EXECUTIVE SUMMARY
GROW-IN AND CULTURAL IMPACTS ON USGA PUTTING GREENS AND THEIR MICROBIAL COMMUNITIES

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The overall goal of this project is to develop a better understanding of the impact of grow-in procedures on putting green establishment and performance. Impacts on the physical, chemical, and microbiological factors associated with the USGA root zones and rhizosphere are emphasized in the project.

The five year project is composed of three phases, One: Construction and Grow-in, Two: Microbial Community Assessments, and Three: Grow-in Procedure Impacts on the Long-term performance of the Putting Green. Phases One and Two span three year periods, while Phase Three will involve experiments repeated over the five years of the project.

Two separate USGA-specification root zone mixtures - one composed of sand and peat (80/20 ratio) and one a combination of sand, soil, and peat (80/5/15 ratio) - were developed in 1996. Materials used for construction complied with USGA Greens recommendations for physical characteristics and organic matter content. First year greens (1997 Greens) were constructed in late summer of 1996, allowed to settle over the winter, and were seeded with Providence creeping bentgrass (1.5 lbs/1000 ft^2) in the spring (May 30) of 1997. Second year greens (1998 Greens) were constructed in the summer of 1997, allowed to settle over the winter, and were seeded with Providence creeping bentgrass (1.5 lbs/1000 ft^2) in the spring (May 27) of 1998.

Results to date indicate the following:

Microbial biomass was not affected by root-zone mix or grow-in procedure on plots established in 1997. Microbial biomass increased over 200% from Spring to Fall and decreased 40-60% as sampling depth increased. Water infiltration from these same plots were not affected by root-zone mix or grow-in procedure when measured in 1998.

The following establishment results were similar in plots established in 1997 or 1998:

For two consecutive years it was found that higher inputs will initially increase cover during grow-in. This increase may not translate to earlier opening for play if environmental stress conditions occur that result in damage to lush, immature turf.

A root zone mix containing soil will establish quicker and recover from environmental stress faster than a soilless mix. A soil-containing mix will also be harder and may result in longer ball roll distance.

Addition of soil to the root zone mix will not effect water infiltration during the establishment year.

I. Title: GROW-IN AND CULTURAL IMPACTS ON USGA PUTTING GREENS AND THEIR MICROBIAL COMMUNITIES

II. Principal Investigator: Dr. R.E. Gaussoin, Principal Investigator
Cooperators: Dr. Rhae Drijber, Dr. William Powers, Mine Aslan, Milda Vaitkus, Leonard Wit

III. Purpose: The overall goal of this project is to develop a better understanding of the impact of grow-in procedures on putting green establishment and performance. Impacts on the physical, chemical, and microbiological factors associated with the USGA root zones and rhizosphere are emphasized in the project.

IV. Location: The project is being conducted at the University of Nebraska's John Seaton Anderson Turfgrass Research Facility located near Mead, NE.

V. Introduction: The five year project is composed of three phases, One: Construction and Grow-in, Two: Microbial Community Assessments, and Three: Grow-in Procedure Impacts on the Long-term performance of the Putting Green. Phases One and Two span three year periods, while Phase Three will involve experiments repeated over the five years of the project.

VI. Methods: Two separate USGA-specification root zone mixtures - one composed of sand and peat (80/20 ratio) and one a combination of sand, soil, and peat (80/5/15 ratio) - were developed in 1996. Materials used for construction complied with USGA Greens recommendations for physical characteristics and organic matter content. First year greens were constructed in late summer of 1996, allowed to settle over the winter, and were seeded with Providence creeping bentgrass (1.5 lbs/1000ft^2) in the spring (May 30) of 1997. Year two plots were constructed in 1997. They were allowed to settle over the winter and were seeded in the spring (May 27) of 1998.

Accelerated and Controlled treatments were applied prior to and after seeding according to the treatment schedule outlined in Table 1.

Data were collected on (1) % vegetative cover, (2) color (1-9=most green), (3) quality (1-9=best quality), (4) ball roll distance (Stimpmeter), and (5) surface hardness (Clegg).

Soil physical properties were also examined in October, 1998. Infiltration rates were measured in the field using a 6" single-ring infiltrometer. Soil cores were sampled and are being analyzed for water retention and total porosity using pressure plate techniques.

VII. Results:

1997 Greens

(1) Early season (6/15) vegetative cover was greater for root zone mix plots containing soil than those without soil; 71% versus 67%, respectively (Table 2). There was no effect of grow-in treatment (Table 3). Quality, Pythium damage and color were unaffected by differences in the root zone mix.

(2) High humidity and little precipitation in July resulted in evidence of *Pythium* sp., as well as direct high temperature injury. Pythium damage was evaluated in mid-July on a scale of 1-9, with 9 indicating greatest decline. The accelerated treatment exhibited greater decline than the controlled grow-in (7.5 vs. 3.0) (Table 3). There was no effect of root zone mix and quality was not adversely affected (Table 2 and 3).

(3) A significant interaction between treatments was found for ball roll distance on June 15 (Table 4). The non-soil root zone mix with accelerated grow-in treatments had longer ball roll than the controlled or soil-containing mix. Root zone mix had no effect on ball roll. On most observation dates, grow-in treatment also had no effect on ball roll; differences between accelerated (57cm) and controlled (54cm) Grow-in Treatments were observed only on September 24 (Table 5). The soil-containing root zone mixture had higher surface hardness than the soil-less mix on all observation dates (Table 6). Surface hardness was not affected by grow-in treatment.

(4) Soil infiltration rates in 1998 were not significantly different between root zone mixes or grow-in treatments.

1998 Greens

(1) Ball roll distance was greater in controlled (52cm) versus accelerated (41cm) greens in October (Table 7), while root zone mix had no effect.

(2) Surface hardness was greater in the root mix containing soil than in the soil-less mix (Table 8). Grow-in treatments appeared not to have any effect on surface hardness.

(3) Soil infiltration rates were not significantly different between root zone mixes or grow-in treatments

VII. Discussion: Results to date indicate the following:

Microbial biomass was not affected by root-zone mix or grow-in procedure on plots established in 1997. Microbial biomass increased over 200% from Spring to Fall and decreased 40-60% as sampling depth increased. Water infiltration from these same plots were not affected by root-zone mix or grow-in procedure when measured in 1998.

The following establishment results were similar in plots established in 1997 or 1998:

For two consecutive years it was found that higher inputs will initially increase cover during grow-in. This increase may not translate to earlier opening for play if environmental stress conditions occur that result in damage to lush, immature turf.

A root zone mix containing soil will establish quicker and recover from environmental stress faster than a soilless mix. A soil-containing mix will also be harder and may result in longer ball roll distance.

Addition of soil to the root zone mix will not effect water infiltration during the establishment year.

Table 1. Establishment and grow-in treatments for GCSAA/USGA Greens Construction Project. (All rates in pounds per 1000ft^2 unless noted.) University of Nebraska. John Seaton Anderson Turfgrass Research Facility Mead, NE, 1998.

	Accelerated				Controlled			
		N	P	K		N	P	K
Preplant Treatments								
STEP (83113)	16	-	-	-	11	-	-	-
Started (16-25-12)	12	2	3	1.4	6	1	1.5	.7
15-0-29 (8845)	9	1.35	0	2.6	4.5	.7	0	1.3
38-0-0 (8820)	7.25	2.75	0	0	3.6	1.34	0	0
Totals		6.1	3	4		3.04	1.5	2
Postplant Treatments								
Starter (16-25-12)	Full rate - Weekly				Half Rate - Every 2 weeks			
STEP	100#/A				60#/A			
	(45/90 days post planting)							
Mowing	3/8' to 3/16'							
Verticutting	Canopy only (7-10 days)							
Topdressing	Light, frequent (7-10 days)							
Roilling	1X weekly				1X every 2 weeks			
Disease Control	Preventative							
Insect Control	Preventative							
Weed Control	Preemergence; Preventative							

Table 2. Cover, Quality, Pythium Damage, and Color Means for USGA/GCSAA Greens Construction Project, 1997 Greens. John Seaton Anderson Turfgrass Research Facility Mead, NE. University of Nebraska, 1998.

1997 Greens	Cover	Quality	Pythium Damage	Quality	Color	Quality	Color
Root Zone Mix	6/15	7/15		9/1		9/15	
Sand/Peat (80:20)	67b	5.8	5.3	6.5	7.2	6.8	6.7
Sand/Peat/Soil (80:15:5)	71a	6.0	5.2	6.5	7.7	6.3	7.2

Data within columns followed by different lower case letters are significantly different based on a LSD (P=0.05).

Table 3. Cover, Quality, Pythium Damage, and Color Means for USGA/GCSAA Greens Construction Project, 1997 Greens. John Seaton Anderson Turfgrass Research Facility Mead, NE. University of Nebraska, 1998.

1997 Greens	Cover	Quality	Pythium Damage	Quality	Color	Quality	Color
Grow-in Treatments	6/15	7/15		9/1		9/15	
Accelerated	69.2	5.7	7.5a	6.2	8.7a	6.8	7.8a
Controlled	68.3	6.2	3.0b	6.8	6.2b	6.3	6.0b

Data within columns followed by different lower case letters are significantly different based on a LSD (P=0.05).

Table 4. Ball Roll Distance (Stimpmeter) for USGA/GCSAA Greens Construction Project, 1997 Greens. John Seaton Anderson Turfgrass Research Facility, Mead, NE. University of Nebraska, 1998.

1997 Greens	Stimpmeter (June 15, 1998)	
	Accelerated	Controlled
Root Zone Mix	cm	
Sand/Peat (80:20)	73 Aa	65 Bb
Sand/Peat/Soil (80:15:5)	68 Bb	67 Bb

Data within rows followed by different upper case letters are significantly different based on a LSD (P=0.05).

Data within columns followed by different lower case letters are significantly different based on a LSD (P=0.05).

Table 5. Ball Roll Distance (Stimpmeter) for USGA/GCSAA Greens Construction Project, 1997 Greens. John Seaton Anderson Turfgrass Research Facility, Mead, NE. University of Nebraska, 1998.

1997 Greens	Stimpmeter			
	7/14	8/14	9/24	10/14
Grow-in Treatments	cm			
Accelerated	67	71	57a	50
Controlled	67	71	54b	53

Data within columns followed by different lower case letters are significantly different based on a LSD (P=0.05).

Table 6. Surface Hardness (Clegg) for USGA/GCSAA Greens Construction Project, 1997 Greens. John Seaton Anderson Turfgrass Research Facility, Mead, NE. University of Nebraska, 1998.

1997 Greens	CLEGG				
Root Zone Mix	6/15	7/14	8/14	9/24	10/14
Sand/Peat (80:20)	55	58	61	57	64
Sand/Soil/Peat (80:15:5)	64	70	71	65	75

Data within evaluation dates are all significantly different based on analysis of variance (P=0.05).

Table 7. Ball Roll Distance (Stimpmeter) for USGA/GCSAA Greens Construction Project, 1998 Greens. John Seaton Anderson Turfgrass Research Facility, Mead, NE. University of Nebraska, 1998.

1998 Greens	Stimpmeter	
	9/24	10/14
Grow-in Treatments	cm	
Accelerated	49	41b
Controlled	53	52a

Data within columns followed by different lower case letters are significantly different based on a LSD (P=0.05).

Table 8. Surface Hardness (Clegg) for USGA/GCSAA Greens Construction Project, 1998 Greens. John Seaton Anderson Turfgrass Research Facility, Mead, NE. University of Nebraska, 1998.

1998 Greens	CLEGG	
Root Zone Mix	**9/24**	**10/14**
Sand/Peat (80:20)	**67**	**79b**
Sand/Soil/Peat (80:15:5)	**74**	**91a**

Data within columns followed by different lower case letters are significantly different based on a LSD (P=0.05).