1990 Athletic Field Research Summary

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Research in the area of athletic fields and high traffic areas was conducted in 1990 at the Hancock Turfgrass Research Center and the Michigan State University Varsity practice fields. This research was made possible by the support provided by the Michigan Turfgrass Foundation.

I. Perennial ryegrass variety trial on Michigan State University varsity practice field.

A cooperative study with the Michigan State University departments of Intercollegiate Athletics and Grounds Maintenance was initiated on May 1, 1990, to evaluate 19 perennial ryegrass (Lolium perenne) cultivars and four perennial ryegrass blends for density and wear tolerance after subjection to actual wear from football players. (It is believed by the author to be the first test of this type.) The perennial ryegrasses used were those sent by seed companies as their recommendation for sports turf. The companies participating in the study were NK Lawn and Garden, Turf Seed Inc., Pickseed Inc., Lofts Seed Inc., and International Seeds Inc. (Note: Jacklin Seed Co. also sent samples for the study but they arrived too late to be included in the trial.)

The studies were established in two locations on the East Varsity football practice field on the Michigan State University campus. The locations were areas of high and medium traffic. The high traffic location was between the 10 and 30 yardline while the medium traffic location was between the 40 yard lines on the field. (This is opposite of the wear pattern on a game field. In the practice scheme at MSU, the players are divided into their specialties and practice at opposite ends of the field. The high wear location was subjected to the offensive unit.) Both studies were established between the hashmarks.

The plot sizes were 1.2 x 1.8 m (4 x 6 feet) and replicated three times. The plots were seeded at a rate of 6.7 kg/ha (6.0 lbs/1000 ft^2) on May 1 and areas needing additional help in obtaining a full stand were seeded June 12. Traffic was withheld from this area until practice began, August 21. The ryegrasses were evaluated for density (qualitatively) seven times beginning September 5 and every two weeks until November 30. The data were analyzed as a one factor (variety) randomized complete block design combined over locations (high and medium wear).

The density ratings are presented in Table 1. There was a significant difference in density between locations on five of seven evaluation periods. The reason for a low density rating on September 5 and then a large increase in density September 20 was due to the environmental conditions present in late August/early September. This was an unusually hot, dry period and the turf received no supplemental irrigation until September 2. The ratings from September 5 reflected these conditions. After this period the growing conditions were very good for the remainder of the fall.

The varieties presented in Table 1 were averaged over locations as there was no significant location x variety interaction in 1990. Two varieties, in the author's opinion, did separate themselves from the other grasses in 1990, 'Dandy' and 'Repell'. These grasses had maintained consistently high densities throughout the trial.

This evaluation will continue for 1991. The high wear location will be reseeded in May (very typical of athletic field practices in this area) while the medium wear trial will not be subjected to reseeding.

II. Crumb rubber from used tires as a soil modifier for athletic fields.

A cooperative study with the Michigan State University departments of Intercollegiate Athletics and Grounds Maintenance was initiated May 1, 1990, at the varsity practice football fields of Michigan State University to investigate the effects of crumb rubber from used tires as a soil modifier. The pretrial thought was that the rubber in the soil would absorb the traffic and the soil would not compact as readily, thereby leaving pore space for root growth and a healthier, longer wearing turfgrass plant.

The rubber pellets (6.0 mm dia.) were tilled into the soil (textural class-sandy loam) at a depth of 10 cm. The plot size was 1.2 x 1.8 m (4 x 6 feet). There were three rubber volumes (0, 10, 15) and each of these treatments were replicated three times. The study was conducted in two separate areas on the field in areas of high and medium traffic (The traffic consisted of the Michigan State University varsity football team). The high traffic area was located between the 10 and 30 yard lines and the medium traffic areas between the 40 yard lines. (These traffic areas are directly opposite of the wear pattern for a actual game. The football team practices in specialized groups at ends of the field, thereby leaving the before mentioned wear patterns). Both studies were established between the hashmarks. The grass sown was perennial ryegrass (Lolium perenne) at a rate of 6.7 kg/ha (6.0 lbs/1000 ft^2). The perennial ryegrass was a blend by NK Lawn and Garden Inc. called Medalist 8. The varieties in the blend were 40% 'Dandy', 30% 'Delray' and 30% 'Target'. Traffic was withheld from these areas until the football practice began August 21.

The plots were evaluated for impact absorption every two weeks beginning September 5 with the Clegg Impact Soil Tester, CIT (Table 2.). The hammer weight was 2.25 kg. The CIT has been used by the author and several others to evaluate and compare turf, soil, and artificial surfaces. An accelerometer mounted in the hammer measures the duration of the impact. The shorter the time period, the greater the deceleration of the hammer, and the harder the surface. The impact is given in units of g's, with g_{max} being the peak deceleration of the object. The design was analyzed as a one factor (rubber volume) randomized complete block design combined over locations (high and medium wear). The rubber x location was not significant during 1990. On five of the seven evaluation dates the rubber incorporated plots had significantly lower g_{max} values than the control (0% rubber). Soil moisture on these dates was not recorded. Soil cores were taken from the areas on each visit. An interesting finding was that the rubber incorporated plots had deeper perennial ryegrass roots than the control plots. (The control plot however was considerably easier to sample with a soil probe.)

The perennial ryegrass density on these sites was not significantly different. It is suspected that the perennial ryegrass in the rubber incorporated plots will be considerably healthier in the spring of 1991 due to decreased compaction. The study will be continued in 1991 as well as more extensive studies at the Hancock Turfgrass Research Center.

III. Effects of perennial ryegrass/Kentucky bluegrass seeding mixtures and compositions on wear tolerance.

In June 1989 a study was initiated at the Hancock Turfgrass Research Center to determine the effects of different perennial ryegrass/Kentucky bluegrass seeding mixtures, their eventual turf composition, and their subsequent ability to resist and recuperate from wear. Two studies were conducted in this area. The first study involved five perennial ryegrass/Kentucky bluegrass ('Citation II'/'Ram I') seeding mixture percentages (0/100, 20/80, 35/65, 50/50, and 80/20) and two priming procedures for Kentucky bluegrass seed (primed vs unprimed). All seeding rates totaled 2.0 lbs/1000 ft^2. The second study involved a 80/20 percentage mix of perennial ryegrass/Kentucky bluegrass at three seeding rates (2,4, and 6 lbs/1000 ft^2) and the priming factor. All of these treatments were seeded June 30, 1989 and allowed to mature until a wear treatment was initiated May 15, 1990. The turf was subjected to wear using a Brinkman Traffic Simulator (BTS) purchased through funds donated by the Michigan Turfgrass Foundation. The BTS simulates athletic field traffic (soccer and/or football) and has an equivalancy of two passes with a water-filled drum type roller with cleat-like appendages equaling traffic received at 40 yard line of one football game. This equivalency was developed by inventors of the BTS at the University of California - Riverside. From May 15 to June 25, 1990 there were two passes two times/week with the BTS. This was increased to four passes three times/week until August 30. This wear constituted what is referred to as Spring/Summer wear. On September 7, a Fall Wear treatment was initiated on a previously undisturbed portion of each plot. The wear was 12 passes/week until November 30, 1989.

Data collected in these studies included turfgrass density, quality resulting from wear treatment, color, and impact values measured with the Clegg Impact Soil Tester. The results of the turfgrass mixes study are presented in Table 3 while the results from the similar mix/different seeding rate study are presented in Table 4. Very little differences were found among the measured characteristics in relation to turfgrass rates (Table 4). The Kentucky bluegrass seed priming was unsuccessful. No significant differences between primed vs unprimed seed were recorded in either study.

In 1991, turfgrass wear will continue. In addition, plant species counts and change in species composition due to wear treatments will be collected and assessed.

IV. Effects of potassium on wear tolerance in turf grasses.

A study was begun in cooperation with Paul Rieke and Mike Saffel at the Hancock Turfgrass Research Center, Michigan State University, in 1989 to investigate the long term effects of annual potassium applications on wear

tolerance in Kentucky bluegrass, tall fescue, and perennial ryegrass turfs. Five K levels (0, 4, 8, 12 lbs/1000 ft^2/year, and K based on soil test recommendation) and four replications were used on separate test areas of 'Baron' Kentucky bluegrass, 'Rebel' tall fescue, and 'Manhattan' perennial ryegrass. The applications were made in 1989 and 1990 at a rate of 2.0 lbs K/1000 ft^2 on a three week interval beginning June 1 and ending September 15.

Wear traffic was begun on May 15, 1990 using the Brinkman Traffic Simulator, BTS. The BTS was developed by researchers at the University of California-Riverside to simulate the wear action of athletic cleats from sports such as football and soccer. The device is made of two hollow steel drums 15" in diameter and 42" wide. There are nuts and bolts attached perpendicular to the drums such that they protrude out to simulate cleats. The drums are filled with water for a total weight of 860 lbs. Data from these researchers show that two passes with the BTS equal the amount of wear on a field at the forty yardline of one football game. The turf was subjected to two passes twice/week from May 15 to June 25, and four passes three times/week from June 25 to August 30, 1990. Another series of wear treatments was begun September 7, 1990 at four passes three times/week on previously unworn plot areas to evaluate effects more closely simulating those obtained during the football season. These treatments ended November 30, 1990.

Turf shear and quality ratings were made periodically throughout the year and are presented for each turfgrass in Table 6. There were no quality or shear resistance differences due to wear or K fertility for any grasses except in tall fescue. During the Fall wear treatment (Sept. 17), the check plot was significantly lower in quality than the soil test and the 8 lb. K treatments.

This study will be continued in 1991. Quantitative sampling of leaf tissue will be analyzed.

Table 1. The effects of football wear on density of Perennial ryegrass cultivars - Michigan State University Varsity Practice Field - 1990.

Date		Sept 5	Sept 20	Oct 4	Oct 19	Nov 2	Nov 16	Nov 30
Location					% Density			
Medium Wear		65	71	73	81	66	69	72
High Wear		47	61	60	50	34	32	33
Significance (0.05)		*	NS	NS	*	*	*	*
Variety								
Dandy	1	64.2	69.2	70.8	72.5	63.3	60.0	65.8
Delray	2	48.3	56.7	57.5	57.5	34.2	40.0	40.8
Caddie	3	39.2	58.3	60.0	58.3	40.8	49.2	45.8
Target	4	63.3	67.5	68.3	67.5	48.3	50.8	55.0
Charger	5	57.5	70.0	68.3	66.7	47.5	52.5	51.7
Birdie II	6	48.3	61.7	63.3	62.5	45.0	45.0	45.8
Citation II	7	45.8	51.7	60.0	57.5	36.7	48.3	43.3
Omega II	8	50.0	69.2	65.0	68.3	52.5	55.8	55.0
Dasher II	9	48.3	66.7	60.8	64.2	50.0	47.5	48.3
Fiesta	10	57.5	68.3	61.7	67.5	50.8	47.5	53.3
Blazer II	11	65.0	72.5	69.2	62.5	52.5	50.8	58.3
N4-88	12	55.8	67.5	65.8	63.3	47.5	50.0	52.5
Repell	13	55.0	65.0	70.8	70.8	58.3	51.7	61.7
Prelude	14	65.0	65.8	71.7	65.8	59.2	55.8	55.8
Palmer	15	64.2	70.8	67.5	73.3	55.8	58.3	57.5
Derby Supreme	16	55.0	67.5	68.3	67.5	51.7	48.3	55.8
Gator	17	56.7	62.5	71.7	68.3	50.0	52.5	50.8
Strider	18	50.8	64.2	74.2	69.2	58.3	49.2	53.3
Troubador	19	54.2	60.8	63.3	61.7	45.0	45.0	45.8
Medalist 8	20	60.0	71.7	65.8	66.7	49.2	53.3	55.0
Alliance	21	55.8	68.3	66.7	67.5	51.7	51.7	54.2
Ultima	22	65.0	70.0	70.8	70.0	56.7	58.3	57.5
Derby/Regal	23	59.2	68.3	67.5	65.8	50.8	45.8	47.5
LSD (0.05)		13.2	NS	9.9	NS	15.7	NS	12.5

Table 2. Impact absorption values (g_{max}) of rubber incorporated plots subjected to football type wear. MSU Varsity Practice Fields - 1990.

Date	9/5	9/20	10/4	10/19	11/2	11/16	11/30
				g_{max}			
Location							
Medium Wear	64	54	58	64	97	75	66
High Wear	66	57	59	69	101	82	67
Significance (0.05)	NS	NS	NS	NS	NS	*	NS
% Rubber (v/v)							
0	67	60	63	72	105	82	69
10	63	53	57	63	96	76	65
15	65	54	55	64	96	77	65
LSD (0.05)	NS	4	5	5	NS	5	4

Table 3. The effects of seeding mixtures and BTS wear on turfgrass density, quality color and impact absorbtion-1989-1990.

% P.Rye/%K.Blue	Density (10/89)	Quality[1] Spring/Summer Wear[3]				Color[2]	Impact
	-%-	4/20	7/21	8/10	9/17	6/4	$-g_{max}-$
0/100	51	3.5	4.5	4.3	3.7	4.1	94
20/80	58	4.5	4.8	4.7	5.2	3.0	91
35/65	67	5.5	4.2	5.5	4.8	2.8	91
50/50	61	5.7	4.2	5.3	4.8	2.4	93
80/20	68	6.5	3.7	3.5	4.5	2.2	86
LSD (0.05)	12	1.5	NS	NS	NS	0.1	NS

1 Quality on a scale of 1-9 with 1=bare ground and 9=ideal turf.

2 Color on a scale of 1-5 with 1=bare ground and 5=darkest green. A score of 3 is acceptable color

3 Spring/summer wear began May 15 and ended August 30. Fall wear began Sept. 7 and ended Nov. 30.

Table 4. The effects of seeding rates of a 80 percent perennial ryegrass/20 percent Kentucky bluegrass mixture and BTS wear on turfgrass density, quality, color, and impact absorption - 1989-1990.

lbs/1000 ft^2	Density (10/89)	Quality[1] Spring/Summer Wear[3]				Fall Wear[3]		Color[2] (6/4)	Impact
	-%-	4/20	7/21	8/10	9/17	9/17	10/30		-g_{max}-
2	68	6.5	3.7	3.5	4.5	4.3	5.0	1.9	86
4	76	6.3	3.2	4.3	4.8	3.5	3.8	2.3	84
6	87	7.1	4.3	4.7	4.5	4.0	4.5	2.6	82
LDS (0.05)	8	NS	NS	1.0	NS	NS	NS	NS	NS

1 Quality on a scale of 1-9 with 1=bare ground and 9=ideal turf.

2 Color on a scale of 1-5 with 1=bare ground and 5=darkest green. A score of 3 is acceptable color

3 Spring/summer wear began May 15 and ended August 30. Fall wear began Sept. 7 and ended Nov. 30.

Table 5. The effects of potassium fertility and turfgrass wear on turfgrass quality and shear resistance in Kentucky bluegrass, tall fescue, and perennial ryegrass turf.

Treatment	Turfgrass Quality[1]				Shear Resistance		
	Spring/Summer Wear			Fall Wear			
	June 9	July 10	August 10	Sept 17	April 20	July 5	Aug 15
						(Nm/m^2)	
Kentucky bluegrass							
1. Soil Test[2]	6.0	4.8	4.3	6.5	47.5	20.0	19.8
2. 4 lbs K/1000 ft^2/yr	5.8	5.0	3.8	5.5	46.2	19.0	18.8
3. 8 lbs K/1000 ft^2/yr	5.8	5.0	4.0	5.8	45.0	19.5	18.4
4. 12 lbs K/1000 ft^2/yr	5.5	4.5	4.0	6.0	44.3	19.5	18.5
5. Check	6.0	5.0	3.8	5.3	45.9	19.6	18.4
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS
Tall Fescue							
1. Soil Test[2]	5.5	4.8	4.0	6.0	41.1	17.7	13.6
2. 4 lbs K/1000 ft^2/yr	5.5	4.5	3.3	5.3	42.0	18.2	14.1
3. 8 lbs K/1000 ft^2/yr	6.0	5.3	3.5	5.8	43.2	18.4	15.0
4. 12 lbs K/1000 ft^2/yr	5.8	4.8	4.3	5.0	38.5	17.7	14.7
5. Check	6.0	4.8	3.5	4.5	43.0	17.4	13.5
LSD (0.05)	NS	NS	NS	1.1	NS	NS	NS
Perennial ryegrass							
1. Soil Test[2]	5.0	4.5	4.5	5.5	43.3	17.2	15.5
2. 4 lbs K/1000 ft^2/yr	5.5	5.3	3.5	6.3	42.0	18.0	14.3
3. 8 lbs K/1000 ft^2/yr	5.8	4.5	3.8	6.0	43.7	17.4	14.6
4. 12 lbs K/1000 ft^2/yr	5.8	5.0	3.5	5.8	42.5	17.8	14.5
5. Check	5.0	4.8	4.0	6.3	41.9	16.2	15.6
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS

[1] Turfgrass quality on a scale of 1-9 with 1 = bare ground and 9 = ideal turf.
[2] Soil test K recommendation was 2.0, 2.5, and 3.0 lbs K/1000 ft^2/year for Kentucky bluegrass, tall fescue, and perennial ryegrass, respectively.