NUTRIENT REQUIREMENTS AND ESTABLISHMENT METHODS OF ATHLETIC TURF IN SAND BASED ROOTZONES.

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INTRODUCTION

As the level of competition and athleticism continue to increase across the nation so to does the need for quality athletic fields. During the summer of 1992 a new athletic field was completed at the Hancock Turfgrass Research Center (HTRC) on the campus of Michigan State University. Known by its acronym of PAT, Prescription Athletic Turf is unique in its design relative to most athletic fields. The PAT field installed at the Hancock Center is a self-contained system. A two-ply plastic sheet seals the PAT system from surrounding soils. Within this membrane a network of drain tiles are spaced evenly throughout the base of the field. These slitted tiles (4" pipes) are covered by a one foot rooting mixture. The rooting mixture is comprised of eight inches of straight sand and the remaining top 4 inches being a 80% sand and 20% peat in composition. Lastly, and most importantly, the drainage tiles are connected to an array of pumps which may extract water when conditions are too wet or subsurface irrigate if conditions are too dry.

OBJECTIVES

Research has been conducted in the areas of establishment and fertility and their importance to the turfgrass system. Much of that research was based on existing turfs within a nonmodified and/or soil based system (not high in sand content). PAT's rooting mixture, as mentioned previously, is quite high in its percentage of sand, serving primarily to resist compaction from traffic. However, sands do not hold nutrients readily due to their low cation exchange capacity. The information available in regard to turfgrass establishment procedures in high sand based rootzones is limited. Therefore a study was initiated in fall 1992 to evaluate establishment methods and fertility programs in high sand based rootzones.

MATERIALS & METHODS

The study was initiated at the HTRC in Fall 1992. Two establishment methods, particularly the difference between washed Kentucky bluegrass (KBG) sod and perennial ryegrass seed, as well as the addition of woven polypropylene fibers were evaluated. The development of a strong rooting system in the sandy PAT rooting mix is a primary concern. The inclusion of the polypropylene fibers with sodded or seeded turf allowed us to investigate the possibility of increased stability at the turf/soil interface.

In association with the establishment and fiber treatments there were six fertilizer treatments. The fertilizers used were chosen so as to provide a mixture of readily available and slowly available nitrogen sources as well as complete and incomplete fertilizers. These factors are summarized in Table 1.

Table 1. Treatment factors for establishment and fertility study of high sand based rootzones.

FACTOR	TREATMENT
A. Establishment Methods	1. Kentucky Bluegrass Sod (washed) 2. Perennial Ryegrass Seed
B. Fiber Treatments	1. With fiber 2. Without fiber
C. Fertilizer Treatments	1. Urea (46-0-0) 2. IBDU (31-0-0) 3. Lebanon (13-25-12) 4. SC Urea (32-0-0) 5. Nutri-Plus (10-3-4) 6. Milorganite (6-2-0)

The experimental design was a 2X2X6 split-plot randomized complete block design replicated three times. Initial establishment took place late summer 1992. On 25 August, 13-25-12 Lebanon was applied over the entire study area at a rate of 1 lb N/M (49 Kg N/ha). Fiber treatments were laid down at a rate of 178 fibers/ft^2 (1916 fibers/m^2). The washed bluegrass sod was laid 28 August with ryegrass being seeded 29 August. On 4 and 16 September, 25-0-25 was applied at 0.5 lb N/M (24.5 Kg N/ha) per application. The first fertilizer applications were administered at a rate of 0.5 lb N/M (24.5 Kg N/ha) for each respective fertilizer treatment on 19 September. The first mowing of the study area was conducted 24 September using a Toro recycler mower at a height of 2.75 inches (7 cm). An application of 0-0-50 was applied at 1 lb K_2O/M (49 Kg K_2O/ha) on 8 October and on 9 October fertilizer applications were applied at the 0.5 lb N/M rate. The grasses had began to harden off at this point as growth rates reduced considerably.

Biweekly fertilizer applications for all treatments resumed on 7 May 1993 at 0.5 lb N/M (24.5 Kg N/ha) rates as well as monthly applications of 0-0-50 at a rate of 1 lb K_2O/M (49 Kg K_2O/ha) to maintain acceptable soil potassium levels based on soil tests. At no time during the study was phosphorous at inadequate levels. Wear treatments were applied using the Brinkman Traffic Simulator beginning 27 August.

Rate of traffic was 8 passes per week thus simulating 4 games between the hash marks at the 40 yard line, (Brinkman & Cockerham, Univ. Cal. Riverside). Traffic simulation was conducted through 15 November. Data collected included color, quality, and density ratings along with shear vane measurements.

Color was rated on a scale of 1-9 with 1 being brown and 9 having a dark green color. Density was rated on a percent coverage basis, 1-100. A quality rating was conducted near the end of the growing season as a means of assessing overall appearance. Shear vane measurements began Sept. 93 after wear treatment had initiated.

RESULTS

The washed Kentucky bluegrass sod was consistently better than the perennial ryegrass for all areas where data was collected. It should also be emphasized that this trend continued even as wear simulation was maintained through the fall. Three dates were chosen for rating color and density relating to early, middle and late season growth. This information is illustrated in Tables 2 and 3.

Polypropylene fibers did not provide significantly better quality and shear vane measurements through the majority of the study, however, significant differences were noted **late** in the season. After approximately 42 simulated games the fibers did prove to be advantageous in that they provided for greater coverage rather than bare soil. The overall benefit of the fibers can be argued as 42 games in one season is atypically high but some situations may present this type of traffic. Both quality and shear vane measures for fiber treatments are shown in Table 4. The turf quality was again an overall assessment of the turf system.

Complete fertilizers as compared to nitrogen only fertility regimes provided significantly higher turf quality ratings. It must be noted that both phosphorous and potassium levels were **maintained at adequate levels** throughout the study. This information emphasizes the importance of additional phosphorous and potassium in the establishment and growth processes of high sand content turf. Table 5 illustrates this point.

CONCLUSIONS

Washed KBG sod provided significantly higher color and quality ratings compared to perennial ryegrass seed. The washed KBG sod had a 12% higher average density and 26% higher average shear measure relative to the seeded perennial ryegrass over the 1993 growing season. The polypropylene fibers added no significant improvements relative to quality or shear early in the study but resulted in significantly higher quality and shear measures **late** in the season (after approximately 42 simulated games).

Lastly, complete fertilizers (N-P-K) provided significantly higher color, density, and quality ratings in comparison to nitrogen only fertilizers in spite of phosphorous and potassium not being limiting in the experiment.

Recognition is deserving to Turfgrass Services Co., Inc. for their donation of material, installation labor, and time in providing M.S.U. researchers an opportunity to conduct proposed studies on such an athletic field.

Table 2. Color, quality, and density ratings for establishment methods averaged over all fertilizer and fiber treatments, 1993, HTRC, Michigan State University.

	Date			
	27 May	6 July	26 Oct.[1]	3 Nov.[2]
Establishment Method	Color[3]			Quality[4]
Washed KBG sod	6.8*	7.2*	7.6*	3.9*
Per. Rye seed	5.4	6.8	5.8	3.0
	Density[5]			
Washed KBG sod	91*	94*	95*	—
Per. Rye seed	78	88	42	—

1 After approximately 38 simulated games.
2 After approximately 42 simulated games.
3 Color 1–9; 1=brown, 9=dark green and 6 acceptable.
4 Quality 1–9; 1=bare ground, 9=ideal turf.
5 Density; Percentage cover 1–100.
* Significant at 0.05 level.

Table 3. Shear vane measurements for establishment methods, averaged over all fertilizer and fiber treatments, 1993, HTRC, Michigan State University.

	Shear Vane Measurements[1]		
	10 Sept.[2]	24 Sept.[3]	11 Oct.[4]
Washed KBG sod	119*	98*	95*
Per. Rye seed	82	66	67

1 Shear vane measures given in kPa.
2 After approximately 10 simulated games.
3 After approximately 18 simulated games.
4 After approximately 28 simulated games.
* Significant at 0.05 level.

Table 4. Turfgrass quality and shear vane measurements for fiber treatments, 3 Nov. 1993[1], HTRC, Michigan State University.

	Quality[1]	Shear Vane[2]
With fibers	3.8*	87*
Without fibers	3.1	63

1 Quality 1–9; 1=bare ground, 9=ideal turf.
2 Shear vane measures given in kPa.
* Significant at 0.05 level.

Table 5. Turfgrass quality ratings for fertilizer treatments, 3 Nov. 1993[1], HTRC, Michigan State University, Ranges shown by lower case letters.

	Quality[2]
Leb. 13-25-12	4.2 a
IBDU	4.0 a
Nutri-plus	3.8 ab
Urea	3.3 bc
SCU	3.2 c
Milorganite	2.3 d

1 After approximately 42 simulated games.
2 Quality 1–9; 1=bare ground, 9=ideal turf.
LSD=0.6 at 0.05 significance.