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# SP535 Managing Trees and Turfgrasses

The University of Tennessee Agricultural Extension Service

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# Managing Trees and Turfgrasses

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Trees and turfgrasses commonly share the landscape, especially our lawns, cities, parks and roadsides. Both trees and turfgrasses require space, light, water, air, essential nutrients and an appropriate temperature for growth and survival. Turfgrass professionals often struggle to maintain quality turf under healthy trees. Tree managers often have problems sharing limited water resources with turfgrass. A tree canopy filters light and actively growing turfgrasses use substantial amounts of water. Trees and turfgrasses can be managed to get the best from both, when we understand their respective needs.

**Fundamental Requirements**

Fundamental requirements of trees and turfgrasses are the same. Shared resources include:

1. physical space, especially below ground;
2. clean air, especially oxygen and carbon dioxide, free of toxins, above and below ground;
3. light, both enough (duration and intensity) and of the appropriate wavelengths (quality);
4. water, the right amount delivered on time;
5. sixteen essential nutrients - carbon, hydrogen and oxygen from air and water, and 13 mineral nutrients supplied by the soil; and
6. minimum and maximum air and soil temperatures appropriate for growth and survival of both trees and turfgrasses.

Individual fundamental requirements deserve consideration when turfgrass/tree decisions are made. It is also important to consider site limitations and plant interactions, as resources are shared by trees and turfgrasses, both species and individuals. Available resources or resource "budgets" must be clearly understood if trees and turfgrasses are expected to co-exist.

Of the resources shared by trees and turfgrasses, light and water are the two most likely to impact the performance of each. For example, excessive shade severely limits turfgrass growth and stand density, while a lack of water stresses both trees and turf.

**Light**

Light is essential as a source of energy for green plants. Photosynthesis, the light-driven production of carbohydrates from carbon dioxide and water, occurs in chlorophyll containing plants including trees and turfgrasses. Light varies in duration, intensity and quality. Each plant requires a unique combination of these to survive and thrive.

Ross K. Clatterbuck

Magnolia tree pruned to remove lower branches that allows turfgrass to prosper.

Ross K. Clatterbuck

Magnolia tree with lower branches extending to the ground preventing sunlight for turfgrasses.

Compared to turfgrasses, trees generally do not have problems collecting sunlight. Turfgrasses, however, have a more difficult time. Turfgrass growth and survival is often dependent on the light passing through a tree's canopy.

As sunlight reaches a tree's canopy, it is either 1) absorbed by the leaves and used for photosynthesis, 2) reflected back into the atmosphere or 3) transmitted to plants (turfgrass) below. Transmitted light is less intense and certain wavelengths, especially visible light important for photosynthesis, are filtered by tree leaves. When the tree canopy provides solid shading, turfgrasses receive only indirect light, totally depleted of many of the wavelengths that result in healthy growth. Absorption, reflection and transmittance of light as it passes through a cottonwood (*Populus deltoides*) tree are presented in Figure 1. Notice that the dotted line, or light transmitted below the tree crown, is very low.

### The Shaded Environment

Shading reduces light intensity, alters light quality and subsequently lowers daytime temperatures. Relative humidity and carbon dioxide content of air may be elevated in a shaded environment. A tree canopy greatly reduces dew formation and restricts air movement over the turf surface. During extended periods of drought, shaded soils sometimes contain more water than those in full sun. Soils on the northeast side of trees are often cool and moist compared to those located in other areas of the landscape.

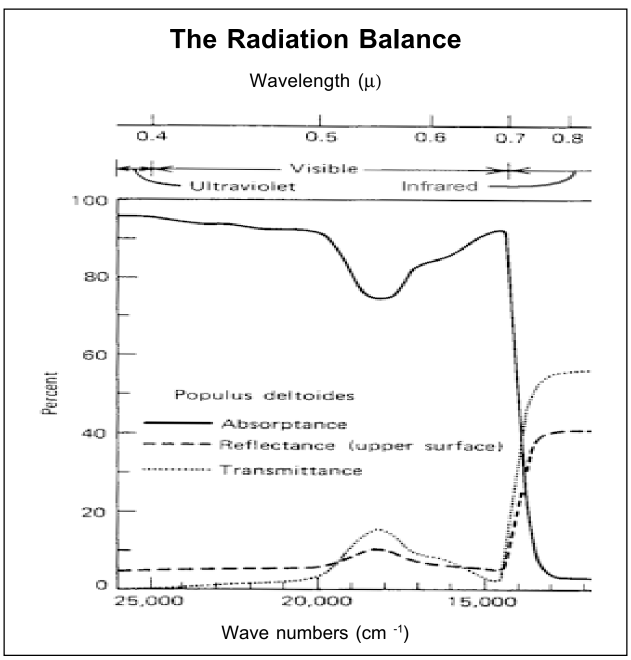


Figure 1. Percentage of wavelengths absorbed, reflected and transmitted through cottonwood leaves. (Adapted from Gates, David, "Energy exchange between organism and environment," in *Biometeorology*, ⌊ 1968, Oregon State University Press.)

**Table 1.** Shade Tolerance of Selected Turfgrasses

| Turfgrass Species | Shade Tolerance[1] |
|---|---|
| Warm-season | |
| Bermudagrass | Poor |
| Centipedegrass | Fair |
| St. Augustine grass | Fair to Good |
| *Zoysia* | Fair |
| Cool-season | |
| Chewings fescue (fine fescue) | Excellent |
| Hard fescue (fine fescue) | Excellent |
| Kentucky bluegrass | Poor |
| Sheep fescue (fine fescue) | Excellent |
| Red fescue (fine fescue) | Excellent |
| Tall fescue | Fair to Good |

[1] Scale in descending order = Excellent > Good > Fair > Poor

### Turfgrass Response to Shade

Heavily shaded turf is often weak and sparse, as turfgrass growth is limited due to low light intensity and energy reserves. Turfgrasses growing in very low light are often spindly, succulent and have few tillers compared to grasses in full sun.

### Shade Tolerant Turfgrasses

Although turfgrasses grow best in full sun, a few can tolerate reduced light. The fine fescues (chewings, hard, red and sheep fescues) have excellent shade tolerance and very limited heat tolerance (Table 1). Tall fescue is usually more tolerant of high temperatures than the fine fescues and is much less tolerant of shade. Kentucky bluegrass is also more tolerant of high temperatures than the fine fescues however, has poor shade tolerance. For more information, please refer to Extension PB 1213, **Managing Cool Season Lawngrasses in Shade**.

Among warm-season turfgrasses (temperature optimum between 80° to 95° F), bermudagrass is virtually intolerant of shade (Table 1). *Zoysia* performs best in full sunlight and may tolerate light shade for a limited time. Although St. Augustinegrass and centipedegrass often tolerate light shade, the adaptation of these two species is severely limited by a lack of low-temperature hardiness.

### Modifying the Shaded Environment

The intensity and quality of light reaching turf below isolated trees may be improved by creative pruning. Generally, at least two-thirds of a tree's total height should contain live branches. Regular pruning of the lower one-third, (removing drooping branches), however, is highly recom-

**Table 2.** Radiation Received Under Selected Shade Trees[1]

| Species | Transmitted radiation[2] |
|---|---|
| Hackberry | Low |
| Black walnut | Low |
| London plane (sycamore) | Low |
| Yellow-poplar | Low |
| Sugar maple | Low |
| White oak | Medium |
| Northern red oak | Medium |
| Shagbark hickory | Medium |
| Honey locust | High |

[1]Research supported ranking (McPherson, E.G., 1984. Planting design for solar control. In E.G. McPherson (ed.), Energy-Conserving Site Design, American Society of Landscape Architects, Washington, DC. )
[2]High=more light; medium=intermediate light; and low=less light

mended to allow sunlight to the turf below. Crown thinning can also be helpful to reduce the crown density and leaf area of the tree allowing more sunlight to filter through the crown.

Another consideration is to plant trees that allow more sunlight to pass through. For example, research indicates that maple and black walnut restrict far more radiation than honey locust (Table 2). Trees can also be selected based on shape to reduce the number of drooping branches that can intercept light at lower angles. Without maintenance, most of our common trees restrict enough sunlight to stress all but the most shade tolerant turfgrasses. Instances where tree cover is multi-layered as in a forest may preclude the use of any turfgrasses.

**Water**

In the top several inches of soil, trees and turfgrasses compete for water. The first plant species established is generally the most successful absorbing water from the soil since it is the first to occupy limited growing space. A large tree with a well-established root system can often absorb water better than a recently installed sod. Likewise, established turf will compete very effectively with a recently transplanted tree for available water.

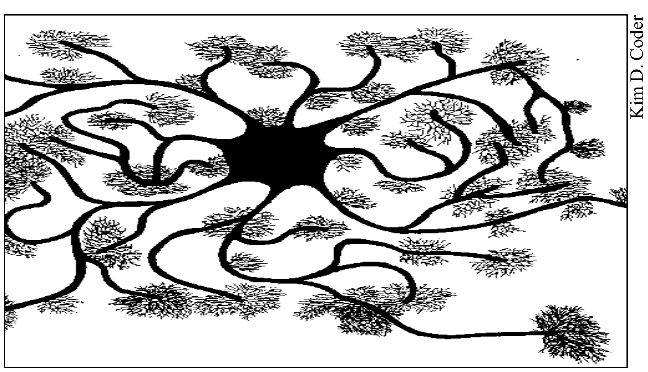


Figure 2. Horizontal soil slice of tree roots 6 inches below the surface.

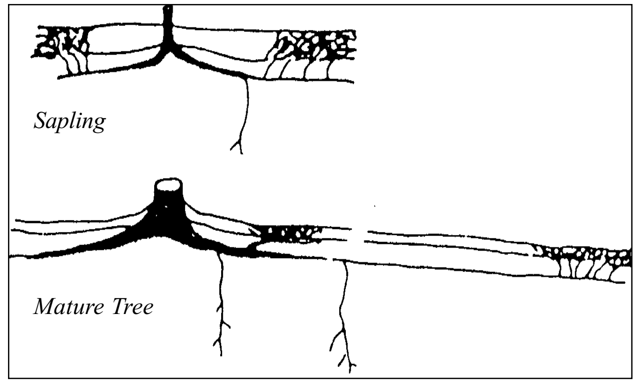


Figure 3. Side view of tree roots. Tree roots growing near the surface can extend well beyond the width of the crown. In this diagram the sapling roots are 22 feet away from the trunk while those of the mature tree extend more than 45 feet. (Adapted from Lyford, W. H. and B. G. Wilson, 1964. Development of the root system of *Acer rubrum* L. Harvard Forest Paper No. 10, Harvard University, Petersham, Mass. 17 pp.)

Tree roots are opportunistic and spread well beyond the width of the crown, wherever conditions favor growth and adequate oxygen is present in soils (Figure 2). This is generally in the top one foot of soil. Some tree roots will penetrate the soil to greater depths, depending on soil characteristics, especially texture (amount of sand, silt and clay) and bulk density. The majority of tree roots are located in the top few inches of soil. Many fine "absorbing" roots actually grow into mulch or thin stands of turf (Figure 3). As with turfgrasses, tree roots are often more dense on the north (shaded) side of the tree where the shade discourages rapid evaporation.

Regular, deep watering is very important for successful tree and turf management. Recently transplanted trees or turfgrass will need supplemental water, at least until an adequate root system develops. For large, transplanted trees, this may be necessary for the several growing seasons. Actively growing established trees and turfgrasses may require from 1 to 2 inches of water a week. Water may be provided with irrigation or natural rainfall.

***Management Considerations for Turfgrasses in Shade***

*1. Select, establish and maintain shade tolerant turfgrasses.* Use only those turfgrasses tolerant of the level of shade encountered (perhaps one of the fine fescues or mixtures of fine fescue species with similar leaf color).

*2. Raise the cutting height within the optimum range when mowing.* For fine fescues, this height is from 2 to 2 1/2 inches. The increased leaf surface resulting from an elevated


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Turfgrass can be maintained under large trees when trees are spaced widely apart and crowns do not extend near the ground.

height of cut will provide greater potential for light absorption by turfgrasses and increased carbohydrate production.

*3. Soil test.* Fertilization and liming according to soil test recommendations will ensure appropriate soil fertility and pH levels. Maintain high soil test levels of phosphorus and potassium.

*4. Irrigate deeply and infrequently.* Maintain adequate soil moisture levels by watering deeply to a minimum 6-inch soil depth. Minimize runoff by watering at a rate less than the water infiltration rate of the soil or by cycling the water source on and off until irrigation is complete. Do not water again until the first signs of drought stress (rolled leaf blades, bluish-gray color and footprinting).

*5. Aerify to relieve soil compaction.* Coring (core aerification) during the growing season will selectively cultivate soils, relieving soil compaction and promoting the movement of air, water and nutrients into soil.

*6. Interseeding*. Annual interseeding may be necessary to maintain turfgrass stand density in shade. Seeding cool season turfgrasses under deciduous trees in late summer (mid-August to mid-September) will provide the longest exposure to direct light before the tree's foliage returns the next year.

*7. Leaf removal.* Remove or recycle (mulching mower) fallen leaves and pine needles as soon as possible to reduce the amount of time light is excluded from turfgrasses.

*8. When turfgrasses will not survive in a shaded environment* due to severe light reduction, perennial, shade-tolerant ground covers (e.g. English ivy, myrtle and pachysandra) and mulches may stabilize soils and control erosion."Naturalizing" an area may be the simplest choice and, in the long term, the most cost-effective relative to time and money.

***Management Considerations for Trees When Turfgrass is Desired***

*1. Choose species of trees that have an open crown*, which allows sunlight to pass through the crown and reach the ground for use by turfgrass. Generally, large, full-crowned trees such as oaks and maples restrict sunlight penetration compared to smaller trees such as dogwood and redbud.

*2. Prune trees*. Prune lower branches to allow sunlight to penetrate from the side. Crown thinning is also recommended to allow more indirect light penetration from above.

*3. Single, solitary trees* have a greater chance for establishment and maintenance of turfgrass than a "forest" of trees where sunlight does not filter through a closed canopy.

*4. Control turfgrasses* around recently transplanted trees by applying a herbicide or broadcasting mulch (e.g. 1 ft. mulch radius for every 1 inch of tree caliper). Mulch should be no more than 3 inches thick when settled and at least 6 inches from the tree trunk. Transplanted trees will need the rootball watered more frequently than the general landscape.

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