

# Zoysiagrass for Florida Lawns<sup>1</sup>

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Zoysiagrasses (*Zoysia* spp.) were introduced into the United States from Asia and provide attractive turf throughout much of the United States. In recent years, newer cultivars of zoysiagrass have entered the market with improved insect resistance, accelerated establishment, and better overall performance.

Zoysiagrasses are adapted to a variety of soil types and have good tolerance to shade, salt, and traffic. When properly managed, they produce a very dense ground cover that resists weed invasion, but certain pests can be problematic. Zoysiagrasses spread through rhizomes and stolons.

Proper lawn maintenance practices are the best means for avoiding pest problems and maintaining a healthy lawn. Zoysiagrass requires proper fertility to maintain good cover and healthy growth characteristics. During certain times of the year, it may need supplemental irrigation, especially during periods of extended drought, to remain green. Pesticides may be needed periodically, but their use can be minimized if other cultural practices (mowing, irrigation, fertilization) are done correctly.

Zoysiagrass maintenance is different from that of other Florida lawn grasses. When improper maintenance practices are followed, undesirable results generally occur. Table 1 provides a quick comparison of zoysiagrass to other lawn grasses.

## Species and Cultivars

Several species and varieties of zoysiagrass are used for residential and commercial landscapes, athletic fields, and golf course greens, tees, fairways, and roughs. They vary widely in leaf color, texture, and establishment rate (Patton et al. 2017).

### Species

#### *Zoysia japonica* Steud.

This species was introduced into the United States in 1894 and is commonly called Japanese lawngrass or Korean lawngrass. Cultivars of this species are generally coarse-textured. Of all the zoysiagrasses, this species has a faster growth rate and exhibits excellent cold tolerance. It is easily mown using a rotary mower. *Zoysia japonica* is the only zoysiagrass for which seed is commercially available;

however, the seeded varieties generally do not produce as high-quality turf as do the vegetatively propagated (sodded or plugged) varieties. Seeded cultivars should be limited to use where convenience of establishment by seed is more important than quality.

#### *Zoysia matrella* (L.) Merr.

Also called Manilagrass, this species was introduced into the United States in 1892 from Japan. It produces a finer and denser turf than *Zoysia japonica* but is generally less winter hardy and slower growing. Manilagrass resembles bermudagrass in texture, color, and quality and is recommended for a high-quality, high-maintenance turf where a slow rate of establishment is not a disadvantage. Cultivars of *Z. matrella* typically have good to excellent shade tolerance and salt tolerance.

#### *Zoysia pacifica* (Goudsw.) M. Hotta & S. Kuroki

Also called Mascarenegrass or Korean velvetgrass, this species is the finest-textured and densest zoysiagrass available. It has good wear tolerance but poor cold tolerance and is only adapted to the central and southern areas of the state. It also produces an excessive thatch, giving it a puffy appearance. This species is often used for low-growing, ornamental specimen plants, especially in Asian-themed gardens, and not for lawns.

### Cultivars

Although information is available on the internet about many zoysiagrass varieties, not all information is pertinent to Florida's climate and environmental conditions. Based on research information and anecdotal observations, following is a summary of what to expect.

#### *Zoysia japonica* Cultivars

'El Toro' is an improved coarse-textured *Zoysia japonica* released in 1986 from California. It has a faster establishment rate, improved cool-season color, better drought resistance, and less thatch buildup than Meyer zoysiagrass. El Toro is also reported to have early spring green-up, more shade tolerance, and improved resistance to rust disease. It is susceptible to large patch disease.

'Empire' ('SS-500') is a popular coarse-textured cultivar. It has a very dense growth habit, maintains a nice green color, and has a good rate of establishment. Empire has

performed well in sandy and clay soil types. Its shade tolerance is like El Toro's and better than Meyer's. Empire is the most common zoysiagrass in Florida and does well throughout the state; however, it is susceptible to large patch disease.

'JaMur' is a medium-coarse-textured cultivar that has performed well in many areas and is available in Florida. It has a very attractive color and does well in moderate shade. JaMur has an excellent rate of establishment and performs well at the recommended height of cut using rotary mowers. It is susceptible to large patch disease.

'Meyer' ('Z-52', 'Amazoy®') is a medium-coarse-textured cultivar that has been in use since the 1950s and is often seen in ads as the "miracle grass." It has excellent winter hardiness; however, it is very slow to establish, and hunting billbugs and nematodes pose serious problems. It is susceptible to large patch disease. It is not produced in Florida and is not recommended for use.

'Palisades' is a coarse-textured zoysiagrass developed by Texas A&M University in 1996. It has more upright leaves compared to Empire and JaMur and is known for its excellent drought tolerance. It has a fast rate of establishment, and its shade tolerance is like JaMur's. Overall, it has good disease resistance but is susceptible to large patch disease.

'Zenith' zoysiagrass is a coarse-textured, seeded cultivar. Generally, the seeded cultivars do not perform as well as the vegetative cultivars. Zenith zoysiagrass is dark green but exhibits poor persistence in Florida due to its susceptibility to disease. Seed of Zenith is commercially available in Florida, but it is not recommended for use in Florida lawns.

### ***Zoysia matrella* Cultivars**

These four cultivars are very similar in appearance, have a very fine texture, and perform well at mowing heights that range from golf course putting green heights to 0.5". Their optimum height of cut is 0.25". These four grasses have limited availability in Florida and are recommended for use on golf courses or very high-end landscapes. They are extremely shade tolerant. 'Cashmere' was selected from a naturalized stand in Florida and entered the market in 1988. 'Diamond' was released from Texas A&M University in 1996 and is known for its high salt tolerance. It is used on putting greens on several golf courses in Florida. 'Toccoa Green™' ('BA-305') was released by the University of Florida in 2004. ('BA-305' was formerly marketed under the brand PristineFlora™.) It has a faster rate of growth and recovers more quickly from scalp damage. 'Trinity' is a more recently available cultivar that has exhibited good adaptability through Florida.

These three cultivars are fine-textured, dark green, and very similar in appearance. All three have limited

availability in Florida. 'Zorro' was developed by Texas A&M University. 'Zeon' is a popular zoysiagrass in many regions but is not as well adapted to Florida. All three have good shade tolerance and are good choices to replace bermudagrasses on golf courses where shade is a concern. They perform well at mowing heights ranging from 0.5" to 2.0". Disease issues include dollar spot and large patch.

'Thrive' is a fine-textured *Z. matrella* with limited availability in Florida. Its appearance resembles Geo, Zeon, and Zorro. Other than anecdotal evidence of good drought tolerance, very little information is available about its origins and suitability for use in Florida.

### ***Hybrid Cultivars***

'CitraZoy™' zoysiagrass was developed and released by the University of Florida in 2019. It is a hybrid between a well-adapted *Z. matrella* and *Z. japonica* with a medium-fine leaf texture between Meyer and the *Z. matrella* cultivars. It has slightly better shade tolerance than the *Z. japonica* cultivars and is less shade tolerant than the *Z. matrella* cultivars. It has good establishment, good sod strength, good wear tolerance, and the best winter color retention of any zoysiagrass on the market. Large patch has never been observed to occur on CitraZoy; however, it will get leaf spot. It is expanding in production with a few Florida producers at the time of publication.

'Emerald' zoysiagrass is a selected hybrid between *Zoysia japonica* and *Zoysia pacifica* developed in Tifton, Georgia, and released in 1955. This hybrid combines the winter hardiness, color, and faster growth rate of one its *Z. japonica* parent with the fine texture and density of its *Z. pacifica* parent. Emerald resembles Manilagrass (particularly Geo, Zeon, Zorro, and Thrive) in color, texture, density, and disease issues, but has better winter hardiness and wider adaptation.

'Icon™' zoysiagrass was developed in Australia and is a hybrid between *Z. macrantha* and *Z. japonica*. It is coarse textured and similar in appearance and uses to Empire, El Toro, Palisades, and JaMur. It has excellent sod strength, very high salt tolerance, and produces very little thatch in comparison to other zoysiagrasses. It has good availability in Florida, and large patch has not been observed in Icon.

'Innovation™' zoysiagrass was jointly developed and released in 2017 by Texas A&M University and Kansas State University. It is a hybrid between a *Z. matrella* and a cold-tolerant *Z. japonica*. Innovation is proven to have excellence winter hardiness with a finer leaf texture compared to Meyer. Its leaf texture is between Meyer and the *Z. matrella* cultivars. Currently, very little is known about its performance in Florida or disease responses, and it has limited availability.

## Establishment of Zoysiagrass

With one exception, zoysiagrasses must be planted vegetatively by sod, plugs, or sprigs. *Zoysia japonica* is the only species for which seed is commercially available. Proper site preparation before planting is critical to ensure successful establishment. Refer to ENH02, *Preparing to Plant a Florida Lawn* (<https://edis.ifas.ufl.edu/lh012>), for complete information.

### Seeding

Establishing zoysiagrass from seed is increasing in popularity. The seed, however, requires light for germination and cannot be covered with soil, as is normally recommended. Consequently, areas to be established by seed need to be covered with some type of erosion cloth to reduce any surface disruption caused by rain or irrigation. The best time to seed is during the period from April to July, because this permits a full growing season before winter weather. In north Florida, fall seeding is undesirable because the young seedlings may not become sufficiently established to withstand cold injury during the winter. It may take up to 2–3 weeks to germinate and an additional 6–8 weeks to establish. During this time, irrigation management is extremely important. After seeding, frequent, light irrigations are necessary to keep the soil moist and encourage germination. Maintain this moisture regime until the planted area is completely covered.

### Plugging

Because of the slow establishment rate of zoysiagrass (compared to St. Augustinegrass), plugs are usually planted on 8- to 12-inch centers. This means that plugs are planted every 8–12 inches in a row and rows are spaced 8–12 inches apart. Depending on the level of maintenance given, at least one full season (and longer for some varieties) is required for complete coverage and a uniform height. Plugs should be tamped firmly into the soil and watered in. During grow-in, the soil should be kept moist until the grass is well rooted. Weeds will dominate the bare areas between the plugs, and they should be scouted on a regular basis and weeds removed before they have a chance to gain hold.

### Sprigging

Planting zoysiagrasses by sprigs is a laborious but effective method of establishment. Fresh sprigs with at least 2 or 4 nodes should be planted in rows that are 6 inches apart. Plant the sprigs end-to-end or no more than 6 inches apart in the row and cover them with soil about 1–2 inches deep, leaving part of each sprig exposed to light. A roller can be used to press sprigs into the soil. Soil must be kept moist until plants initiate new growth, and the area is completely covered.

### Sodding

Sodding produces an instant turf as the entire area to be planted with grass material is covered. Sodding can also reduce potential weed competition that can occur when using other planting methods that leave bare ground. However, it is important to remember that the grass is still vulnerable at this stage, and it is not yet safe for play, traffic, or other activities. It is quite dependent until the roots have developed and extended down into the soil. Sod should only be laid over bare, moist soil, with pieces laid in a staggered brick-like pattern and the edges fitted tightly together to avoid any open cracks (Figure 1). Rolling and watering thoroughly ensures good contact with the soil for fast rooting. Sodded areas should be watered at least twice per day with  $\frac{1}{4}$  inch of water until the sod is held fast to the soil by new roots (usually 2–3 weeks), after which watering should be reduced to an as-needed basis.



Figure 1. Sodding produces an instant lawn.

Credit: UF/IFAS

## Maintenance of Zoysiagrass

### Nutrient Management

Proper turfgrass nutrition is very important for sustaining a healthy lawn. Nutrients needed by plants come from many sources, including soil organic matter, trace amounts in rainfall, and fertilizers. Fertilization and other cultural practices influence the overall health and quality of the lawn and reduce its vulnerability to numerous stresses, including weeds, insects, and disease. It is very important that anyone fertilizing their lawn be familiar with and follow the Florida-Friendly Landscaping™ Best Management Practices (BMPs). These practices are designed to maintain healthy lawns and reduce potential nonpoint source pollution of water resources that might result from lawn and landscape fertilization and other cultural practices. There are state and local regulations that cover lawn fertilization, so be aware of city and county guidelines and always follow the directions on the fertilizer bag. For more information on BMPs, please refer to ENH979, *Homeowner Best Management Practices for the Home Lawn* (<https://edis.ifas.ufl.edu/ep236>).

A soil test is used to determine soil pH and what nutrients are available in the soil. The local Extension office has instructions and supplies for taking soil samples and submitting them to the UF/IFAS Extension Soil Testing Laboratory for analysis. Refer to SL281, *Soil Sampling and*

Testing for the Home Landscape or Vegetable Garden (<https://edis.ifas.ufl.edu/ss494>), for more information. In particular, phosphorus levels are best determined by soil testing. Because many Florida soils are high in phosphorus, it is often not necessary to add phosphorus fertilizer to a lawn once it is established.

Florida Rule (5E-1.003) mandates that the fertilizer application rates cannot exceed 1 lb of nitrogen per 1000 square feet for any application. Based on the percentage of nitrogen that is in a slowly available or slow-release form in a fertilizer, UF/IFAS recommendations call for applying  $\frac{1}{2}$  pound (water-soluble nitrogen source) to 1 lb (slow-release nitrogen source) of nitrogen per 1000 square feet of turfgrass.

As a general rule, the first fertilizer application of the year should be early April in central Florida and mid-April in north Florida. In south Florida, fertilizer applications may be made throughout the year because growth is year-round. UF/IFAS guidelines for lawn grass fertilization offer a range of fertilizer rates over which a particular species may be successfully maintained in the various regions of the state. These ranges account for individual homeowner preferences for low-, medium-, or higher-input grass. Additionally, localized microclimatic effects can have a tremendous impact on turfgrass growth. A range of rates allows for these environmental variations. An example of this would be a typical home lawn that is partially shaded and partially sunny. The grass growing in the shade needs less fertilizer than that growing in full sun. Fertilization is also affected by soil type, organic matter in soils, and practices such as clipping management. Recycled clippings return some nutrients back to the soil and are accounted for in UF/IFAS nutrient recommendations. Additionally, a newly sodded lawn on a sand soil with no organic matter may need more fertilizer than a lawn that has been fertilized for years. In Florida, new homes and new developments may be next to much older, developed landscapes, and a one-size-fits-all approach to fertilization is not reasonable. Thus, the guidelines provide a base range from which the end user can begin a fertilization program. The homeowner is encouraged to initiate a program based on these guidelines and to adjust it over time based on how the turfgrass responds.

Zoysiagrass responds better to a "spoon-feeding" fertilizer regimen (smaller quantities applied more frequently) rather than supplying larger quantities infrequently. It is best to take the annual fertilizer guidelines (Table 2) and divide the annual quantity into three applications (north Florida) to six applications (south Florida) per year in most situations. Avoid applying nitrogen fertilizer simply to promote green color. Instead, monitor growth and apply only when the growth rate has declined. Potassium nutrition also is important and should be applied at rates equal to nitrogen. During excessively rainy periods,

potassium may need to be applied more frequently due to its leaching ability.

Because zoysiagrass is slow to green-up in the spring, avoid applying fertilizer until after the turf has become fully green to avoid premature green-up, which is prone to frost injury. This is especially important in north Florida, where late spring frosts may damage the grass. Delaying spring fertilization until the turf is actively growing and can use the fertilizer also reduces the potential for nitrogen leaching from fertilizer. Likewise, do not fertilize too late in the year, because this can slow regrowth the following spring. Applying nitrogen on zoysiagrass in early spring and late fall significantly increases the risk of large patch disease.

On high-pH ( $>7.0$ ) soils or where high-pH water is applied, yellow leaf blades may be an indication of iron (Fe) or manganese (Mn) deficiency. Foliar applications of soluble or chelated sources of these micronutrients can provide a green-up due to elevated pH.

For iron deficiency, spray ferrous sulfate (2 ounces in 3–5 gallons of water per 1000 square feet) or a chelated iron source (refer to the label for rates) to temporarily enhance color. Iron applications every 6 weeks help maintain green color and, unlike nitrogen, do not promote excessive top growth. Granular iron sources should be limited to chelated sources (i.e., EDTA, DTPA, or EDDHA), whereas foliar applications can include soluble Fe sulfate or chelates. For information on using iron on Florida turfgrasses, please refer to ENH1287, *Iron for Florida Turfgrasses* (<https://edis.ifas.ufl.edu/publication/EP551>).

Note that iron is not a substitute for nitrogen, which provides the building blocks for turfgrass growth and is required for turf health. While both iron and nitrogen deficiencies result in yellowing of turfgrass, they are distinctly different deficiencies in plants. Applying iron does not cure yellowing due to nitrogen deficiency, and iron fertilizer is not a substitute for nitrogen fertilizer. Foliar iron fertilizers, such as iron sulfate or chelated iron solutions, help correct iron deficiencies, and nitrogen fertilizers applied according to BMPs correct nitrogen deficiencies.

## Mowing

With proper fertility, zoysiagrasses require regular mowing during the summer to look their best. Medium- to coarse-textured zoysiagrasses should be mowed weekly, or when they reach a height of 3–4 inches. They should be mowed at a height of 1.75–2.5 inches with a rotary mower. Fine-textured zoysiagrasses maintained at heights below 1 inch require more frequent mowing. Because zoysiagrass leaves contain more lignin and silica than other turfgrasses, they can be quite difficult to mow. Clippings should be left on the ground after mowing unless they

become excessive and clump on the turf surface. A sharp, well-adjusted rotary or reel mower should be used.

## Watering

Zoysiagrass responds to drought by turning brown and going dormant in a short period of time (within a week under typical drought conditions). In the absence of rain or irrigation, zoysiagrass stays dormant for extended periods of time. Once irrigation or rainfall resumes, zoysiagrass will regain its green color.

Irrigating on an "as-needed" basis is the best way to water any established, mature grass if the proper amount of water is applied when needed. Allowing the zoysiagrass to go off-color is an acceptable water-conserving measure. However, when green grass is desired, irrigation is needed when leaf blades begin to fold up, wilt, or turn a blue-gray color, or when footprints remain visible after walking on the grass. Apply  $\frac{1}{2}$ – $\frac{3}{4}$  inch of water per application. This applies water to roughly the top 8 inches of soil, where most of the roots are. Be sure to follow any local watering restrictions. Refer to the EDIS publication LH025, *Watering Your Florida Lawn* (<https://edis.ifas.ufl.edu/lh025>), for additional information on proper watering techniques.

To determine application rates of a sprinkler system, place several straight-sided cans (e.g., tuna fish or cat food) throughout each irrigation zone. Run each zone to determine how long it takes to fill the cans to the  $\frac{3}{4}$ - or 1-inch level, then record the time. Each zone will likely take different amounts of time to give the same quantity of water. The recorded run times for each zone should then be programmed into the irrigation clock for automated systems. If the variation in the catch cans is great, a more thorough audit of the irrigation system is needed. Irrigation frequency should change seasonally, with less water needed in the fall and winter. Do not adjust the amount applied per irrigation event, just the frequency.

## Thatch Management

Zoysiagrasses typically develop a thick thatch layer in the years after establishment—especially when overfertilized with nitrogen. Thatch is an intermingled layer of living and dead turfgrass shoots, stems, and roots between the green vegetation and the soil. This thatch must be controlled or removed mechanically to maintain a uniform grass appearance. This is most often done using a vertical mower or power rake every year or two (Figure 2). Some have noted that scalping, during or shortly after spring green-up, helps reduce thatch buildup, but this can be injurious to the lawn. One of the most important methods of reducing thatch buildup is to keep nitrogen fertility at the recommended levels. Proper mowing heights also help prevent thatch buildup.



Figure 2. Aggressive vertical mowing to remove thatch.

Credit: Alex J. Lindsey, UF/IFAS

## Pest Management

Like other lawn grasses grown in Florida, zoysiagrass lawns encounter pest problems. Periodic control of one or more of these problems may be necessary to grow a healthy turf. The local UF/IFAS Extension office can help identify pest problems and provide current control recommendations (<http://sfyl.ifas.ufl.edu/find-your-local-office/>).

## Weeds

One of the best attributes of zoysiagrass is its ability to resist weed invasion due to its thick, dense growth habit. Insect and disease problems can damage zoysiagrass, creating voids in this dense mat where weeds can invade. Fortunately, unlike St. Augustinegrass and centipedegrass, zoysiagrass is very tolerant to many effective pre- and postemergence herbicides, giving a wide range of options to the turf manager (Table 1). Refer to ENH884, *Weed Management Guide for Florida Lawns* (<https://edis.ifas.ufl.edu/ep141>), for more information.

## Insects

Hunting billbug can be a serious insect on zoysiagrass. Billbugs feed on roots, causing the turf to die in irregular-shaped patches. The damage most often occurs in the fall and spring when populations are high and when damage may be misdiagnosed as dormancy. Stems and rhizomes break easily and have irregular feeding marks, and the turf will not hold together if cut. Most damage occurs on infertile or dry soil. If 10–12 billbugs are seen per square foot, control may be necessary.

Mole crickets and white grubs can also negatively impact zoysiagrass. Mole crickets feed on grass roots and leaf blades, and their tunneling activity dislodges plants from the soil, causing the plants to dry out. White grubs, like billbugs, feed on roots, causing the turf to turn yellow, wilt, and eventually die. Both of these insect pests often attract raccoons, skunks, armadillos, and birds, which may actually cause more damage than the insect itself.

Sod webworms can cause periodic injury to zoysiagrass. Injury from these insects can range from a mining of the green tissue (Figure 3) from the leaf tips to leaves completely chewed off.



Figure 3. Sod webworm damage on zoysiagrass.

Credit: J. Bryan Unruh, UF/IFAS

For more information, refer to *Insect Management in Your Florida Lawn*

(<https://journals.flvc.org/edis/article/view/116061>).

### **Nematodes**

Many turf managers state that nematodes are serious pests on zoysiagrasses; however, this is not well documented in scientific literature. UF/IFAS researchers and turfgrass breeders are working to identify the extent of zoysiagrass susceptibility, and they are identifying superior cultivars that can withstand nematodes. The UF/IFAS Extension Service Florida Nematode Assay Laboratory in Gainesville (<https://entnemdept.ufl.edu/nematology-assay-lab/>) can diagnose whether nematodes are a problem by looking at a soil sample taken from the margin of the affected area. Proper cultural factors to encourage zoysiagrass root growth lessen nematode stress. These include applying less nitrogen, providing less frequent (but deep) watering, and ensuring adequate soil potassium and phosphorus.

### **Diseases**

The most troubling disease for zoysiagrass is large patch (Figure 4). This disease becomes active when soil temperatures (4-inch depth) are between 65°F and 75°F each fall and can be a problem through the following spring. Although zoysiagrass is probably not more susceptible to this disease than St. Augustinegrass, recovery can be slow due to zoysiagrass' prolonged dormant to semidormant condition. Zoysiagrass is the first turf species to go off-color in the fall and the last to green-up in the spring. Therefore, if a large patch disease outbreak occurs, damage will be visible well into the next summer. With this in mind, if damage cannot be tolerated, it is important to treat preventively to ward off any likelihood of this disease. Refer to PP-233, *Homeowner's Guide to Fungicides for Lawn and Landscape Disease Management* (<https://edis.ifas.ufl.edu/pp154>), for more information on fungicides. Additionally, avoid excessive

applications of soluble nitrogen, keep thatch levels to a minimum, and avoid irrigating at a time that will not allow the turf to dry prior to nightfall. Refer to <https://edis.ifas.ufl.edu/topics/turfgrass-diseases> for additional information on turfgrass diseases.



Figure 4. Large patch disease caused by *Rhizoctonia solani*.

Credit: J. Bryan Unruh, UF/IFAS

Other diseases that impact zoysiagrass include dollar spot and rust. Dollar spot typically occurs when nitrogen is below optimal levels. This can easily be corrected with a light application of nitrogen. Rusts occur during mild, humid weather and appear as small yellow to orange to reddish-brown pustules on the leaves. Fungicides are effective, but most often, frequent mowing with clipping removal will keep this under control.

### **Other Problems**

Other factors can also decrease the quality of a lawn. Excessive shade, compacted soils, over- or underwatering, improper mowing, traffic, and high or low pH can all cause a lawn to perform poorly.

## **Literature Cited**

Patton, A. J., B. M. Schwartz, and K. E. Kenworthy. 2017. "Zoysiagrass (*Zoysia* spp.) History, Utilization, and Improvement in the United States: A Review." *Crop Science* 57 (S1): S-37–S-72.  
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Table 1. A generalized comparison of zoysiagrass to common lawn grasses grown in Florida.

	Centipedegrass	St. Augustinegrass	Zoysiagrass
Mowing Height	1.5"-2.5"	Cultivar dependent (2"-4")	Cultivar dependent (0.25"-2.5")
Mower Type	Rotary	Rotary	Reel-type or rotary
Annual Fertility Requirement	1-2 lb N/1000 ft <sup>2</sup>	2-6 lb N/1000 ft <sup>2</sup>	2.0-4.5 lb N/1000 ft <sup>2</sup>
Grassy-Weed Herbicides	Preemergence—many Postemergence—few	Preemergence—many Postemergence—none	Preemergence—many Postemergence—many
Broadleaf Weed Herbicide Tolerance	Many are damaging.	Many are damaging.	Most are safe.
Insects	Spittlebugs Ground Pearls	Chinch Bugs Sod Webworm White Grubs	Hunting Billbugs Sod Webworm Mole Crickets White Grubs
Diseases	Centipedegrass Decline	Take-all Root Rot Large Patch Gray Leaf Spot	Large Patch Dollar Spot Rust
Comparative Water Use	Persists on less water but can wilt quickly in the absence of water.	Moderate—wilts, but some leaves remain green for longer periods of time.	Moderate, but can wilt quickly in the absence of water. Within 1-2 weeks, the leaves will be brown and the turf will go dormant.

Table 2. Annual fertilization recommendations for zoysiagrass in three regions of Florida.

Location <sup>1</sup>	Nitrogen Fertility Guideline <sup>2</sup> (lb N/1000 sq ft/year)
North Florida	2-3
Central Florida	2-4
South Florida	2.5-4.5

<sup>1</sup> North Florida in this example is considered to be anything north of Ocala. Central Florida is defined as anything south of Ocala to a line extending from Vero Beach to Tampa. South Florida includes the remaining southern portion of the state.

<sup>2</sup> Preferences for lawn quality and maintenance level vary; therefore, a range of fertility rates is recommended. Additionally, effects within a localized region (i.e., microenvironmental influences such as shade, drought, soil conditions, and irrigation) necessitate a range of fertility rates.

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