TURFGRASS RESEARCH FOR HIGH TRAFFICKED AREAS

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1999 was another busy year for turfgrass research for high trafficked areas. This year we concentrated our research on finishing up some existing research projects as well as beginning a number of new studies. Copies or extended versions of these reports are also available via the World Wide Web at www.css.msu.edu.

Major areas of research include:

1) EFFECTS OF TRNEXAPAC-ETHYL AND WETTING AGENT ON ESTABLISHMENT RATE OF *POA PRATENSIS* IN A SAND-BASED ROOT ZONE.
2) MANAGING *POA SUPINA* SCHRAD.
3) AMMENDMENTS FOR LOW BUDGET ATHLETIC FIELDS.
4) QUEST FOR TRACTION IN THE ALTERNATIVE SPIKE WORLD.
5) ENGINEERING AND AGRONOMIC PROPERTIES OF SOIL MIXES.

Each of these areas will be reviewed in this paper and/or in subsequent papers within these proceedings.

EFFECTS OF TRINEXAPAC-ETHYL AND WETTING AGENT ON ESTABLISHMENT RATE OF *POA PRATENSIS* IN A SAND-BASED ROOT ZONE.

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Objective

The objective of this research was to investigate the use of a plant growth regulator and wetting agent to aid in establishment and subsequent development of Kentucky bluegrass (*Poa pratensis*) in a sand-based root zone. Our hypothesis was that one or both of these chemicals could enhance establishment, leading to a more rapidly established turfgrass stand.

Introduction

The challenge for the sports turf manager is to sustain a dense turf stand throughout the competitive season. However, often times, regardless of proper management practices, areas of the field or entire fields can be worn very thin or even bare due to their intense use. Consequently, when the turf wear resistance reaches its breaking point, the perennial focus of athletic field management is the establishment of a new turf stand, often as quickly as possible. The objectives of these studies were to evaluate the effects and interactions of both Trinexapac-ethyl and soil surfactant applied during the establishment process. Plant growth regulators have been researched for a number of uses. Plant growth regulators use on mature sod has been investigated for a variety reasons, including installation and management (Hall and Bingham, 1993). Trinexapac-ethyl has also been investigated for its potential in aiding in establishment of mature sod (Wynne *et al.*,1998, Bingaman and Christians, 1998). Trinexapac-ethyl applied to established turf has been shown to enhance the lateral growth (Watschke and Dipaola, 1995). This study was designed to evaluate various Trinexapac-ethyl rates applied at different times during the establishment process to determine effects on the establishment rate of *Poa pratensis*. If density can be increased early during the establishment process, then wear tolerance could be increased (or the establishment process shortened) from this perennial activity.

Today's top athletic fields have an additional characteristic other than intense use that can make the establishment of turf difficult: high sand content root zones. High sand content root zone mixes are desirable because they drain very well and resist compaction, but these mixes can present some problems, particularly during establishment. Sand particles tend to have high surface tension causing them to be hydrophobic, making moisture retention for seed germination difficult. One way to reduce the surface tension of the sand particles and increase the moisture retention of the sand is through the application of a soil surfactant, Aqueduct™, incorrectly sited as Primer™ 604 in the proposal. This increased moisture retention could enhance the germination process.

Materials and Methods

This two-year study was initiated in May 1998 on a sand-based root zone research area (97.4% sand, 0.9% silt, 1.7% clay) at the Hancock Turfgrass Research Center located on the Michigan State University campus, East Lansing, MI. In May 1999 the plots were stripped and tilled and the entire experiment was repeated. The experiment was a 5 x 2 (plant growth regulator x wetting agent) factorial in a randomized complete block, strip plot design with three replications. Traffic was applied as a strip treatment. The plots measured 3.0 m (10 ft) by 3.6 m (12 ft). *Poa pratensis* 'Touchdown' was seeded over the entire area at 12.2 g m^{-2} (2.5 lb 1000 ft^{-2}) on 20 May 1998 and 27 May 1999. Four plant growth regulator (PGR) treatments (Primo™, Novarits, Greensboro, NC) and a control were used: (1) 0.1 ml m^{-2} (0.3 fl oz 1000 ft^{-2}) 7 days after seedling emergence; (2) 0.2 ml m^{-2} (0.6 fl oz 1000 ft^{-2}) 7 days after seedling emergence; (3) 0.1 ml m^{-2} (0.3 fl oz 1000 ft^{-2}) applied after the first mowing; and (4) 0.2 ml m^{-2} (0.6 fl oz 1000 ft^{-2}) applied after the first mowing. Control plots received no PGR. In 1998, treatments 1 and 2 were applied 28 days after seeding and treatments 3 and 4 were applied 52 days after seeding. In 1999, treatments 1 and 2 were applied 24 days after seeding and treatments 3 and 4 were applied 49 days after seeding.

A wetting agent (Aqueduct™, Aquatrols, Cherry Hill, NJ) was applied every 10-14 days throughout the growing season to half the plots in each replication at the rate of 2.0 ml m^{-2} (6.0 fl oz 1000 ft^{-2}). Following turf establishment, all PGR treated plots received two supplemental PGR applications 30 and 60 days after the initial application. In 1998, for treatments 1 and 2 these dates were 20 July and 21 August, for treatments 3 and 4 they were 12 August and 11 September. In 1999, for treatments 1 and 2 these dates were 26 July and 19 August, for treatments 3 and 4 they were 19 August and 18 September. In both 1998 and 1999 the plots received 9.8 g P m^{-2} (2.0 lb P 1000 ft^{-2}) using 13-25-12 (Lebanon Country Club, Lebanon, PA) at seeding and 4.9 g P m^{-2} (1.0 lb P 1000 ft^{-2}) in early June. Beginning the first week in July, the plots received 2.5 g N m^{-2} (0.5 lb N 1000 ft^{-2}) every week throughout the growing season using 26-0-26 (Northern Star Mineral, East Lansing, MI). The plots were mowed three times per week at 3.2 cm (1.25 in) using a John Deere 2653A triplex reel mower (Moline, Ill).

Plots were evaluated weekly or as needed from late June through November using color and density ratings. The color ratings were done visually using a 1-9 scale where 1=brown-yellow, 5=acceptable, and 9=dark green. Density ratings were assessed visually by estimating percent cover. A cup cutter with a diameter of 8.9 cm (3.5 in) was used to take three random cores from each plot to quantify differences in density on 4 September and 20 November in 1998. In 1999 samples were taken on 25 September. The cores were trimmed by hand to remove all green tissue present. Verdure samples were combined to make a composite sample for each plot. Composite samples were then oven dried for 48 h at 50° C and weighed. In 1998, from 11 September to mid-November 1998 traffic was applied twice per week as a strip application to a portion of each plot using the Brinkman Traffic Simulator (Cockerham and Brinkman 1989). In 1999 traffic was applied from 21 September to mid-November. The objective was to simulate the traffic between the hashmarks of 2-3 football games per week. Post-traffic density ratings were taken to determine wear tolerance differences between treatments. In 1998, the sod strength of only the untrafficked turf was quantified on 22 October using the Calrochan Sod Puller (Sorochan, *et al.*, 1999) (Pictures 1& 2), a device developed at Michigan State University. The device measures the peak force necessary to completely tear a piece of sod. The sod strength was tested again on 25 November after the turfgrass had hardened off for the season. In 1999, sod strength measurements were taken on 22 October and 23 November. Data were analyzed by analysis of variance (ANOVA, alpha = 0.1).

Results and Discussion

The results from the 1998 study are presented in Figures 1 and 2. While there was some increase in density in 1998 due to the use of Trinexapac-ethyl and wetting agent separately (Figure 1), it became apparent that the combination of these two products was detrimental to turf establishment. This is further exhibited from the sod strength measurements (Figure 2). Although these measurements were recorded in late November the positive effects of Trinexapac-ethyl and the negative effects of the wetting agent + PGR were still apparent. The high rate of PGR 7 days after seeding emergence had significantly higher sod strength than the control (Figure 2). It appeared that Trinexapac-ethyl had potential to accelerate Kentucky bluegrass establishment. However, in 1999 the results did not match those of 1998. There were no positive effects of the Trinexapac-ethyl and wetting agent applied separately. The wetting agent applications resulted in significantly weaker sod strength and the increase in density attributed to Trinexapac-ethyl was not observed (Table 1). Rust (*Puccinia sp.*) outbreaks were observed in 1998 and 1999. The plots that had the highest incidence of the disease were those that received Trinexapac-ethyl in late August or later (Table 1). The conflicting results between 1998 and 1999 are difficult to explain, but emphasizes the importance of repeating a study before recommendations are made. More research must be completed before the use of a wetting agent and/or plant growth regulator is recommended to increase the establishment rate of Kentucky bluegrass on sand.

Figure 1. Effects of Wetting Agent (WA) and Plant Growth Regulator (PGR) on Density of Kentucky Bluegrass (21 July 1998)

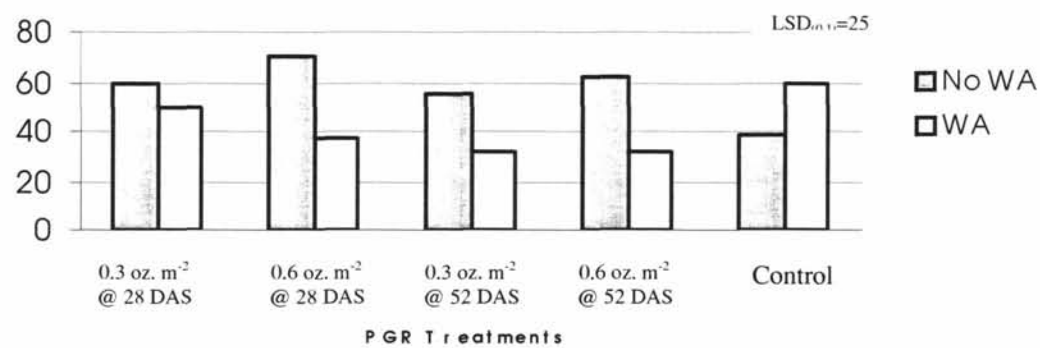

Figure 2. Effects of Wetting Agent (WA) and Plant Growth Regulator (PGR) on Sod Strength of Kentucky Bluegrass (25 November 1998)

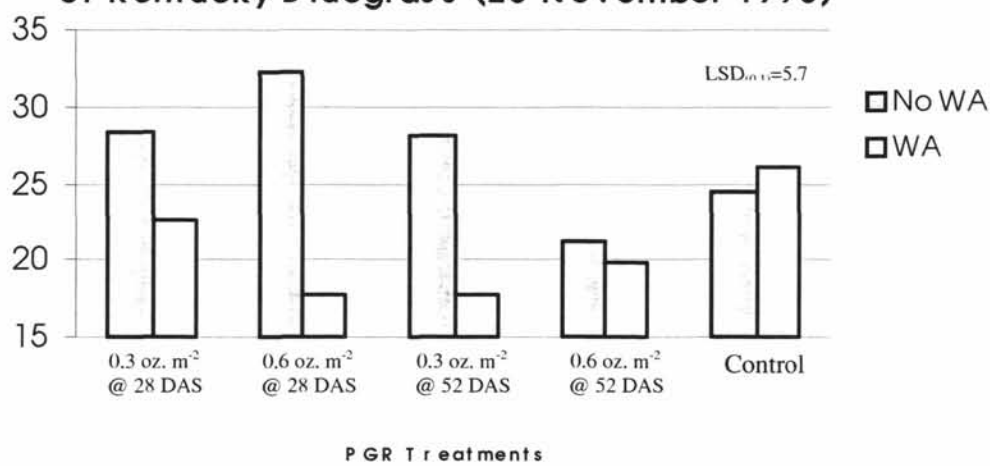

Table 1. Main effects and interaction effects of wetting agent and Trinexapac-ethyl on establishment of Kentucky bluegrass in a high sand-based root zone (selected dates) 1999.

	Color†	Pre-traffic turf cover‡ (%)		Post-traffic turf cover§ (%)		Verdure¶ (g)	Sodpull# (kg)		Rust††
Treatments	21/07	21/07	02/09	22/10	11/11	25/09	22/10	23/11	26/10
Wetting agent (WA)									
No WA	4.4	62.3	90.7	68.7	55.7	10.2	30.1*	27.9*	6.1
WA	4.1	58.0	87.9	67.7	52.3	9.7	23.7	23.3	5.5
Trinexapac-ethyl (PGR)									
0.1 ml m^{-2} 24 DAS‡‡	4.0	57.5	86.0	72.5	59.2	10.3	23.9	27.3	4.2
0.2 ml m^{-2} 24 DAS	4.0	67.5	87.2	70.0	53.3	10.7	25.5	24.5	5.3
0.1 ml m^{-2} 49 DAS	4.5	54.1	88.3	60.8	52.5	9.7	26.9	24.5	7.2
0.2 ml m^{-2} 49 DAS	4.8	49.2	88.0	60.0	46.7	9.7	27.7	22.5	8.7
No PGR	4.0	72.5	97.5	77.5	58.3	9.3	30.5	29.4	3.7
$LSD_{(0.1)}$	0.2	NS	6.0	12.2	9.7	NS	NS	NS	1.1
WA x PGR									
No WA 0.1 ml m^{-2} 24 DAS	4.0	63.3	91.0	80.0	65.0				
No WA 0.2 ml m^{-2} 24 DAS	4.0	51.7	85.0	65.0	60.0				
No WA 0.1 ml m^{-2} 49 DAS	5.0	70.0	95.0	68.3	50.0				
No WA 0.2 ml m^{-2} 49 DAS	5.0	48.3	88.7	50.0	36.7				
No WA x No PGR	4.0	78.3	96.7	80.0	66.7				
WA x 0.1 ml m^{-2} 24 DAS	4.0	51.7	81.0	65.0	53.3				
WA x 0.2 ml m^{-2} 24 DAS	4.0	83.3	89.3	75.0	46.7				
WA x 0.1 ml m^{-2} 49 DAS	4.0	38.3	81.7	53.3	55.0				
WA x 0.2 ml m^{-2} 49 DAS	4.7	50.0	89.3	70.0	56.7				
WA x No PGR	4.0	66.7	98.3	75.0	50.0				
$LSD_{(0.1)}$	0.3	24.1	8.5	17.3	13.6				

* Significant at the 0.1 probability level.
† Color was rated visually on a 1-9 scale where 1 = dead or brown turf, and 9 = dark green turf.
‡ Turf cover was estimated visually as a percentage (0-100%).
§ Traffic began 21 September 1999.
¶ Verdure based on 186.6 cm^2 sample.
# Sod strength was measured with the Calrochan Sod Puller.
†† Rust severity was rated visually on a 1-9 scale where 1 = no rust and 9 = desiccation due to rust.
‡‡ DAS, days after seeding (seeded on 27 May 1999).

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MANAGING *POA SUPINA* SCHRAD.(SUPINA BLUEGRASS) IN MICHIGAN 1996-1998

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Introduction

Due to the need to develop better turf systems for high wear areas on golf courses and athletic fields a research program was started at Michigan State University in 1994 to develop management practices for supina bluegrass in Michigan. A preliminary report has been published on the comparison of supina bluegrass, Kentucky bluegrass (*Poa pratensis* L.), and perennial ryegrass (*Lolium perenne* L.) sods for sand based athletic fields (Rogers et al., 1996). Although supina bluegrass has been used extensively in certain areas of Europe, little published research exists to recommend specific management practices. This is the fourth and final year for data collection from the following three experiments. Results from 1996 and 1997 data can be found in last years Annual Michigan Turfgrass Conference proceedings. In 1995, three plot areas were established to satisfy the following research objectives: 1) Determine the appropriate mowing height range, 2) Determine the fertility requirements on sandy loam soil, and 3) Determine the effect of seeding ratios of supina bluegrass : Kentucky bluegrass on turf characteristics, with a long term objective to determine the changes in stand composition over time.

This is the final year for these studies and final drafts are currently being drawn up for refereed publications. Therefore, results and conclusions will be available on the aforementioned web site in early February when final drafts are completed.

Materials and Methods

Experiment 1: Fertility requirements of supina bluegrass

Supina bluegrass 'Supra' was established on a sandy loam soil at the Hancock Turfgrass Research Center, Michigan State University, MI., during summer 1995. The plot area (40 ft x 40 ft) was seeded with 1.5 lb/1000 ft^2 seed on 21 June 1995 using a drop spreader. Starter fertilizer (13-25-12) was applied at time of seeding to supply approximately 1 lb. N and 1 lb. P/1000 ft^2. The area was hydromulched and an automated irrigation system used to maintain sufficient moisture levels for germination, establishment, and subsequent maintenance. All plots were fertilized equally during 1995 with approximately 2.75 lb. additional N/1000 ft^2 with approximately 1 lb/1000 ft^2 additional P and 1.5 lb/1000 ft^2 additional K. On 17 Nov. 1995 a dormant application of 1 lb/1000 ft^2 N was applied using SCU (40-0-0). Beginning July 1995 all plots were mowed with a triplex riding mower at approximately 1.25" cutting height. Clippings were returned in each year (1995-1999).

A factorial experiment was developed to test individual fertility treatments beginning spring 1996, and was continued through 1999. Both total N (2, 4, and 6 lb/1000 ft^2/year) and N to K ratios (2:1 and 1:1) were investigated. The experimental design was a strip-plot, randomized complete block with three replications. Main plots were fertility treatments which were stripped for traffic (no traffic and simulated athletic traffic). Fertility treatment dates were as follows (Table 1), with 1 lb. N/1000 ft^2 and ½ (treatments 1-3) or 1 lb. K/1000 ft^2 (treatments 4-6) applied on each date. Urea (46-0-0) was used as the N source and sulfate of potash (0-0-50) was used as the potassium source.