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## Zoysiagrass

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Zoysiagrass is native to the temperate regions of East Asia and the South Pacific. Its cultivars have been spread into subtropical regions and are commonly used in home lawns, golf course fairways, and other landscaped areas throughout Hawai'i. Zoysiagrasses are among the most wear-tolerant of the warm-season turfgrasses, but they have poor recuperative potential and therefore should not be used on high-traffic areas like athletic fields. Zoysiagrasses have a slow rate of establishment compared to other warm-season turfgrasses, such as bermudagrass (*Cynodon* spp.) and seashore paspalum (*Paspalum vaginatum*).

Three different *Zoysia* species are grown in Hawai'i: *matrella*, *japonica*, and *tenuifolia*. While the japonicas are sometimes called Japanese lawngrass, they are most often referred to as, simply, zoysiagrass. *Z. matrella* is commonly called manilagrass, while *Zoysia tenuifolia* is referred to as templegrass, koreangrass, or velvetgrass.

*Zoysia japonica* (Photo 1), has medium- to coarse-textured, dark green leaves, and it resembles centipedegrass (*Eremochloa ophiuroides* [Munro] Hack) in general appearance. However, the vernation of centipedegrass is folded, while that of zoysiagrass is rolled.

*Z. matrella* has a deep green color, fine leaf texture, and stiff, flat leaf blades.

*Z. tenuifolia* has a medium green color, fine leaf texture, and stiff leaf blades with sharp points. This species produces an extremely dense canopy with slow vertical growth; *Z. tenuifolia* turf seldom needs to be mowed. It produces pronounced mounds or tufts with heavy thatch and is extremely slow to establish (Photo 2). This species is not recommended for regular lawns. It is normally used as a ground cover around the base of



1. 'El Toro' zoysiagrass

trees, in "oriental" gardens, and between flagstones in walks and patios (Photo 3). No improved cultivars are commercially available, as breeding efforts have focused on *Z. japonica*, *Z. matrella*, and interspecific hybrids.

All zoysiagrasses grow slowly and tolerate stress from heat, drought, and shade. Zoysiagrass shoots (extending stems and emerging leaves) are very stiff and sharply pointed. Leaf texture varies with the species: *Z. japonica* has the coarsest leaf texture, *Z. tenuifolia* the finest, and *Z. matrella* is intermediate. In terms of growth rate, *Z. japonica* is fastest, *Z. tenuifolia* is slowest, and *Z. matrella* is intermediate. According to ecosystems-at-risk assessments (e.g., [www.hear.org](http://www.hear.org)), these *Zoysia* species are not an invasive-species risk in Hawai'i.

\*This revises a 1999 publication of the same title by J. Deputy and D.H. Hensley.



2. *Z. tenuifolia* forms mounds naturally.



3. Zoysiagrass as an ornamental ground cover

### Cultivars

As of March 2008, not all of the cultivars mentioned in this publication are available in Hawai'i due to quarantine restrictions. Given the popularity of this species as a turfgrass here, approval for import of most *Zoysia* cultivars is expected.

### Seeded selections

*Zoysia japonica* is the only *Zoysia* species that can be propagated by seed. Seeded cultivars of *Zoysia japonica* generally do not produce a turf that is as high in quality as those that are vegetatively propagated. However, there are two improved seeded cultivars, 'Zenith' and 'Compadre', in today's market.

'Zenith' is a medium-textured, dark green, proprietary cultivar distributed by Patten Seed (Lakeland, Georgia). Similar to 'Meyer' zoysiagrass in overall turfgrass quality, 'Zenith' is slightly less dense and has better resistance to diseases such as brown patch (*Rhizoctonia solani*) and dollar spot (*Sclerotinia homeocarpa*). Of all the seeded zoysiagrass cultivars, 'Zenith' ranked highest in overall turfgrass quality in the 2003–2006 National Turfgrass Evaluation Program Variety Trials (NTEP 2008)

'Compadre' is a proprietary cultivar distributed by Seed Research of Oregon (Corvallis, Oregon). Occasionally referred to as 'Companion', this cultivar is similar to 'Zenith' in overall color, density, and seedling vigor. Resistance to brown patch and dollar spot between the two cultivars is also similar (NTEP 2008).

### Vegetatively propagated selections

While a select number of *Zoysia japonica* cultivars can be established from seed, the majority are propagated vegetatively. All *Z. matrella* cultivars must be vegetatively propagated as well.

### *Z. japonica* selections

'El Toro' is a selection from California that resembles 'Meyer' zoysiagrass in appearance; however, 'El Toro' has a coarser leaf texture than 'Meyer'. The establishment rate of 'El Toro' is two to three times faster than other cultivars. 'El Toro' has improved shade and drought tolerance compared to 'Meyer' and produces less thatch. 'El Toro' is commonly used in home lawns statewide.

'Meyer' was developed in 1951 as an improved selection of *Z. japonica*. As the first of the improved vegetatively propagated cultivars, 'Meyer' has been referred to as the "standard" zoysiagrass. It has a medium texture and dark green color, less rhizome production than other cultivars, and a reported susceptibility to billbug and nematode damage.

'Palisades' is a *Z. japonica* selection released by Texas A&M University (TAMU) in 1996. It offers an improved growth rate and tolerance to shade. On the U.S. mainland, 'Palisades' is marketed for its improved winter hardiness.

### *Z. matrella* selections

'Cavalier' is a dense, fine-textured, dark green cultivar released in 1996 by TAMU. It is characterized as having "long, slender leaves," and research has found it to have



4. 'Emerald' zoysiagrass

an improved tolerance of drought, salt, traffic, and shade stress. Research conducted in Dallas found 'Cavalier' to exhibit resistance to fall armyworms and brown patch.

'**Diamond**' is a dense, fine-textured, dark green cultivar released in 1996 by TAMU. It has excellent shade tolerance and can be mowed at heights less than 1/2 inch, but it is highly susceptible to tropical sod webworms.

'**Zeon**' is a dense, medium-fine textured, dark green cultivar released in 1996 by TAMU. It is extremely drought tolerant and has been found to exhibit shade tolerance similar to the zoysiagrass hybrid 'Diamond' but with a significantly faster establishment rate.

'**Zorro**' is dense, fine-textured, dark green cultivar released in 2001 by TAMU. It offers improved shade tolerance and recuperative potential, as well as reduced susceptibility to brown patch and dollar spot. Research has found 'Zorro' to be the fastest establishing *Z. matrella* cultivar. It was one of the top-ranking cultivars for overall turfgrass quality in the 2003–2006 NTEP trials (NTEP 2008).

### Interspecific hybrids

'**Emerald**' is a hybrid of *Z. japonica* and *Z. tenuifolia* developed in Tifton, Georgia, and released in 1955. The cross was intended to combine the color, texture, and density of a *Z. tenuifolia* parent found on Guam with the cold hardiness and aggressive growth rate of a *Z. japonica* parent found in Korea. 'Emerald' has a fine texture and dark green color (Photo 4). The growth rate and range of adaptation of 'Emerald' is greater than most *Z. matrella* cultivars. Although one of the top-ranking

cultivars for overall turfgrass quality in the 2003–2006 NTEP trials, 'Emerald' is susceptible to dollar spot and brown patch. The excessive thatch production of this cultivar will increase disease susceptibility if it is not properly maintained.

'**Z-3**' is a hybrid of *Z. japonica* and *Z. matrella* that was selected in Hawai'i. It is a medium-textured cultivar with medium green color. The growth rate of 'Z-3' is slower than that of 'El Toro' but faster than 'Emerald.' It is more coarse-textured than 'Emerald' but finer than 'El Toro'. 'Z-3' is not used extensively on the U.S. mainland.

### Soil and environmental requirements

Zoysiagrasses tolerate a wide variety of soil types but do best in well drained soils with a pH between 5.8 and 7.5. They grow best in full sun but tolerate shade better than many other warm-season turfgrasses. Zoysiagrasses grow throughout the year in Hawai'i.

### Establishment

Most zoysiagrass cultivars are established vegetatively by sodding, sprigging, or plugging. Sprigging zoysiagrass can be difficult due to the fact that the stolons of some cultivars can be difficult to harvest, and many do not contain enough vegetative nodes to be viable. Plugging is the most common establishment method used in Hawai'i.

Research has found zoysiagrass establishment rates to be associated with rhizome and stolon development. Cultivars that have a more prolific network of vegetative propagules ('El Toro', 'Zorro') will establish faster than those that do not ('Meyer', 'Diamond') (Patton and Riecher 2007).

### Plugging

Plugging is the most common method of establishing zoysiagrass in Hawai'i. When plugging, sod is cut into small pieces called plugs (2–4 inches in diameter, square or circular). The plugs are planted into moist soil on 6–14-inch centers (Photo 5); Plugs should be slightly below ground level to minimize mounding. Increasing plug diameter and decreasing plug spacing will increase the rate of establishment. Specialized mechanical plugging equipment is available for use on large areas.

After planting, roll the plugs lightly to minimize mounding, and irrigate thoroughly. Lack of irrigation is the most common cause of failed establishment. Light, frequent irrigation (four to six times daily) is recommended until roots become established.



5. Plugs are spaced 6–12 inches apart.

Plugs take 6–8 weeks to become re-established after planting. New stolons (“runners”) will usually develop at this time as well. In Hawai‘i, approximately 12–18 months are required to completely fill in the bare soil between the plugs, depending on cultivar, plug size, plug spacing, and environmental conditions.

### Seeded establishment

The germination rate for zoysiagrass seed is generally very poor. However, seeds of many recently developed proprietary seeded cultivars are chemically treated to break dormancy and produce an acceptable, uniform rate of germination. Research on the U.S. mainland predicts that most seeded cultivars germinate in 10–15 days, with complete turf cover obtained in 8–12 weeks under optimum growing conditions (Patton and Riecher 2007). Significantly longer germination and establishment rates for seeded cultivars have been observed in Hawai‘i.

Sow at a rate of 2 pounds of hulled, treated seed per 1000 sq ft to produce a dense turfgrass stand. Research has found no advantages to seeding at rates higher than this, and when seeded at higher rates, zoysiagrasses are more susceptible to drought stress.

Seed is often sown with a rotary spreader. To promote uniform coverage, divide the seed into two equal portions and apply these in two directions across the area.

After seeding, lightly roll the area to promote seed-to-soil contact, and apply a light (<math>\frac{1}{4}</math> inch) layer of topdressing (e.g., soil, mulch, compost, or hydromulch). *Zoysia* seeds are very small and must be within  $\frac{1}{4}$ – $\frac{1}{2}$

inch of the surface to germinate and grow. The seed is extremely sensitive to light and should not be completely covered with soil.

During seeded establishment, light, frequent irrigation (four to six times daily) is recommended until complete germination is observed.

During both seeded and vegetative establishment, there will be a need to control both broadleaf and grassy weeds, as well as sedges. Bare-soil areas will be exposed for extended periods of time due to the slow growth rate of zoysiagrass. To prevent invasion of annual weeds into these areas during vegetative establishment, apply a preemergence herbicide over the entire area. Ronstar® is the only preemergence herbicide effective against grassy weeds that is available in Hawai‘i and safe to use on newly sprigged or plugged zoysiagrass plantings. Do not use preemergence herbicides when establishing zoysiagrasses from seed; instead, rely on the various postemergence herbicide options that are available. Patton (2006) reported that over 15 chemicals, including MSMA, Confront, and Monument, can be safely applied to zoysiagrass 2 weeks after seedling emergence. Consult the CTAHR publication *Chemical Weed Control Recommendations for Turfgrasses in Hawaii* for more information, as many of these materials can injure turfgrass seedlings if used incorrectly.

### Mowing

The general appearance of a zoysiagrass turf is probably influenced more by mowing than any other factor. If maintained at heights greater than 2 inches, most zoysiagrasses will form a puffy, tufted, dense turf with a deep thatch layer. This type of lawn is very difficult to mow, and consequently can be scalped very easily. It is recommended that zoysiagrasses be mowed every 7–10 days at heights of from  $\frac{1}{2}$  inch to  $1\frac{1}{2}$  inches. The optimum height for most zoysiagrass lawns is  $\frac{3}{4}$  inch. It is essential that no more than one-third of the leaf blade be removed during a single mowing.

A reel mower is required to maintain zoysiagrasses at mowing heights of 1 inch or less. Rotary mowers can be used to maintain zoysiagrasses at mowing heights above 1 inch. Blades of both reel and rotary mowers should be sharpened regularly. Mowing with dull blades causes tearing and bruising of leaf tissues, conditions associated with increased disease incidence.

A mature zoysiagrass stand that is not mowed will form a spongy, dense, multi-tufted carpet 6–10 inches thick, depending on the cultivar. This type of growth

habit can be very useful in low-maintenance areas such as median strips and for groundcover in ornamental gardens (Photo 3).

### Thatch management

Thatch is a layer of partially decomposed organic matter intermingled with live plant stems at the soil surface. Frequent mowing at recommended heights of cut will help decrease thatch accumulation. Leaving clippings on the surface after mowing does not cause thatch buildup.

Periodic removal of thatch with a “vertical mower” (Photo 6) is necessary to properly maintain a healthy zoysiagrass stand. Homeowners can rent this specialized turf maintenance equipment, but the best result may be obtained when it is operated by a landscape professional. Vertical mower blades penetrate into the surface, removing thatch buildup at the soil-turfgrass interface. Mow in two directions at right angles. Debris (thatch) brought to the surface after vertical mowing can be raked, vacuumed, or blown off, but its removal is essential. This can be done by hand or with one of the many commercially available units. Dethatching results in major damage to the turf (ripping, tearing, and scalping). Therefore, to limit the period of recovery after dethatching, it should be done only when the turf is most actively growing, during late spring and mid-summer.

### Nutrient management

After establishment, zoysiagrasses generally require two to five applications per year of a complete fertilizer at a rate of 1 lb of nitrogen (N) per 1000 sq ft. This results in a total annual N application of 2–5 pounds. Low-maintenance home lawns should be given amounts at the lower end of this range. On golf courses, zoysiagrasses should receive 4–5 lb N per 1000 sq ft per year on tees and 2–4 lb N per 1000 sq ft per year on fairways and roughs. Yearly application rates in areas of the United States with shorter growing seasons than Hawai'i will be less than these amounts.

Complete fertilizers formulated for general use on turfgrasses often contain N, P, and K in ratios such as 2:1:1, and sometimes the N content is even higher. Formulations that provide both quick- and slow-release N can be useful in limiting frequency of application. Regardless of formulation or frequency of application, keep the total amount of N applied annually below the maximums mentioned above. Excessive amounts of N fertilizer cause thatch buildup.



6. Vertical mower blades

### Watering

Once established, zoysiagrasses require very little watering. Zoysiagrasses are among the most drought- and heat-resistant of the warm-season turfgrasses. The deep root system of a well established zoysiagrass lawn allows for watering to be conducted on an “as-needed” basis. When leaf blades show signs of slight wilt, irrigate the turf heavily, applying  $\frac{3}{4}$  inch of water. Do not water again until the next time signs of wilt are apparent, and do not vary the amount of water applied each time. As with all turfgrasses, the best time to water is in the early morning hours, just before or soon after sunrise. (For more information, see CTAHR publication TM-7, *Watering lawns*.)

### References

- Anonymous. 2008. National Turfgrass Evaluation Program 2002 Zoysiagrass Final Report, No. 07-11. National Turfgrass Evaluation Program. Bethesda, Maryland. [http://ntep.org/reports/zg02/zg02\\_07-11f/zg02\\_07-11f.htm](http://ntep.org/reports/zg02/zg02_07-11f/zg02_07-11f.htm)
- Patton, A.J., Z.J. Reicher, A.J. Zuk, J.D. Fry, M.D. Richardson, and D.W. Williams. 2006. A guide to establishing seeded zoysiagrass in the transition zone. Online Applied Turfgrass Science. <http://www.plant-managementnetwork.org/pub/ats/guide/2006/zoysia/>
- Patton, A.J., and Z. Riecher. 2007. Zoysiagrass establishment rates. Golf Course Management. March 2007. p. 98–101. <http://www.gcsaa.org/GCM/2007/march/pdfs/zoysia%20rates.pdf>

Patton, A.J., J.J. Volenec, and Z. J. Reicher. 2007. Stolon growth and dry matter partitioning explains differences in zoysiagrass establishment rates. *Crop Science* 47:1237–1245.

Samples, T. and J. Sorochan. 2007. Zoysia. University of Tennessee Cooperative Extension Bulletin W159-H. <http://utextension.tennessee.edu/publications/wfiles/W159-H.pdf>

Unruh, J.B., L.E. Trenholm, and J.L. Cisar. 2006. Zoysiagrass in Florida. Environmental Horticulture Department, Florida Cooperative Extension Service Publication ENH11. University of Florida. <http://edis.ifas.ufl.edu/pdffiles/LH/LH01100.pdf>