Light Requirement for Emergence of Turf-type Bermudagrass Seed

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Photo by Aaron Patton

Unhulled bermudagrass seed

Summary. In the transition zone, improved cultivars of seeded bermudagrass are becoming increasingly popular. Recent studies suggest that competition for light can significantly reduce germination, but there has been limited work on the light requirements for emergence of seeded bermudagrass. The objective of the present study is to determine how reduced light affected germination and emergence of three bermudagrass cultivars, including Transcontinental, Riviera, and SR-5990. Twenty-five seeds of each of the three cultivars were planted into two-inch diameter plastic pots. Three different types of shade cloth (30, 60, and 90% shade) were placed on top of each pot to reduce light and were compared to a non-shaded control. Emergence of seedlings was monitored for a 3-wk period to determine the effects of shading on germination and emergence. Shade significantly reduced the emergence of all cultivars. However, the emergence of Transcontinental was greatly inhibited by shade.

Abbreviations: DAS (days after seeding)

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Newer cultivars of seeded bermudagrass (*Cynodon dactylon*) are becoming some of the most popular turfgrasses in the transition zone due to their ease of establishment and excellent performance. For turf managers in the transition zone and southern United States, establishing or renovating a sports field or high-traffic area can be frustrating as optimal planting periods often coincide with periods of high use. It has been demonstrated that improved cultivars of seeded bermudagrass can be dormant-seeded during the winter (Shaver et al., 2006) and this approach may provide turf managers with an alternative means to renovate damaged turf areas.

Bermudagrass sports fields are often overseeded with a cool-season turfgrass in the dormant months to maintain a high-quality playing surface with an aesthetically pleasing green color. While winter overseeding with cool-season grasses is a well-accepted practice, the presence of an actively growing turf presents some limitations that are not conducive to seed germination. Competition for water, nutrients, oxygen, and light is the main limitation for germination to occur in an actively growing stand of turf. Of these four resources, light is likely the most limiting factor for adequate germination to occur. Shin et al. (2006) reported that seeded seashore paspalum germination is greatly influenced by light and temperature.

On a golf course or athletic field, water and nutrients can be made readily available for young seedlings to establish, but light is a limiting factor and is usually impractical to physically apply to the turf. In an overseeded stand of turf, light is extremely restricted from reaching the soil surface. In a mature overseeded turf, when temperatures are sufficient for bermudagrass seed germination, the overseeded turf will prevent light from entering the canopy and likely reduce the seed germination. Zuk et al. (2005) found that with lower light levels and lower temperatures, there was a reduction in zoysiagrass seedling germination and establishment.

Recent findings show that emergence of improved varieties of seeded bermudagrasses can occur at temperatures under 60ºF (Shaver et al., 2006); however, there has been limited work on the light requirements for emergence on newer varieties of seeded bermudagrass. Therefore, the objective of the study is to determine how reduced light conditions affect the germination and emergence of three varieties of seeded bermudagrass.

Materials and Methods

A growth chamber study (Conviron E7) was conducted at the University of Arkansas, Rosen Alternative Pest Control Center in Fayetteville, to determine the effects of reduced light on emergence of seeded bermudagrass. Three bermudagrass cultivars, Transcontinental, Riviera, and SR-5990, were evaluated for seedling emergence under varying light regimes. These cultivars were selected based on previous work that demonstrated they had different levels of shade tolerance as a mature turf (Baldwin et al., 2008). Twenty-five seeds of each bermudagrass cultivar were planted into two-inch-diameter plastic pots that contained a silt-loam soil. The soil was sterilized by fumigating with methyl bromide to ensure that there was no weed seed contamination. Cheese cloth was placed in the bottom of each container to ensure that the soil did not move out of the pot during watering. Four different shade treatments were used in this study, including 30%, 60%, and 90% shade and a non-shaded control. Shade rings that would fit directly over the pots were constructed out of PVC pipe (2.5-inch diam.). Shade cloth was stretched over the top of the PVC rings and cinched tightly to the outside of the ring with plastic fasteners (Fig. 2). After applying the seed to the soil surface, each pot received a light application of sand (1-2 mm) to ensure good seed-to-soil contact. Pots were placed in plastic trays and watered daily by allowing water to wick up through the soil profile and wet the growing media.

Light in the growth chamber was provided by a combination of fluorescent (Sylvania High-Output Fluorescents: F48T12/D/HO, 34 watt) and incandescent (Phillips 23096-1, 40 watt) bulbs.

Photon flux density data were collected through the shade cloths using a quantum foot-candle meter (Field Scout, Spectrum Technologies, Inc. Plainfield, Ill.). The photon-flux density readings of the control, 30%, 60%, and 90%, were 160 (100% of control), 100 (62.5%), 32 (20.0%), and 19 (11.9%) µmol m^{-2} s^{-1}, respectively. Temperatures were maintained at a constant 86°F and light was set on a 12 h day/12 h night schedule. Every two days, pots were checked for seedling emergence and emerged seedlings were removed after counting. The experimental design for this experiment was a randomized complete block design with four replications of each cultivar and shade treatment.

Results and Discussion

Shade and cultivar had a significant effect on seedling emergence on most evaluation dates, but there was no shade x cultivar interaction observed in this study. As such, the results will be presented and discussed as main effects only. Beginning at five days after seeding, shading had a negative effect on emergence of bermudagrass seedlings (Fig. 1). The slowest emergence was seen with the 60% and 90% shade treatments, while the 0% (control) and 30% shade treatments had similar emergence.

Emergence was significantly affected by cultivar at 4, 5, and 6 days after seeding (DAS). Riviera and SR9554 had greater emergence at 4, 5, and 6 DAS compared to Transcontinental (Fig. 2). The lack of a cultivar x shade interaction suggests that all cultivars were equally affected by reduced light and that differences in shade tolerance at maturity (Baldwin et al., 2008) may not affect germination under reduced light. These findings suggest that bermudagrass seed will be less capable of emerging when a dense stand of turf is present due to reduced light. However, some emergence was observed at the highest shade levels (Fig. 1), suggesting that turf managers can get emergence in areas that have weak or thin turf. In a previous investigation, Transcontinental was noted for having enhanced shade tolerance at maturity compared to other varieties of seeded bermudagrass (Baldwin et al., 2008). While Transcontinental took longer to reach a sufficient level of emergence, this cultivar could have the ability to sustain growth under low light once fully emerged. In conclusion, this research indicates that Riviera, Transcontinental, and SR9554 are dependent on light for emergence; therefore, successful establishment in an overseeded athletic field or fairway may be difficult due to a reduction in light at the soil surface.

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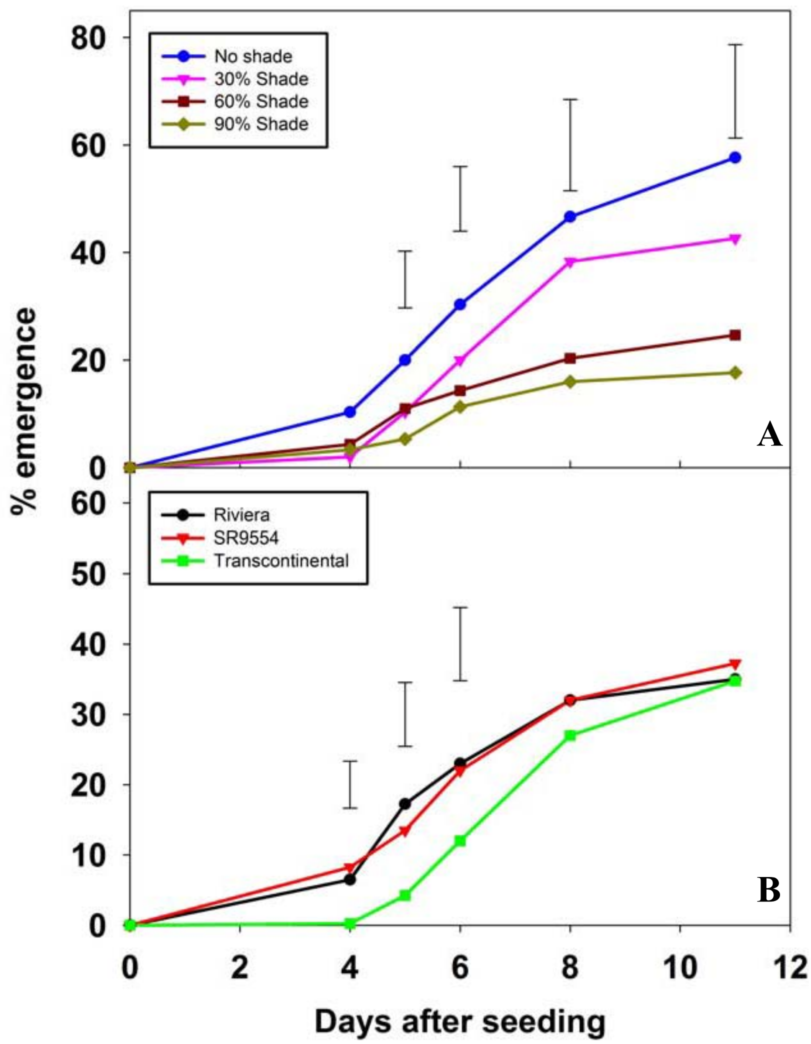

Fig. 1. Effects of varying levels of shade (A) and cultivar (B) on emergence of bermudagrass seedlings at 86°F. On dates when significant differences were observed, error bars can be used to compare treatments.

Fig. 2. Various intensities of shade cloth were stretched over the top of PVC rings and cinched tightly to the outside of the ring with plastic fasteners. These were then placed over the pots containing soil and bermudagrass seed.

Table 1. Analysis of variance results, testing the effects of cultivar and shade intensity on emergence of bermudagrass seedlings.

Treatment effects	4	5	6	8	11
	------------------------ days after seeding ------------------------				
Rep	ns	ns	ns	ns	ns
Cultivar	*	*	*	ns	ns
Shade	ns	*	*	**	***
Cultivar x shade	ns	ns	ns	ns	ns

* = $p < 0.05$
** = $p < 0.01$
*** = $p < 0.001$
ns = not significant