

Ocean Expo Research Center Special Lecture: Turfgrass in the Ryukyu Islands

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The average annual temperature in the Ryukyu Islands is more than 20°C. At this temperature, warm-season grasses¹ are used. The main warm-season grasses that can be used for turf in the Ryukyu Islands are *Cynodon dactylon*, *Zoysia matrella*, *Paspalum vaginatum*, *Stenotaphrum secundatum*, *Axonopus compressus*, and *Eremochloa ophiuroides*. Compared to other locations in the world with similar annual temperatures, the Ryukyu Islands are notable for having fewer hours of sunshine. This restricts the amount of light available for photosynthesis, causing the grasses with better shade tolerance (especially *Z. matrella* and *S. secundatum*) to perform better than the others in this climate. Management practices to optimize turfgrass performance in conditions of low sunlight include choosing a more shade tolerant grass, increasing the mowing height, reducing the nitrogen application rate, and applying the growth regulator trinexapac-ethyl.

¹ Warm-season grasses are those that utilize the C₄ photosynthetic pathway.

The Grasses

THE AVERAGE annual temperature in the Ryukyu Islands is about 23°C. At Naha, the coldest month is January with an average temperature of 17°C and the hottest month is July with an average temperature of almost 29°C. With these temperatures, warm-season grasses are used; as a general rule, cool-season grasses can be used only in locations where the average annual temperature is less than about 18°C. These are the main warm-season grasses used as turf around the world and to some extent in the Ryukyu Islands.

Bermudagrass

Bermudagrass (*Cynodon dactylon*) is the most widely-used warm-season turfgrass around the world. It performs especially well in the southern United States and in the sunny parts of the Hawaiian Islands. However, this grass has a high light requirement, and it requires special management to perform well here.

Manilagrass

Manilagrass (*Zoysia matrella*) is native to these islands. Both *Z. matrella* and *Z. pacifica* syn. *Z. tenuifolia* are found here and it is difficult to distinguish² between them. *Z. matrella* is more commonly used as a turfgrass and for the purposes of this discussion *Z. pacifica* will

² Hikaru Akamine, Yasuhiro Kawamoto, Yukio Ishimine, Hitoshi Kuramochi, and Nobumasa Ichizen. Morphological characteristics of *Zoysia tenuifolia* Willd. *Journal of Japanese Society of Turfgrass Science*, 33(2):122–126, 2005

not be discussed in detail. Manilagrass can be found growing in nature without supplemental management. This grass is noted for its relatively slow growth rate and excellent shade tolerance.

Seashore paspalum

Seashore paspalum (*Paspalum vaginatum*) is a grass with excellent tolerance of saline conditions. It has recently been used more often in the United States and its use has been promoted in many other warm-season areas of the world. In Asia, when irrigated with relatively clean water, seashore paspalum does not perform well, and in fact under conditions of low maintenance it will be overtaken by *Zoysia matrella*.³ Seashore paspalum may outperform bermudagrass or manilagrass in special situations, but in general it is a high maintenance grass in this climate (Figure 1).

St. Augustine grass

St. Augustine grass (*Stenotaphrum secundatum*) is a grass noted for its adaptation to shaded conditions. It performs well as a lawn grass here. However, as a sports turf it is not ideal because of its relatively coarse leaf blade and because it generally does not tolerate mowing below about 12 mm.

Broadleaf carpetgrass

Broadleaf carpetgrass (*Axonopus compressus*) is a shade tolerant grass that does not seem to be in common use as a lawn or sports turf in the Ryukyu Islands but there is potential for it to be used. At areas with similar temperature and similar wintertime low temperatures, such as Hong Kong and other parts of southern China, *A. compressus* produces an excellent lawn or sports turf. This grass has only moderate wear tolerance, so it is not used in areas with high traffic, but it is tolerant of mowing heights below 10 mm (Figure 2), so in some ways it is more adaptable than is *S. secundatum*. In tropical environments where there is no winter dormancy, broadleaf carpetgrass is generally free of diseases. In areas where winter temperatures are less than 20°C, a disease such as large patch (*Rhizoctonia solani*) may occur.

Centipedegrass

Centipedegrass (*Eremochloa ophiuroides*) can grow here⁴ and could be used in some lawn areas. It seems to be used less frequently than are manilagrass and St. Augustine grass.

³ Xin-Ming Xie, You-Zhi Jian, and Xiao-Na Wen. Spatial and temporal dynamics of the weed community in a seashore paspalum turf. *Weed Science*, 57:248–255, 2009

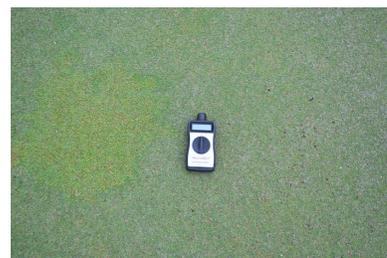


Figure 1: A patch of seashore paspalum has invaded bermudagrass near Naha on a golf course putting green mown at less than 4 mm. In this situation, seashore paspalum can perform well.



Figure 2: At Hong Kong, bermudagrass at left, *Axonopus compressus* at right, with a mowing height of about 8 mm.

⁴ Centipedegrass is native to southern China

Climate

THE RYUKYU ISLANDS have a distinctive climate, most notably in the relatively low sunshine hours in the winter, but even during July and August the amount of sun is less than we would find in places like Honolulu or Miami. Climate charts have been developed that show the climatological normals for a number of worldwide cities. These charts are available at <http://climate.asianturfgrass.com/>. The interactive chart for major Japanese cities includes Naha, other major cities in Japan, and the cities of Bangkok, Thailand and Atlanta, USA for comparison. Naha is also included in an interactive chart of more than 90 worldwide cities. The monthly and annual charts do not include Naha, but they do include Ishigaki, as does the chart with 46 warm-season cities. From the comparisons we can make with these charts, we see that Ishigaki and Naha have annual temperatures very similar to Rio de Janeiro, Hong Kong, and Hilo (Hawaii).

Improving turfgrass performance in shade

CLOUDS REDUCE the photosynthetically active radiation (PAR) by 50 to 75%. In the Ryukyu Islands⁵, where there is relatively high cloud cover, shade tolerant grasses perform well. In some cases, especially for sports turf such as golf course putting greens or for soccer (football) fields, we may want to use grass such as bermudagrass in order to obtain a certain type of sporting surface. In general, these four steps can be taken to optimize turf performance in areas with low levels of PAR.

1. Choose a more shade tolerant species or a more shade tolerant variety from within a species.
2. Increase the mowing height. This allows there to be more leaf area to capture the available light, and it allows for less frequent mowing.
3. Reduce the amount of nitrogen applied. Less light means less energy is available for photosynthesis, thus less nitrogen is required.
4. In situations (such as golf course putting greens) when the mowing height must be low in order to achieve the desired surface, application of the growth regulator trinexapac-ethyl⁶ will improve turfgrass performance in low light.⁷

⁵ I've measured the photosynthetic irradiance here and the results are summarized in a report available at this link: <http://bit.ly/0j1X49>

⁶ Sold in Japan as Primo Maxx

⁷ Christian Baldwin and Haibo Liu. Nitrogen management for 'Champion' bermudagrass under full sun and shade. *USGA Turfgrass and Environmental Research Online*, 9(6):1-8, 2010