Table 3. Turfgrass Density on 4 Growth Media (Averaging Turf species)

Growth media	Weeks after seeding 2	3	5	10
	Percent cover (%)			
Pine mulch	1.8	5.0	15.2	35.8
Sand	1.3	2.8	12.0	18.8
Ecomat™	2.0	3.3	19.5	36.7
SprotGrass™	3.3	13.2	90.3	97.8
$LSD_{(0.05)}$	n/s	2.4	7.9	14.4

Effect of seeding ratio of Supina bluegrass and Kentucky bluegrass and fertility on turf subjected to simulated sports traffic.

J.C. Stier, J.N. Rogers, III, and J.C. Sorochan

Introduction

Supina bluegrass (*Poa supina* Schrad.) has been recognized for its exceptional wear tolerance, disease resistance, and aggressive competitive ability for many years in Germany and other areas of Europe (Berner, 1980; Pietsch, 1989). Unfortunately the cost of Supina bluegrass seed is quite high, approximately $25/lb, so the practicality of seeding monostands of the grass is often economically unfeasible. Evidence from Germany suggests relatively low rates (e.g., less than 10%) of Supina bluegrass seed can be mixed with other cool season grasses and after several years of heavy traffic the stand will be predominantly Supina bluegrass, providing superior cover compared to stands without Supina bluegrass. The objective of this project was to determine the effect of seeding ratios of Supina bluegrass:Kentucky bluegrass on turf characteristics. A long-term objective is to determine the changes in stand composition over time.

Materials and Methods

Plots were established June 1995 on a sand based root zone (80:10:10, sand:peat:soil). Individual plots (10 x 18 ft) were seeded by hand (1.25 lb seed/1000 ft^2) and the seed was raked lightly into the surface. Plots were covered with hydromulch and kept moist during the germination and establishment processes. Following establishment all plots were mowed at 1.25" height with a riding triplex mower; clippings were returned. Plots were irrigated daily, or as needed in the spring and fall, using an automated irrigation system to prevent moisture stress. All plots were fertilized equally during 1995 with approximately 2.75 lb additional N/ 1000 ft^2, approximately 1 lb/1000 ft^2 additional P, and 1.5 lb/1000 ft^2 additional K. Fertilizer was applied on six dates between June through October with no more than 0.6 lb N/1000 ft^2 applied at any date. On 17 Nov. 1995 a dormant application of 1 lb/1000 ft^2 N was applied using SCU (40-0-0).

A factorial experiment was used to evaluate the effect of seeding mixtures and monostands of Supina bluegrass (SB) 'Supra' and Kentucky bluegrass (KB) 'Touchdown' on turf characteristics and eventually, changes in stand composition over time. The experimental design was a split-plot, randomized complete block with three replications. Main plots were the six seeding treatments: Trt 1=100% SB, Trt 2=50%SB:50% KB, Trt 3=75% SB:25%KB, Trt 4=10% SB:90%KB, Trt 5=5% SB:95% KB, and Trt 6=100% KB. Plots were split to evaluate the effects of low (4 lb N/1000 ft^2/year) and high (6 lb N/1000 ft^2/year) fertility levels. Nitrogen was applied at approximately a 1:1 ratio with potassium on most dates using an 18-3-18 fertilizer (Table 1).

Table 1. Fertility schedule and rates for Supina bluegrass:Kentucky bluegrass seeding ratio study.

Low fertility (4 lb N/1000 ft²/year)	High fertility (6 lb N/1000 ft²/year)
10 May 0.5 lb N, 18-3-18	10 May 0.5 lb N, 18-3-18
	24 May 0.75 lb N, 18-3-18
3 June 0.5 lb N, 18-3-18	14 June 0.5 lb N, 18-3-18
28 June 1.0 lb N, 40-0-0 SCU	28 June 1.0 lb N, 40-0-0 SCU
	2 Aug. 0.5 lb N, 18-3-18
16 Aug. 0.5 lb N, 18-3-18	16 Aug. 0.75 lb N, 18-3-18
5 Sept. 0.5 lb N, 18-3-18	5 Sept. 0.5 lb N, 18-3-18
	1 Oct. 0.5 lb N, 18-3-18
16 Nov. 1.0 lb N, 46-0-0 urea	16 Nov. 1.0 lb N, 46-0-0 urea
TOTAL ANNUAL N = 4 LB/1000 FT²	TOTAL ANNUAL N = 6 LB/1000 FT²

Simulated athletic trafic was applied using a Brinkman Traffic Simulator (BTS). Lightweight athletic traffic (i.e., soccer-type) was applied as a split-plot treatment using a Brinkman Traffic Simulator (BTS) with empty rollers from 28 May to 9 July for a total of an estimated 11 games. Beginning 9 Aug., the rollers on the BTS were filled with water and used to simulate one to three football games per week ending 18 November.

Turf color, density, and quality were evaluated on a regular basis. An Eijkelkamp shear vane apparatus was used to determine turf shear resistance. Dollar spot disease ratings were collected on 17 September. Changes in stand composition will be determined by spring 1997 and spring 1998 by collecting plants at random from each plot using a point quadrat and determining the percentages of Supina bluegrass and Kentucky bluegrass.

Results and Discussion

Kentucky bluegrass displayed significantly darker green color compared to any mixture or the monostand of Supina bluegrass (Table 2). Mixtures containing between 75 to 95% Kentucky bluegrass had significantly darker green color compared to either the 50:50 mixture or pure Supina bluegrass both of which had a relatively similar light green color.
Turf density and quality of all mixtures were similar to one another. Kentucky bluegrass alone had similar density compared to all mixtures. Turf quality of the 100% KB stand was initially lower than any mixture or the monostand of Supina bluegrass although by autumn the 100% KB turf quality was equivalent to all mixtures and superior to the monostand of Supina bluegrass. Lack of sufficient irrigation in the autumn may have caused a decline in quality of the monostand of SB. Mixtures containing 75-95% KB resulted in a mottled turf early in the spring although this effect declined towards autumn, presumably as the SB comprised an ever greater proportion of the turf stand.

As expected, both species responded positively to the higher fertility rate initially although by 13 Dec. the high fertility rate caused a significant decline in turf density and quality, perhaps due to decreased root:shoot growth and increased succulence of the turf. There were no interactions between fertility rate and seeding ratio on turf density or quality at any time in 1996.
Shear resistance values were not significantly different among any seeding treatments although there was a trend toward decreased shear resistance values as the percentage of SB was increased (Table 3). This may have been due to lack of adequate moisture in the autumn to sustain root growth of SB. KB may be less affected than SB by lower soil moisture levels. SB has been reported to have relatively poor drought tolerance (Berner, 1980; Leinauer, 1991). In addition, KB may have inherently greater shear resistance compared to SB due to the presence of rhizomes which SB lacks. Previous research has noted the low shear resistance of SB compared to

KB (Shildrick and Peel, 1985). The high fertility rate did decrease shear resistance values by October, probably due to decreased root:shoot growth.

Dollar spot severity was not significantly different among any seeding treatments although there was a trend towards decreased severity as the percentage of KB increased (Table 3). However, in no instance could dollar spot damage be considered severe. Previous research and observations have indicated good disease resistance of SB to many diseases (Berner, 1980; Shildrick and Peel, 1985). The low fertility treatment resulted in significantly more dollar spot damage compared to the high fertility treatment which had negligible dollar spot (Table 3).

Conclusions

Within one year a 50:50 mixture of SB:KB displayed similar color compared to 100% SB although density and total quality were significantly superior and equivalent to mixtures containing 75-95% KB. Plots of 100% SB were always lighter green compared to KB regardless of fertility rates although higher fertility levels did enhance color of both species. High fertility rates decreased turf quality, density, and shear resistance of both species, although turf quality and density was only decreased by December and the differences for practical purposes were small. Consequently, the high fertility rate was deemed superior to the low fertility rate for general management. This is an ongoing project and changes in stand composition and their effects on turf characteristics will be investigated over the next several years.

Table 2. Effects of Supina bluegrass (SB) and Kentucky bluegrass (KB) seeding ratios and fertility rates on turf subjected to simulated sports traffic, East Lansing, MI, 1996.

	13 June	16 July	14 Aug.	14 Oct.	13 Dec.
Treatment			Color†		
Seeding mixture ‡					
100 % SB	5.1	5.2	4.9	4.5	4.1
50% SB:50% KB	5.8	5.4	4.9	4.8	3.6
25% SB:75% KB	5.9	5.8	5.1	5.4	3.5
10% SB:90% KB	6.2	6.0	5.6	5.5	4.3
5% SB:95% KB	7.1	6.4	6.4	6.0	5.0
100% KB	8.6	8.2	8.5	7.9	4.8
LSD (0.05)	0.6	0.6	0.6	0.9	ns
Fertility §					
low	6.5	6.1	5.5	4.8	3.1
high	6.4 ns	6.2 ns	6.3	6.6**	5.3**

cont.

Table 2. cont.

Seeding mixture			Density (% turf cover)		
100 % SB	99.7	97.0	97.8	86.8	65.0
50% SB:50% KB	99.7	97.3	97.5	92.3	79.8
25% SB:75% KB	98.5	97.3	98.2	92.7	80.3
10% SB:90% KB	99.0	97.5	99.2	95.2	81.2
5% SB:95% KB	98.2	97.0	99.2	95.5	84.8
100% KB	99.2	98.7	99.7	81.5	84.8
LSD (0.05)	ns	ns	ns	ns	11.8
Fertility					
low	98.7	97.3	97.6	91.7	82.4
high	99.3 ns	97.6 ns	99.6**	89.6 ns	76.3*

Seeding mixture	Quality¶				
100 % SB	8.9	8.5	6.9	4.5	2.1
50% SB:50% KB	8.8	8.6	6.8	6.0	3.6
25% SB:75% KB	8.6	8.2	6.7	6.0	3.4
10% SB:90% KB	8.5	7.6	6.8	6.9	3.4
5% SB:95% KB	8.3	7.7	6.6	6.7	3.8
100% KB	8.0	8.7	8.4	7.0	4.0
LSD (0.05)	0.3	0.4	ns	0.6	ns
Fertility					
low	8.6	8.1	6.2	6.1	3.6
high	8.5 ns	8.3 ns	7.9**	6.3 ns	3.1*
No. games simulated#	6	14	1	17	29

*,** Significant at the 0.05 and 0.01 probability levels, respectively; ns = not significant at p=0.05.

† Color was rated visually on a 1-9 scale; 1=100% brown, 9=dark green.

‡ Plots were seeded with Supina bluegrass 'Supra' and/or Kentucky bluegrass 'Touchdown' at 1.5 lb seed/1000 ft^2 in June 1995. Mixtures were on a weight:weight basis.

§ Low fertility: ½ lb N/1000 ft^2 using 18-3-18 on 10 May, 3 June, 16 Aug., and 5 Sept., plus 1 lb N/1000 ft^2 using sulfur coated urea (40-0-0) on 28 June and 1 lb N/1000 ft^2 using urea on 16 Nov. 1996. High fertility: ½ lb N/1000 ft^2 10 May, 14 June, 2 Aug., 5 Sept., 1 Oct.; ¾ lb N/1000 ft^2 24 May, 16 Aug., all using 18-3-18, plus 1 lb N/1000 ft^2 using sulfur coated urea (40-0-0) on 28 June, and 1 lb N/1000 ft^2 using urea on 16 Nov.

¶ Quality was rated visually on a 1-9 scale: 1=100% necrotic turf/bare soil, 9=dense, uniform turf with acceptable color (color ≥ 5).

A Brinkman Traffic Simulator (BTS) with empty rollers was used to simulate soccer games from 14 May- 9 July; afterwards, the rollers were filled with water and the BTS was used to simulate football games from 9 Aug. - 18 Nov.

Table 3. Effects of Supina bluegrass and Kentucky bluegrass seeding ratios on turf shear resistance and dollar spot severity of turfgrass subjected to simulated sports traffic, East Lansing, MI, 1996.

	Shear resistance (N m)		Dollar spot, % area affected
Treatment	23 July	16 Oct.	14 Aug.
Seeding mixture †			
100 % SB	17.5	9.9	1.7
50% SB:50% KB	19.7	11.6	1.7
25% SB:75% KB	19.2	12.0	1.5
10% SB:90% KB	21.2	13.3	0.3
5% SB:95% KB	21.2	13.7	0.5
100% KB	20.3	14.9	0.2
LSD (0.05)	ns	ns	ns
Fertility ‡			
low	20.4	14.3	1.6
high	19.3 ns	10.8*	0.3*
No. games simulated§	14	18	1

* Significant at the 0.05 probability level; ns = not significant.

† Plots were seeded with Supina bluegrass 'Supra' and/or Kentucky bluegrass 'Touchdown' at 1.5 lb seed/1000 ft^2 in June 1995. Mixtures were on a weight:weight basis.

‡ Low fertility: ½ lb N/1000 ft^2 using 18-3-18 on 10 May, 3 June, 16 Aug., and 5 Sept., plus 1 lb N/1000 ft^2 using sulfur coated urea (40-0-0) on 28 June and l lb N/1000 ft^2 using urea on 16 Nov. 1996. High fertility: ½ lb N/1000 ft^2 10 May, 14 June, 2 Aug., 5 Sept., 1 Oct.; ¾ lb N/1000 ft^2 24 May, 16 Aug., all using 18-3-18, plus 1 lb N/1000 ft^2 using sulfur coated urea (40-0-0) on 28 June, and 1 lb N/1000 ft^2 using urea on 16 Nov.

§ A Brinkman Traffic Simulator (BTS) with empty rollers was used to simulate soccer games from 14 May- 9 July; afterwards, the rollers were filled with water and the BTS was used to simulate football games from 9 Aug. - 18 Nov.

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