words helps in diagnosing a disorder.

4. Explain how to tactfully change directions with a client when the evidence for the cause of a lawn problem leads down another road.

5. Why is it important to discuss management options ONLY after the problems have been diagnosed?

6. In the landscape setting, what is the universal limiting factor for root growth?

7. What percentage of lawn problems are related to root/soil/water issues?

8. Describe techniques to evaluate soil/root disorders and soil compaction.

9. Why is it important to know if a client uses a professional lawn care company, or is a do-it-yourselfer?

10. Why is it important to look at the ENTIRE landscape (trees, flowers) when diagnosing a lawn problem?

11. Why look to see if the problem is occurring in the back yard/front yard as well – or in neighboring lawns? What can that tell you?

12. What kind of tests can be done to determine whether or not chemical injury has occurred on a lawn?

Diagnosing Biotic Pest Problems on Lawns

1. List the four steps in the diagnostic process.

2. What is the "disease triangle" and how does it apply to diagnosing lawn disease problems?

3. What percentage of summer lawn problems in Colorado are related to irrigation amount/frequency, or other aspects of lawn irrigation?

4. If a client tells you that they get the SAME problem every year, in the same part of the lawn, what are some potential causes of the lawn problem?

5. What is the proper way to obtain a sample of turf for diagnostic purposes? How should it be stored and transported?

6. What do you tell a client who believes that "fungus" has been tracked onto their lawn by a lawn care company's mowing or aeration equipment?

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CMG GardenNotes #551

Basic Turf Management

Outline:

Reasons for Lawn Problems…

Although there are many specific reasons to which one could attribute lawn problems, the most common general reasons include:

- Poor management decisions (soil compaction, improper mowing, irrigation, fertilization, pest management)
- Using poorly adapted species or cultivars. Limitations in resources (water, time/labor, dollars)

Mowing

The two most important facets of mowing are mowing **height** and **frequency**. The **preferred height** for all species in a lawn is two and half to three inches. Mowing to less than two inches can result in decreased drought and heat tolerance (due to shallow rooting and reduced photosynthesis) and encouraged weed invasion. Higher encourages insects, diseases, and weeds. Mow the lawn at the same height all year. There is no reason to mow the turf shorter in late summer or in the fall.

Mow the turf often enough so no more than one-third of the grass height is removed at any single mowing. This may mean mowing a bluegrass or fescue lawn every three to four days during the active spring growth period, but only once every seven to 10 days at other times of the year when growth is slowed by heat, drought or cold. If weather or another factor prevents mowing at the proper time, raise the height of the mower temporarily to avoid cutting too much at one time. Cut the grass again a few days later at the normal mowing height. [Figure 1]

Figure 1. Mow often enough that no more than 1/3 of the grass height is removed in any single mowing.

Let **grass clippings** fall back onto the lawn while mowing, unless they are to be used for mulching elsewhere in the landscape. Grass clippings decompose quickly and provide a source of recycled nutrients (equivalent to 1 to 1½ fertilizations per year) and organic matter for the lawn. Although a mulching or recycling mower makes this easier to do, clippings can be recycled into the lawn using any mower (as long as the 1/3 rule of mowing frequency is used). Grass clippings do not contribute to thatch accumulation.

Lawn Clippings and Surface Water Pollution

Lawn clippings and leaves mowed, swept, or blown onto the street are the major source of phosphorus pollution in urban lakes and streams. With side discharge lawnmowers, mow in a direction to prevent clippings from being blown onto the street, driveway, and other hard surfaces. Do not sweep or blow lawn clippings into the gutter and street. [Figures 2 and 3]

Figure 2. In a Minnesota study, 60 to 80% of the phosphate loading of surface water in an urban setting came from lawn clippings and leaves that were mowed or blown into the streets.

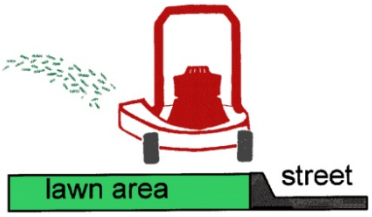

Figure 3. When mowing the lawn, mow in a direction to prevent clippings from being blown into the street.

Also, leave an unmowed grass buffer strip edging any lakes, streams, ponds, and wetlands. [Figure 4]

Figure 4. To reduce surface water pollution, leave an unmowed buffer strip around lakes, streams and ponds.

In a natural setting, rain and snowmelt absorbs mostly into the soil. Air-borne pollutants and pollen washed out of the air are broken down by soil microorganism activity. The nitrogen and phosphorus released from the decay of grass, leaves, and other organic matter recycle back into the soil.

However, in the landscape setting, the water cycle is greatly changed by large areas covered by hard surfaces (streets, driveways, walks, parking lots, compacted soils, and buildings). In a typical landscape setting 55% of a rainfall moves as surface runoff, compared to only 10% in a naturalized setting. Nutrients from grass and leaves (along with fertilizers, pesticides, and other water-soluble pollutants) readily wash off the hard surfaces into the storm sewer system. Here the pollutants end up in local streams, ponds, and lakes.

Fertilization

Selecting a Lawn Fertilizer

Nitrogen (N) is the most important nutrient for promoting good turf color and growth. However, do not over-stimulate the turf with excess nitrogen, especially during the spring and summer. Over-fertilization can contribute to thatch buildup with some species, as well as increased mowing and irrigation requirements. Under-fertilization of some species (bluegrass and ryegrass, for example) can result in poor turf color and turf thinning, which can encourage weed and disease problems. Turf species differ in both the amount of nitrogen required to keep them healthy, as well as the best time of the year to fertilize them.

Balanced or complete fertilizers contain various amounts of phosphorus, potassium, iron, and sulfur. They are a good safeguard against a potential nutrient deficiency and there is no harm in using a “complete” fertilizer. However, if you leave clippings on the lawn, these nutrients are recycled back into the lawn, so there is little likelihood of seeing these deficiencies. Besides nitrogen, the most commonly deficient nutrient in lawns is iron (Fe).

Organic fertilizers will work as effectively as synthetic types. However, it is important to understand the release characteristics of the different fertilizers so that they can be used at the correct times of the year. Organic fertilizers typically release nutrients more effectively when soils are warm and moist. Many synthetic

types work well when soils are cooler, but some synthetic types work like the natural organic sources.

Better lawn fertilizers include a quick release form of nitrogen for quick green-up, plus slow-release forms of nitrogen for sustained greening. Examples are listed in Table 1.

Table 1. Example of Quick and Slow Release Fertilizers

Quick-Release Nitrogen for fast green-up	Slow-Release Nitrogen for sustained green
Ammonium sulfate	Resin-coated urea
Ammonium nitrate	Sulfur-coated urea
Potassium nitrate	Isobutylidene diurea (IBDU)
Urea	Methylene urea
	Urea formaldehyde
	Compost and manure
	Poultry waste
	Poultry feathers

When to Fertilize and How Much to Apply

The natural grass growth cycle influences proper fertilization time for lawns. Figure 5 illustrates typical root and shoot growth patterns of cool season turfgrass species. [Figure 5]

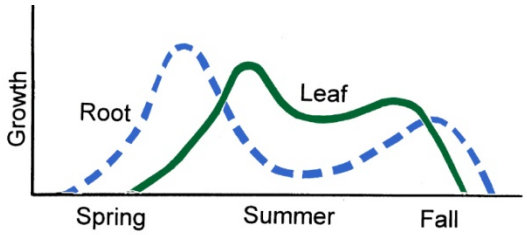

Figure 5. Growth cycle of roots and shoots for cool season turf.

Figure 6 on the right illustrates the influence on shoot growth when nitrogen fertilizer is applied. Heavy spring fertilization promotes shoot growth, reducing carbohydrate energy reserves and stress tolerance. [Figure 6]

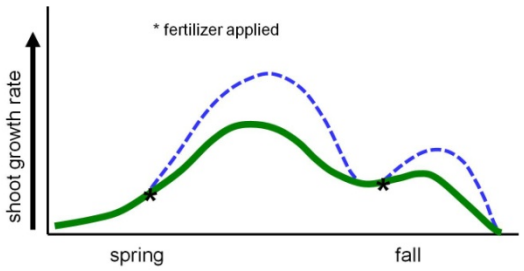

Figure 6. Influence on shoot growth for nitrogen fertilization.

Benefits of Fall Fertilization on Cool Season Home Lawns

- Enhances storage of carbohydrate energy reserves
- Strengthens root system
- Increases shoot density
- Increases stress tolerance
- Better fall and winter color
- Earlier green-up in spring

Timing and Application Rate

Timing and application rates are given in Table 2. If lawn clippings are returned to the lawn, reduce application rate by ¼ to 1/3.

Table 2. Fertilizer Application Schedule for Established Colorado Lawns[1, 2]

Turfgrass species		Mid-March to April[3]	May to mid-June	July to early August	Mid-August to mid-September	Early October to early November[4]
(Nitrogen application rates are in pounds of nitrogen per 1,000 square feet of lawn area.)						
Cool Season Species	High maintenance Bluegrass and Ryegrass	½ to 1	1	Not required	1	1-(2)
	Low Maintenance Bluegrass	½	½-1	Not required	1	(1)
	Turf-Type Tall Fescue	½	½-1	Not required	1	(1)
	Turf-Type Fine Fescue	½	½-1	Not required	½-1	Not required
Warm Season Species	Buffalograss, Blue Grams, and Bermudagrass	Apply no N	½-1	½-1	Apply no N	Apply no N

1 Nitrogen applications can often be reduced by 1/4/ to 1/3 when grass clipping are returned to the lawn during mowing. Nitrogen and other nutrients contained in the clippings are recycled to the lawn as they decompose. **Grass clippings do not contribute to thatch accumulations in lawns.**

2 On sandy soils, use slow-release nitrogen fertilizers (sulfur-coated ureas, IBDU, and natural orgainic-based fertilizers) throughout the year to reduce the potential for leaching loss. On very sandy soils, do not fertilizer turf after late September. Nitrogen can leach into ground water during the winter months.

3 The March-April nitrogen application may not be needed if fertilized in late fall (September to November) the previous years. If spring green-up and growth is satisfactory, delay fertilizing until May or June.

4 Make the final fall nitrogen application (October-November) while the grass is still green and at least two to three weeks before the ground begins to freeze. Optional N applications shown in (). Use extra nitrogen applications where a higher quality turf is desired or on a heavily used turf.

Fertilizers and Water Pollution

Home lawn management techniques play a significant role in protecting or polluting surface water. Popular press has incorrectly labeled lawns as a major contributor to water pollution. It is not the lawn, but rather the management style of the gardener that become the problem.

Fertilizers and pesticides (herbicides, insecticides, and fungicides) spread onto hard surfaces (driveways, sidewalks, streets, and compacted soils) will move with surface water into neighboring lakes, streams, and ponds. (Surface water running down the street gutter is not treated before release into local lakes, streams, and ponds.)

However, phosphate fertilizer applied to a lawn or garden soil is bound to the soil and does NOT leach into ground water. The phosphate could move into surface water with soil erosion.

Organic fertilizers are not necessarily safer for the environment. The pollution potential is based on where the fertilizer is applied and application rates. Any fertilizer becomes a potential pollution problem when over-spread into hard surfaces. Over application of both manufacture and organic fertilizers have been linked to ground water contamination.

Potential pollution problems arise from the careless application rather than the type of fertilizer applied. In most Western soils, lawns do not need phosphate fertilizers.

Irrigation

Many factors influence lawn water requirements, and no two lawns will have exactly the same needs. Table 3 gives the typical water requirement (rain plus irrigation) per week. A healthy, high-quality bluegrass or ryegrass lawn may require up to 2 to 2.25 inches of water per week under hot, dry, windy summer conditions; but may require much less when the weather is cool or cloudy. Turf-type tall fescue may perform well with less irrigation than a bluegrass lawn, if it can grow a deep root system and the soil in which it is growing is holding usable water. In many cases, however, a tall fescue may require as much water as bluegrass to look good. [Table 1]

Table 3.
Typical Water Requirement (Rain Plus Irrigation) for Colorado Lawns

	Late April	May & June	July & August	September	Early October
Inches of water per week (irrigation plus rain)	0.75”	1.0”	1.5”	1.0”	0.75”

Buffalograss and blue grama lawns can remain green for weeks without watering, even during the hottest summer weather, with rainfall.

Shady lawns (not in the rooting zone of large trees) and areas protected from the wind require less water over the growing season than more exposed turf. However, the roots of mature trees and shrubs also need water. You may have to water more in mature landscapes where the roots of many plants compete for water. Healthy turf encouraged by proper mowing, fertilizing, and cultivation, uses water more efficiently.

How Much Water?

Each time you water the lawn, apply enough water to moisten as much of the root zone as possible. Use a soil probe or shovel to determine what the average rooting depth is in your lawn. If the roots grow down 6 inches deep, water so the soil is moistened to that depth. It is important to know not only how deep the turf roots grow, but also how deep your irrigation water penetrates. Watering too deeply, especially on sandy soils, wastes water and allows it to percolate past the root zone. [Figure 7]

Figure 7. Typical water (rain plus irrigation) is given in Table 5. However, actual water use jumps around from day to day based on temperature, wind, humidity, and solar radiation (sunny or cloudy).

How Often Should a Lawn be Watered?

Grass growing on a sandy soil must be watered more often than the same grass growing on clay or loam soils. Even after a thorough watering, sandy soils hold little plant-available moisture. They require more frequent irrigation with smaller amounts of water.

Conversely, turf growing on clayey soils can be irrigated less frequently, with larger quantities of water. Watering less often means more efficient water use because of less loss to evaporation. It can also reduce the number of weeds that appear in the lawn. With most soils, do not apply all of the water in a short period of time. If applied too quickly, water will run off of thatchy turf, from sloped areas, or from turf growing on heavy clay or compacted soils. In these cases, it is more effective to apply only a portion of the water and move the sprinkler or switch to another station to water another section of the lawn. Cycling through irrigation stations (“soak cycles”) will promote infiltration and reduce runoff and puddling in low spots. This allows water to soak into the soil rather than run off.

Core cultivation (aeration) can resolve some infiltration problems by reducing thatch and compaction. Wetting agents may enhance water movement into the soil, but they should not be considered a cure-all, especially when compaction and thatch are problems.

What are Some Signs that Turf Needs to be Watered?

A sure sign that turf requires irrigation is a wilted appearance. One symptom is “footprinting,” where footprints on the lawn that do not disappear within an hour or so following traffic. This symptom is soon followed by actual wilting, where

the turf takes on a grayish or purple-to-blue cast. If only a few such spots regularly appear in the same general location, spot water them to delay watering the entire lawn for another day or so. These indicator spots help predict that the entire lawn will soon need watering.

A hardened or toughened lawn, attained through less frequent, deep irrigation, often withstands minor drought and generally has fewer disease problems. It is important, however, that the turf not be allowed to become overly drought-stressed between waterings. This weakens the turf and makes it more susceptible to insect and disease damage and to weed invasion.

During extended dry periods from late fall to spring, it may be necessary to "**winter water**" every four to six weeks if the ground is thawed and will accept water. Pay particular attention to exposed slopes, sites with shallow soil, and south- or west-facing exposures, where winter mites may infest and kill drought-stressed turf during the winter and early spring.

The most efficient **time of day** to water is late evening and early morning (between 9 p.m. and 9 a,m.). It generally is less windy, cooler, and more humid at this time, resulting in less evaporation and more efficient use of water. Water pressure is generally better, optimizing sprinkler distribution patterns. Contrary to popular belief, watering at night (after 9 p.m.) does not encourage disease development in turf.

Thatch

Thatch is a tight, brown, spongy, organic layer of both living and dead grass roots and stems that accumulates above the soil surface. Factors that lead to thatch problems include the following: [Figure 8]

- **Sod over compacted soil** – When sod is laid over compacted soils, a thatch problem will develop in a couple of years.
- **Soil compaction** is a common contributor to thatch build-up as it slows the activity of soil microorganisms.
- **Over fertilization** is a common contributor to thatch build-up as the lawn may be growing faster than the microorganism can break it down.
- **Grass species** – Thatch tends to be a problem on Kentucky bluegrass, bentgrass, and fine fescue lawns. It is rarely a problem with tall fescue or buffalograss.
- **Frequent heavy irrigation** may contribute to thatch as lower soil oxygen levels slow the activity of soil microorganisms.
- **Pesticides** – Excessive use of some pesticides may also slow soil organism activity.

Figure 8. Thatch is a tight, brown, spongy, organic layer of both living and dead grass roots and stems that accumulates above the soil surface.

Grass clippings do not contribute to thatch accumulation and should be returned to the lawn during mowing to recycle the nutrients they contain.

Measure thatch depth by removing a small piece of turf, including the underlying soil. Up to ½ or ¾ inch of thatch is acceptable and will enhance traffic tolerance. The thatch depth can increase quickly beyond this point, making it difficult to control later. As the thatch layer thickens, it becomes the main rooting medium for the grass. This predisposes the turf to drought stress or winterkill and increases the possibility for insect, disease and weed problems. In addition, fertilizers and pesticides applied to a thatchy lawn work less effectively.

Power Raking for Thatch Management

This method of thatch removal has been used for years. Light (shallow) power raking may be beneficial if done often. Deep power raking of a thatch lawn can be damaging, and often removes a substantial portion of the living turf. Used properly, power raking of wet, matted turf can speed spring green up by letting air move into the root zone and warm the turf. Compost all removed thatch and organic material to kill any living grass before it is used as a mulch or soil amendment.

Core Cultivation or Aerating.

This can be more beneficial than power raking. It helps improve root zone conditions by relieving soil compaction, while controlling thatch accumulation. Soil compaction, in fact, is one factor that contributes to thatch buildup. Aeration removes plugs of thatch and soil two to three inches long (the longer, the better) and deposits them on the lawn. Enough passes should be made to achieve two-inch spacing between holes.

What is done with the cores is a matter of personal choice. From a cultural perspective, there may be an advantage to allowing the cores to disintegrate and filter back down into the lawn. Mingling soil and thatch may hasten the natural decomposition of the thatch. The little fluffs of thatch and turf that remain behind can be collected and composted. Depending on soil type, core disintegration may take a few days to several weeks. Irrigation helps wash the soil from the cores. Running over dried cores with a rotary mower can be effective but will dull the blade. If the cores are removed from the lawn, compost before using as a mulch or soil amendment.

Soil Compaction

Soil compaction is the most common problem in lawn quality. With reduced soil oxygen levels, rooting systems will be more shallow. With compaction, the grass roots have reduced access to water and nutrients. Irrigation and fertilization will need to be light and more frequent.

Aerating (removing plugs) once or twice a year will help reduce soil compaction in an established lawn area if enough passes are made to yield plugholes at two-inch intervals. The best time of year to aerate a lawn is late August to late September,

as fewer weed seeds germinate this time of year. Aerating the lawn area around a tree is also the best method to promote tree vigor. [Figure 9]

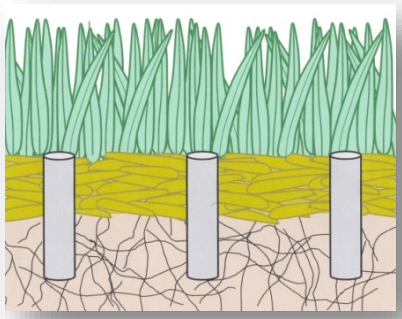

Figure 9. Core aeration helps reduce soil compaction when enough passes are made over the lawn to yield plugholes at two-inch intervals.

Weed Management

Lawn weed killers provide only temporary control if management factors that favor weeds are not addressed. In a thin turf with heavy traffic, weed problems may intensify following the use of weed killers. When the weeds (which help absorb the wear and tear of foot traffic) are removed with weed killers, the lawn may thin. The thin lawn opens the soil to increased weed problems.

Soil compaction is the primary cause of weed problems. Weed management factors include the following.

Core aeration – Soil compaction favors weeds and discourages lawn growth. Common lawn weeds including annual bluegrass, black medic, chickweed, clover, crabgrass, knotweed, prostrate spurge, and plantain thrive in compacted soils. Clover may be a good companion crop for lawns in compacted soils, filling in between the thin grass.

Mowing – High mowing height (shading) and frequent cutting discourages weeds.

Watering – Deep, infrequent watering will drought out many common shallow rooted lawn weeds. [Figure 10]

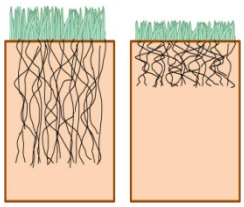

Figure 10. Deep infrequent watering will drought out many common shallow root lawn weeds.

Limited fertilizer – A thick, actively growing turf chokes out most weeds. However, fertilizer will not thicken up a turf when soil compaction is the growth-limiting factor.

For additional information on turf weed management, refer to these CSU Extension Publications available online at www.cmg.colostate.edu.

- ***Annual Grassy Weed Control in Lawns***, Extension Fact Sheet #3.101

Insect and Disease Management

In semi-arid climates like Colorado, turf insect and disease problems are minimal, compared to other areas of the nation.

Frequent use of lawn insecticides may increase the occurrence of lawn insect problems. Some garden insecticides have a potential to kill birds feeding in the treated areas (refer to the insecticide label). Thus, avoid unwarranted treatments of lawn areas.

When controlling soil insects, the insecticide must be watered into the root zone to be effective. Some insecticides get heldup in the thatch and do not water in effectively.

In semi-arid climates like Colorado, lawn diseases are minimal, compared to other areas of the nation. With Colorado's dry climate, fungicides do little to nothing for home lawn disease management. Cultural practices (fertilizer, watering, and soil compaction) are the keys to disease management. [Table 3]

Table 3. Influence of Cultural Practices on Kentucky Bluegrass Diseases

	Soil Compaction	High N	Low N	Thatch	Irrigation	Mowing
Asochyta Leaf Blight	yes	yes		yes	timing	yes
Necrotic Ring Spot	yes	yes		yes	drought with heat	yes
Leafspot and Melting Out	yes	yes	yes	yes	timing (wet/dry cycle)	yes
Gray Snow Mold	yes	yes				
Dollarspot	yes		yes	yes	drought	low
Stripped Smut			yes	yes		
Fairy Ring	yes		yes	yes		

Authors: Tony Koski, PhD, Extension Turf Specialist, and David Whiting, Extension Consumer Horticulture Specialist (retired); Department of Horticulture & LA; Colorado State University. Artwork by David Whiting and Tony Koski; used by permission.

- Colorado Master Gardener *GardenNotes* are available online at www.cmg.colostate.edu.
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MASTER GARDENER
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CMG GardenNotes #552

Broadleaf Weed Control in Lawns

Outline:

Dandelion, clover, plantain and other broadleaf weeds are among the most common and troublesome turf pest problems in lawns. Even though most broadleaf weeds can be easily controlled with herbicides, a completely weed-free lawn is neither practical nor environmentally sensible. A safe and sound approach to lawn weed control is to grow a healthy lawn, spot-treat weeds with the correct weed control product as they appear, and avoid the temptation to have a 100% weed-free lawn.

The best way to minimize weed problems in your lawn is through the use of good cultural practices: proper mowing height and frequency, sensible fertilization, and adequate irrigation. On the other hand, lawn weeds are encouraged by: mowing your lawn too short or not often enough; fertilizing too much, not enough, or at the wrong time of the year; and over- or under-watering.

Where Do Lawn Weeds Come From?

- Seeds of broadleaf weeds occur naturally in all soils, and can persist for 30 or more years. They will germinate when a lawn is thin and not healthy, when the seeds are brought to the surface by human or pet traffic, or when the turf is damaged or killed by drought, heavy traffic, insect feeding, or disease activity.

- Cheap, low-quality grass seed often contain unwanted weed seed. If the seed label lists ANY weed seed as a component, DON'T buy it! The best quality grass seed (sold by professional seed suppliers) will almost always be 100% weed-free, and will often cost nearly the same as poor quality products which contains weed seed. READ THE SEED LABEL! The Weed Content of any grass seed you buy (expressed as a %) should be 0%.

- Weed seeds are often brought to a landscape in topsoil or low quality compost. Make sure that all soil or compost comes from a reputable supplier and is guaranteed to be weed-free.

Using Herbicides to Manage Lawn Weeds

The most common herbicide choice is a general- purpose mixture comprised of two or three of the following individual herbicides or active ingredients: 2,4-D; MCPP (mecoprop); and dicamba (Banvel). Multiple active ingredients will control a wider spectrum of broadleaf weeds, than a single active ingredient. Read and follow all directions on the herbicide label if you choose to apply a herbicide to your lawn.

The best time to apply a general-purpose broadleaf herbicide for the control of perennial broadleaf weeds such as dandelion, plantain, and clover is early-September to early November. As winter approaches, perennial broadleaf weeds are storing energy reserves in stems and roots; a fall-applied herbicide will enter the plant and travel to these plant parts with the food reserves. The second best time is in the late spring or early summer period after the weeds have flowered. If applying in the late spring, be extremely cautious with these herbicides near ornamentals, trees, flowers, and vegetable gardens because these plants can be damaged by these herbicides through direct application, drift, and/or volatilization (the herbicide turns into a vapor). This is another reason why we prefer to apply these herbicides in the fall.

- If you only have a few weeds in your lawn, simply spot-apply a herbicide rather than applying to the entire lawn. Apply just enough to wet the leaf and do not apply to the point that the herbicide is dripping off the leaf.
- Apply to actively growing, preferably young weeds.
- Do not apply herbicides when the soil moisture is low and weeds are drought-stressed; an actively growing, healthy, non-stressed weed is the easiest one to control.
- Apply herbicides on a calm, clear day when the air temperature is between 50 and 85F; applying when temperatures exceed 90^{o} F increases the potential for volatilization injury to other plants in the landscape.
- Don't apply if rainfall will occur within 12 hours; avoid applying irrigation for at least 12 hours following a herbicide application.
- Don't mow the lawn for 2 days before and after the herbicide application.
- Do not apply to new turfgrass seedlings until the grass has been mowed at least three times.
- Delay applying a broadleaf herbicide to new sod for 4 to 5 weeks after planting.

Summer Broadleaf Weed Management

Summer annual broadleaf weeds (e.g., spurge, knotweed, purslane, etc.) are very difficult to control for a number of reasons. Depending on the species, these weeds germinate at different times during the summer and mature in a very short period of time. Thus, a single application of herbicide might only control a single weed species because other species have not germinated or have grown

too large to be controlled. Summer annual weeds often have a thick, waxy cuticle layer on their leaf surface to prevent water loss; this layer may also make it more difficult to get herbicide into the weed.

Some annual broadleaf weeds can be effectively controlled by preemergence herbicides. For example, summer annuals like spurge, knotweed, purslane and puncturevine can be controlled with products containing prodiamine, pendimethalin or isoxaben.

Difficult-to-Control Weeds

Weeds such as bindweed, thistles, and wild violets are difficult to control because they spread by underground stems. Multiple herbicide applications may be necessary to completely control difficult perennial weeds, including dandelions. Post-emergence broadleaf herbicides containing 2,4-D, MCPP, dicamba, triclopyr or sulfentrazone should be used.

Author: **Tony Koski,** Ph.D., Extension Turf Specialist, Department of Horticulture & LA, Colorado State University Extension.

- For additional information on lawn care, refer to csuturf.colostate.edu.
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December 2010

MASTER GARDENER
COLORADO STATE UNIVERSITY
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CMG GardenNotes #553

Dog Urine Damage on Lawns:
Causes, Cures and Prevention

Outline:

Urban Legends About Urine Damage

Dog urine damage is a common problem for home lawns, and one that has generated numerous home remedies and commercial products claiming to be cures for the spots. This lawn problem is misunderstood when it comes to causes and cures. Dog spotting on turfgrass is caused by the deposition of a high concentration of nitrogen (N)-containing compounds and associated salts on a small area in the lawn. These deposits are often concentrated in a relatively small portion of the lawn, resulting in turf injury or death. Some common "urban legends" surrounding dog urine damage to lawns are:

- **Only female dogs cause spotting in lawns.**

  FALSE. Dog spotting in lawns is most often caused by dogs that squat when they urinate, thus depositing a large volume of concentrated urine in a small area. Most "squatters" are female dogs, but some males do this as well, especially in their own yard. Many male dogs tend to "mark" vertical objects in the landscape (trees, posts, etc.), which presents problems for landscape plants.

- **Dog spots are more common with certain breeds of dogs.**

  MOSTLY FALSE. Dog spotting is more likely to occur (or be more obvious) with larger dogs, since they produce larger amounts of urine. Dog spots can occur with smaller breeds, especially if the dog tends to urinate in a limited area of the lawn.

- **Dog spots occur because urine is alkaline (has a pH above 7.0).**

  FALSE. Dog spots occur because a high concentration of N and salts has been deposited in a very small area of the lawn. In some cases, the added N causes dark green spots and rapid grass growth, without injuring the grass. In other cases, the result is a brown spot – often surrounded by a halo of dark green grass. The browning is caused by the concentrated nitrogen deposited in the center, which burns the leaf tissue, and may or may not cause tissue death. The lower concentration of salts on the periphery fertilizes the grass – resulting in a darker green ring.

- **Dog spots can be prevented by using food supplements that acidify a dog's urine.**

  FALSE. Dog spots do not occur because a dog's urine is alkaline. Products advertised to "naturally" reduce urine alkalinity (including the amino acid, dl methionine, also known as methioform) may cause urinary system problems and can affect calcium deposition in growing bones of younger dogs. The addition of baking soda, potassium citrate and other salts are likewise not recommended as curatives for dog spots. A veterinarian should always be contacted before giving a dog a food supplement known to affect urine pH. There are medically sound reasons for altering urine pH, but the prevention of dog spots in lawns is not one of them. *There are no dietary supplements that have been scientifically proven to reduce either the incidence or severity of dog spotting in lawns.*

- **Dog spots can be "cured" by sprinkling the affected area with baking soda, gypsum, dishwashing detergent, etc. to neutralize the urine.**

  FALSE. The only "product" that can neutralize the urine's negative effects is water. Gypsum and baking soda (sodium bicarbonate) are salts and may compound the problem. Dishwashing detergents, which act as wetting agents or surfactants, may enhance water movement into and through the soil. While this theoretically could promote leaching and dilution of accumulated salts, some dishwashing detergents can burn grass plants.

Dealing with Dog Spots

What can be done with the dog(s)?

- Train the dog to use a non-turf area in the landscape, such as an area covered with mulch or gravel, or select a location where dog spotting will not become an aesthetic problem and damage can be tolerated. *This is the ONLY sure solution for the problem!*

- Always provide adequate water for your pet; increased water consumption will dilute urine, reducing the potential for turf injury.

- While the addition of salt, garlic, tomato juice and other "home remedies" to your pet's food can increase water consumption (thus diluting their urine),

your veterinarian should always be consulted before doing so. The increased salt intake can cause problems for older dogs, as well as for those with heart or kidney conditions.

- Except for the addition of water to a dog's food, no additive or supplement should be fed to your pet without first consulting with your veterinarian. Certain additives may increase a dog's water intake, but can have detrimental and unintended consequences for its health.

If the affected spots are green and grass growth is stimulated (no browning is apparent):

1. Increase nitrogen fertilization frequency and/or the amount of fertilizer to help mask the urine-induced stimulation of growth and color; dark green spots will be especially visible on lawns that are not receiving adequate nitrogen fertilization.

2. Maintain adequate irrigation to prevent accumulation of salts in the soil; drought or lack of water can allow salts to accumulate and injure or kill turf.

If the affected spots are brown, (the turf may or may not be dead):

1. Increase irrigation amount and/or frequency to help dilute salts that have accumulated in the soil. This may help still-living turf recover, and will dilute salts in those areas where the turf has been killed (allowing for more effective re-seeding).

2. When turf has been killed, the dead sod and some soil (0.5-1 inch of soil) can be removed. Re-sod the area with new grass.

3. Individual dead/damaged spots can be re-seeded as follows:

    - In a **Kentucky bluegrass lawn:** Spot seed with Kentucky bluegrass (marginally effective) or perennial ryegrass (more effective). Tall fescue, K31 tall fescue, "dwarf" fescue, or annual (Italian) ryegrass should NOT be used for spot-seeding a bluegrass lawn.

    - In a **tall fescue lawn:** Spot seed with turf-type tall fescue (sometimes called "dwarf" fescue). Perennial ryegrass can also be used, but it has a finer texture and the newly seeded spots will look different from the rest of the lawn. Do NOT use K31 fescue or annual (Italian) ryegrass for spot-seeding a tall fescue lawn.

    - **Fine fescue lawns:** Seed with fine fescue seed. The use of perennial ryegrass or tall fescue is NOT recommended, as the spots will have a different color, texture, and growth rate.

    - **Zoysiagrass and bermudagrass lawns:** Patch using sod from a sod farm, or by transplanting sod from an inconspicuous area of same the lawn.

Consult your veterinarian before supplementing a pet's diet with any product or food additive claiming to reduce dog spots in lawns. Similarly, no "spray-on" product for lawns, claiming to prevent or "cure" dog spots, has been scientifically proven to be effective.

Authors: *Alison Stoven O'Connor, Ph.D, CSU Extension Horticulture Agent, Larimer County; and Tony Koski, Ph.D., Extension Turf Specialist;* Colorado State University Extension.

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MASTER GARDENER
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CMG GardenNotes #554

Earthworms and Nightcrawlers
In The Home Lawn

Earthworms and nightcrawlers can be considered beneficial in lawns because they aid in the decomposition of turfgrass thatch and grass clippings, which helps to recycle nutrients and organic matter into a lawn's soil. The tunneling and burrowing caused by earthworm activity provides a natural cultivation effect which helps oxygen and water to enter the turf root zone more easily.

Earthworms are sometimes regarded as pests because their burrows and ejected waste material, called castings, can cause a lawn surface to become anywhere from slightly to extremely bumpy. The bumpy, uneven surface can be difficult to mow and walk on. Extreme earthworm activity can sometimes cause lawns to become less dense, especially when earthworms are active in shady parts of the landscape.

Several species of earthworms are found in the U.S. The nightcrawler, *Lumbricus terrestris* Linnaeus, and the red earthworm, *Lumbricus rubellus* Hoffmeister, are the most common larger species. Smaller species belong to the genera *Allolobophora* and *Eisenia*. Earthworms are generally found in the top 12" to 18" of the soil because this is where food is most abundant. The worm ingests soil and organic matter that is swallowed and ground in the gizzard. The castings are used to line the burrow or are deposited on the lawn's surface, at the burrow's entrance, which causes the lawn's surface to become bumpy. Earthworm activity is greatest when soil is warm and moist, becoming active when soil thaws in the spring. The worms will move deep into the soil if it becomes dry during the summer.

Pesticide Use and Earthworms

Compared to turf pesticides used during the 1930s to the 1970s, those used on lawns today are unlikely to kill, discourage, or otherwise negatively affect earthworm populations. Applications of insecticides, with the goal of reducing or eliminating earthworm activity, will not affect earthworms and are NOT recommended. When used as recommended, label rates, herbicides and fungicides will not adversely affect earthworms in lawns.

Reducing Earthworm Activity in Lumpy Uneven Lawns

In many lawns earthworm activity can cause the surface to become mildly to excessively lumpy and uneven. Where earthworm populations approach nuisance levels, some measures can be taken to discourage activity or to reduce the impact of earthworm activity on surface smoothness.

- Core cultivation of the lawn and spreading of the plugs throughout the lawn may cause some leveling of a severely bumpy surface.
- The use of heavy rollers to flatten the lawn surface can be effective. However, heavy rolling is likely to cause soil compaction and should be followed by core cultivation.
- Topdressing (spreading a thin layer of soil or other material) the bumpy lawn with soil/sand is not recommended as a way of smoothing the surface. Introducing layers of soil that differs from what is already present in the lawn can cause problems for water and air exchange on the lawn's surface. The creation of layers and interfaces on the lawn's surface can result in poor rooting and can complicate lawn irrigation because water uptake can be seriously reduced by soil layering. Applications of compost, on the other hand, can be useful as a temporary aid for smoothing the lawns surface.
- Earthworms prefer moist soil. Less frequent irrigation, that allows the soil surface to dry out between irrigation events, may reduce surface activity of the earthworms.
- Dethatching mowers, also known as power rakes, can be used to level the earthworm mounds. Adjust the power rake so that the teeth operate low enough to shave off the tops of the worm mounds, but not so low that the crowns and roots of the grass plants are pulled up. It is best to do this early in the spring, before the lawn has begun greening up.
- Applications of sulfur, ammonium sulfate, ammonium chloride, lime, gypsum, or other fertilizers will NOT reduce earthworm activity.
- Lawn care operators may not, by law, apply any pesticide for the purpose of controlling earthworms.
- Employees of Colorado State University may not recommend any pesticide application for the purpose of controlling earthworms in any turf area.

The presence of earthworms in the home lawn is an indicator of a healthy soil environment. Earthworms aid in the breakdown of thatch and other organic matter and create tunnels, which promote water infiltration, oxygen movement, microbial activity, and deeper grass rooting. Rich in nutrients, their castings are a combination of minerals moved from deep in the soil and from their main food sources: grass clippings and thatch. Although the bumpiness caused by earthworm mounds can be annoying, the homeowner should consider the benefits provided to their lawn's health and avoid the temptation to use pesticides to reduce or eliminate earthworm populations in the lawn.

Authors: Tony Koski, Ph.D., CSU Extension Turf Specialist, Department of Horticulture & LA. Reviewed September 2022 by Tony Koski.

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