Research Technical Note
Urban Greenery Series
RTN
06-2012

Selecting Turfgrass Species for Shady Conditions

Author: Vivek Govindasamy

'Choosing Turfgrass Species for Shady Conditions' is a basic management guideline for turf grown under shady conditions.

Shade Stress

Figure 1 Shade stress imposed by tress (left) and concrete structures (right)

Shade stress is one of the major problems affecting the quality of turfgrasses, as light is essential for the growth of plants. Where light is absent or inadequate, turfgrasses will experience stress and their growth may be affected.

The impact of shade on plant growth depends on the amount of light that is allowed to pass through. The two most common elements of an urban landscape contributing to the shade effect are trees and man-made structures.

Tree Shade

Figure 2 Shade stress impact under rain tree (*Samanea saman*) [left] and trumpet tree (*Tabebuia rosea*) [right]

The micro-environment under a tree canopy is characterised by reduced air and soil temperatures, increased relative humidity and impaired wind velocity. Almodare (1980, Texas A&M University, USA) reported that the difference in air and soil temperatures from the open environment is between 4–6°C. The canopy shade effect varies for different tree species (Figure 2). Within the same species, there are also slight changes over time, as the trees ages.

Impact of Shade on Turfgrass Growth

Shade stress affects the health of turfgrasses in terms of morphology, physiology and anatomy. Turfgrasses need light for photosynthesis[1]. The effects of shade are reduced photosynthetic rate and hence, depletion of chlorophyll content; the leaves tend to become light and pale green or even turn yellow as the chlorophyll content depletes. Other symptoms, with respect to morphology, are reduced tillering and shoot density, thinner leaves and stem, and decreased root density. Under extreme conditions, the growth of turfgrasses will be negatively affected, resulting in the appearance of patches of bare soil.

Shade Tolerance of Warm Season Turfgrasses

Some of the common warm season turfgrasses have the ability to overcome shade stress and achieve acceptable turf quality. This is possible through morphological, physiological and anatomical adaptations. The shade tolerance adaptation can also be found in some of the improved cultivars which are bred for such qualities.

Turfgrass Species for Shady Conditions

In a recent study, the Centre for Urban Greenery and Ecology (CUGE) identified a number of turfgrass species tolerant to shady conditions.

Twelve warm season turfgrass species were evaluated under three different shade levels (50%, 70%, and 80% shade). The experiment details and results are presented in the tables below.

Figure 3 Shade study to test the shade tolerance of twelve warm season turfgrass species.

Table 1 List of Warm Season Turfgrass species used for the Study

1.	*Axonopus affinis* (U.S Carpetgrass)
2.	*Axonopus compressus* (Cowgrass)
3.	*Axonopus* sp. (Pearlgrass)
4.	*Cynodon dactylon* (Bermudagrass)
5.	*Digitaria didactyla* (Serangoongrass/ Blue couch)
6.	*Paspalum notatum* (Bahiagrass)
7.	*Paspalum vaginatum* (Seashore paspalum)
8.	*Pennisetum clandestinum* (Kikuyugrass)
9.	*Stenotaphrum secundatum* (St. Augustinegrass)
10.	*Zoysia matrella* (Manilagrass)
11.	*Zoysia japonica* (Japanese lawngrass)
12.	*Zoysia pacifica* (Templegrass)

Polyester screens of varying opacities were used to stimulate shade effects (50%, 70% and 80% of shade). Table 2 is the light measurements obtained under the four shade levels and under a *Tabebuia rosea* tree at different times of the day. Light readings taken under different trees can be compared using the table below.

Table 2 Light measurements taken at the experimental site (HortPark)

Unit - Lux

Shade level	Time		
	10:00 am	11:30 am	2:30 pm
Direct sunlight (0% shade)	1036	1600	1852
50% shade	631.4	825.6	868.8
70% shade	108.8	698.2	683.7
80% shade	116.8	474	404
Tabebuia rosea tree shade - 2 feet away from the trunk	34.3	52.8	236.6

Table 3 Results

Shade level				
50%		70%		80%
St. Augustinegrass	High Quality	St. Augustinegrass	High Quality	Pearlgrass
Pearlgrass		Pearlgrass		St. Augustinegrass
Cowgrass		Cowgrass		Cowgrass
Serangoongrass		Serangoongrass		Serangoongrass
U.S carpetgrass		U.S carpetgrass		U.S carpetgrass
Seashore paspalum		Seashore paspalum		Seashore paspalum
Manilagrass		Manilagrass		Manilagrass
Japanese lawngrass		Japanese lawngrass		Japanese lawngrass
Templegrass		Templegrass		Templegrass
Bahiagrass		Bahiagrass		Bahiagrass
Bermudagrass		Bermudagrass		Bermudagrass
Kikuyugrass	Low Quality	Kikuyugrass	Low Quality	Kikuyugrass

Highlighted turfgrass species had acceptable turf quality. Under 50% and 70% shade, Pearlgrass was lower than St. Augustinegrass and was on par with Cowgrass because of its slow growth and spread. Under 80% shade, Pearlgrass was a better performer compared to all other turfgrass species.

Application

Turf can be adversely affected by shade. whilst shade is important, turf act as ground covers preventing erosion. The challenge is therefore to have shade and at the same time have turf cover.

Selecting shade tolerant turfgrass species is the obvious answer to this challenge. Most warm season turfgrass species can tolerate partial shade. However, under full shade, only a few turfgrass

species will survive. Partial or full shade refer to the number of light hours per day. Sites which receive full sunlight only for six hours or less each day come under partial shade. Sites which do not receive full sunlight throughout the day come under full shade. In general, shade stress refers to full shade. Improved cultivars of shade tolerant turfgrass species have better shade tolerance.

Under shade stress, the turfgrass hormones which aid lateral branching are altered. Ervin *et al.*, (2004 – Virginia State University) reported that application of plant regulating hormones will enhance shade tolerance of turfgrasses. In Singapore, further research is needed to explore the effects of plant regulating hormones on the shade tolerance of turfgrasses.

Based on the experimental results, Pearlgrass and St. Augustinegrass were found to be highly tolerant to shade stress, while Cowgrass and Serangoongrass showed moderate tolerance. On the other hand, Seashore paspalum and *Zoysia* species can be grown under partial shade but not under full shade. It should be noted that special management practices have to be followed for these tolerant turf species under shady conditions.

Tips for maintaining turf under shade conditions

- Close mowing must be avoided.
- Mowing height can be fixed at 50 - 70 mm from soil surface.
- Fertilizer application must be moderate (0.2 kg N/100 sq m/month) as excess nitrogen will lead to high disease incidence.

Footnote:

1. Photosynthesis is a chemical process in which carbon dioxide is converted into organic compounds, especially sugars (food source for plants) using the energy from sunlight.

References

1. Almodares, A. (1980). The adaptation of *Stenotaphrum secundatum* (Walt.) Kuntze and *Festuca arundinacea* Schreb. to tree shade environments as affected by mowing heights. Ph.D. thesis, Texas A&M University, College Station, Texas, USA.
2. Ervin, E.H., C.H. Ok, B.S. Fresenburg, and J.H. Dunn. 2002. Trinexapac-ethyl restricts shoot growth and prolongs stand density of 'Meyer' zoysiagrass fairway under shade. HortScience 37:502–505.