Evaluating the Photosynthetic Effects of Athletic Field Paint on Perennial Ryegrass

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Introduction

Athletic field painting is a multi-million dollar industry and turf managers routinely paint fields for proper field marking and aesthetics. To maintain high quality and visually appealing playing fields during the dormant season, sports fields are typically overseeded with a cool season grass such as perennial ryegrass (*Lolium perenne*). Therefore, the majority of play for the major sports of football, baseball, and soccer in the southern portion of the U.S. transition zone occurs on overseeded perennial ryegrass surfaces. Thus, perennial ryegrass is the species that is routinely painted prior to games and events.

Materials & Methods

Research was conducted in 2012 and 2013 at the Oklahoma State University Turfgrass Research Center in Stillwater, OK. The experiment was replicated three times and consisted of commercially available 'Patriot' bermudagrass (*Cynodon dactylon* x *C. transvaalensis*) with individual plot sizes of 2.1 x 1.2 m. Each bermudagrass plot was overseeded with Palmer's Pride Par 3 perennial ryegrass on September 26, 2012 at 80g/m^2 and again on October 17, 2012 40g/m^2. No pre-cultivation methods were used before overseeding with a drop spreader.

Paint applications were made to the perennial ryegrass overseeded plots when maturity was reached (Fig 1). Paint applications were made on November 15, 2012 and March 14, 2013. All paint treatments consisted of Pioneer Brite Stripe Athletic Field Paint (Pioneer Athletics). Nine total treatments included the colors: red, orange, yellow, green, blue, purple, white, black and an unpainted control (Fig. 2). The dilution ratio of each paint color was a 1:1 volumetric dilution of paint and water. A Graco Magnum LTS Airless painter was used to apply the paint treatments.

Net photosynthesis rates of each treatment were measured one week after each paint application (Fig.3). Photosynthesis rates were taken using a LI-COR 6400-15 extended reach portable gas exchange system (Fig. 4). The chamber is designed with a 1.0 cm diameter aperture specifically for measuring small leaves which are difficult to clamp in customary chambers. Leaf area of each leaf clamped in the LI-COR 6400 was taken using a LI-3000C portable leaf area meter. Net photosynthesis was then calculated based on the leaf area of the individual perennial ryegrass leaf due to the leaf not covering the entire 1 cm chamber of the LI-COR 6400.
Temperature ratings of each treatment were measured one day and two weeks after painting application with a Fluke 561 Infrared Thermometer.

Purpose & Objectives

- Examine the effects of athletic field paint on overall turfgrass health
- Examine the effects of 8 different athletic field paint colors on net photosynthesis and canopy temperature of perennial ryegrass

Table 1. Net photosynthesis of overseeded perennial ryegrass

Treatment	Fall	Spring
	Net Photosynthesis	Net Photosynthesis
	µmol $CO_2m^{-2}s^{-1}$	µmol $CO_2m^{-2}s^{-1}$
Untreated	13.0a	23.6a
White	8.7cd	12.2a
Red	11.0b	15.6b
Orange	10.1bc	12.9cd
Yellow	10.3bc	12.6cd
Green	7.8de	13.5cd
Blue	7.4de	13.6c
Purple	7.6de	12.0d
Black	6.3e	12.1e
LSD	**1.6**	**1.5**

Table 2. Canopy temperature of overseeded perennial ryegrass

Treatment	16- Nov	30-Nov	15- Mar	28- Mar
Untreated	71.6ef	65.8c	82.3d	78.9e
White	71.1f	65.2c	82.1d	78.2e
Red	73.1cd	65.9c	88.6b	80.3cd
Orange	72.6c-e	66.0c	87.7b	80.5cd
Yellow	71.9d-f	65.9c	83.9c	79.5de
Green	78.6a	67.1b	91.3a	81.1bc
Blue	75b	67.2b	91.3a	82.3ab
Purple	73.8bc	66.1c	85.4c	78.6e
Black	79.7a	68.9a	92.0a	83.5a
LSD	**1.3**	**.9**	**1.5**	**1.4**

Results

There was a significant interaction between year and painting treatments and data is presented separately for each year. In both 2012 and 2013, untreated plots had the highest net photosynthesis among all treatments (Table 1). In 2012, the red treatment had higher net photosynthesis compared to purple and black, but was not different from other paint colors. In 2013, the red treatment had higher net photosynthesis than all other colors. In 2012, the black treatment had lower net photosynthesis compared to untreated and red, but in 2013 black had the lowest net photosynthesis among all treatments. In both years, there was no difference in net photosynthesis among blue, green, orange, yellow, and white treatments. In both years, purple had lower net photosynthesis than untreated and red, and in 2013 was also lower than blue. For canopy temperature there was a significant interaction between rating date and treatment and data is presented separately for each rating date (Table 2). Black rated significantly higher at each rating date than all other colors except green on 16-Nov and green and blue on 15-Mar.

Fig. 1: Paint Application

Fig. 3: Photosynthesis Measurements

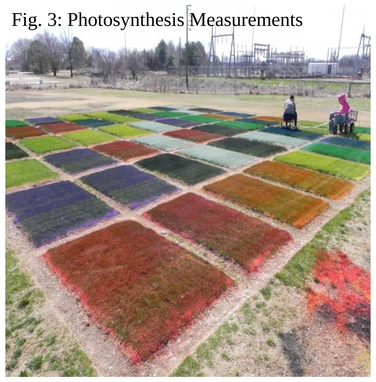

Fig. 2: Completed Paint Treatments

Fig. 4: LI-COR 6400-15

Discussion

Athletic field paint applications are an essential component of popular athletic events all over the world. Establishing the connection between paint and turfgrass health not only has the potential to increase the safety and aesthetics of athletic turf but also the potential to fundamentally change the nature of paint products themselves. Choice of paint color on athletic fields has a significant effect on plant photosynthesis whereby darker paint pigments reduced turf photosynthesis rates.