EXECUTIVE SUMMARY

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

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

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 project is being conducted at the University of Nebraska's John Seaton Anderson Turfgrass Research Facility located near Ithaca, NE. 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. In 1996, Phase One of the project was initiated.

Materials for the gravel layer and root zone mix were sampled from two local (Nebraska) sand and gravel suppliers with experience in golf green construction. The goal was to develop two separate USGA-specification root zone mixtures - one composed of sand and peat, and one a combination of sand, soil, and peat. Materials were tested for compliance with USGA Green construction recommendations for physical characteristics and organic matter content. Based upon analytical results, a supplier was chosen. The putting green site was constructed and root zone mixture plots established. Thus, year one construction objectives were met and plots are ready for creeping bentgrass establishment in spring of 1997.

In the spring of 1997, creeping bentgrass will be seeded into the year one plots. Year two plots will also be constructed and seeded. Grow-in procedure treatments effects on establishment will be evaluated in both year one and year two plots. An extensive microbiological survey of the year one and year two plots will also be performed to determine rhizosphere community temporal and spatial patterns during grow-in. All these studies will focus on the comparison of the accelerated versus controlled grow-in treatments.

To provide oversight for this project, an advisory committee of six golf course superintendents from the Nebraska Golf Course Superintendents Association has been formed. Their input on a variety of management issues will be solicited and used in the development of grow-in procedures.

All funds provided by the USGA and GCSAA were used for technical support and student labor. University cooperators devoted .65 FTE (Full Time Equivalents) to the project in 1996.
□

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

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

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.

Construction and Grow-in Procedures

In 1996, the initial phase of the project was initiated. Materials for the gravel layer and root zone mix were sampled from two local (Nebraska) sand and gravel suppliers with experience in golf green construction (Suppliers A and B). The goal was to develop two separate USGA-specification root zone mixtures - one composed of sand and peat, and one a combination of sand, soil, and peat. Materials were tested for compliance with USGA Green construction recommendations for physical characteristics and organic matter content. All analyses of materials (sand, soil, and peat) were performed by Hummel & Co., Inc. (Trumansburg, NY). Results are summarized in Table 1.

Materials provided by Supplier B did not adequately meet USGA Green Construction specifications; thus, Supplier A became the sole source for gravel and the components of the root zone mixtures. Initial analyses of root zone mixtures showed that combinations of sand/peat and sand/soil/peat using Dakota Reed sedge did not result in USGA Green specifications mixtures. The fine texture and high density of this peat led to limitations in the amount of soil and peat that could be added to sand while still maintaining desirable physical properties, such as such as appropriate bulk densities, total porosity, and hydraulic conductivity. Canadian Sphagnum peat was acquired and tested in the mixes. Preparing root zone mixes using sphagnum peat as the organic source, however, proved problematic for the supplier and it took several attempts with each mixture to arrive at appropriate Pug Mill settings. Following delivery of the root zone mixes at the project site and prior to final construction (spreading the root zone mixture over the gravel under-layer), the mixtures were again analyzed to ensure appropriate quality control. Year one construction objectives have been met and plots are ready for creeping bentgrass establishment in spring of 1997.

In the spring of 1997, creeping bentgrass will be seeded into the year one plots. Year two plots will also be constructed and seeded. Grow-in procedure treatments effects on establishment will be evaluated in both year one and year two plots. Studies will focus on the comparison of the accelerated versus controlled condition treatments listed in the following table (Table 2). Treatments will be evaluated for their effects on rate of stand establishment, putting green quality, thatch and mat accumulation, and putting speed. Soil physical parameters to be measured as part of these evaluations

include water infiltration rate, soil water retention, soil bulk density, and total soil porosity.

Microbiological Investigations
Samples of each of the root zone mix components (sand, soil, and peat) are presently being analyzed to establish baseline microbial data for root zones prior to construction. In 1997, an extensive survey of the year one and year two plots will be performed to determine rhizosphere community temporal and spatial patterns during grow-in.

Advisory Committee
To provide oversight for this project, an advisory committee of golf course superintendents from the Nebraska Golf Course Superintendents Association has been formed (Table 3). Their input on a variety of management issues will be solicited and used in the development of final grow-in procedures for this project.
□

TABLE 1. PARTICLE SIZE ANALYSIS/PARTICLE SHAPE/PARTICLE SIZE PARAMETERS/pH

SAMPLE	% Soil Separates			Small Particle Diameter (mm) % Retained						Sphericity	Angularity	pH	D_{85}	Cu
	Sand	Silt	Clay	Gravel 2mm	V. coarse 1mm	Coarse 0.5mm	Medium 0.25mm	Fine 0.15mm	V. Fine 0.05mm					
Supplier A														
90-10 (sand-peat*)	98.8	0.8	0.4	1.6	8.0	22.7	47.4	16.4	2.7	Medium	Sub-rounded	7.6	0.80	2.2
90-5-5 (sand-soil-peat*)	97.9	1.5	0.6	1.8	8.1	23.9	46.0	15.0	3.1	Medium	Sub-rounded	8.0	0.80	2.3
85-10-5 (sand-soil-peat*)	95.8	3.2	1.0	1.8	8.8	22.4	42.5	15.2	5.1	Medium	Sub-rounded	8.3	0.85	2.9
85-5-10(sand-soil-peat*)	96.3	2.8	0.9	1.2	7.6	22.4	45.6	15.6	3.9	Medium	Sub-rounded	7.5	0.75	2.6
80-20 (sand-peat**)	98.9	0.8	0.3	1.3	8.0	29.1	44.1	13.9	2.5	Medium	Sub-rounded	5.3	0.80	2.4
80-10-10 (sand-soil-peat**)	95.6	3.4	1.0	1.4	7.2	25.2	41.9	14.5	5.4	Medium	Sub-rounded	7.2	0.78	3.0
80-5-15 (sand-soil-peat**)	97.4	2.2	0.4	1.5	7.8	26.6	43.9	14.0	3.6	Medium	Sub-rounded	7.0	0.82	2.6
Supplier B														
root zone mix	98.4	1.0	0.6	5.0	29.2	28.8	25.3	8.1	2.0	Medium	Sub-rounded	5.7	1.5	3.7
USGA Specifications		5%	3%	5% Gravel 10% combined		60%		20%	5%					

* Dakota Reed Sedge peat.
** Canadian sphagnum peat.

TABLE 1. (Cont'd) PHYSICAL PROPERTIES

Sample	Particle Density	Bulk Density	Saturated Conductivity	Total Porosity	Aeration Porosity	Capillary Porosity	OM
	g/cc	g/cc	in/hr	%	%	%	%
Supplier A							
90-10 (sand-peat*)	2.62	1.65	17.7	36.9	20.4	16.5	0.70
90-5-5 (sand-soil-peat*)	2.63	1.71	11.3	34.8	18.9	16.0	0.42
85-10-5 (sand-soil-peat*)	2.63	1.72	3.8	34.4	17.0	17.4	0.48
85-5-10(sand-soil-peat*)	2.62	1.69	5.0	35.5	15.6	19.9	0.86
80-20 (sand-peat**)	2.62	1.63	13.3	37.8	17.6	20.2	1.04
80-10-10 (sand-soil-peat**)	2.63	1.72	4.8	34.6	13.3	21.3	0.62
80-5-15 (sand-soil-peat**)	2.62	1.67	8.9	36.2	16.3	19.9	0.75
Supplier B							
root zone mix	2.63	1.76	7.6	33.2	15.9	17.3	0.83
USGA Specifications		1.2-1.6	6-24	35-55	15-30	15-25	0.7-3

* Dakota Reed Sedge peat.
** Canadian sphagnum peat.

TABLE 2. GROW-IN TREATMENTS

INPUTS	ACCELERATED	CONTROLLED
Nitrogen ($g\ m^{-2}S^{-1}$)	150	50
Seedbed	25	10
After Seeding	125	40
Phosphorous ($g\ m^{-2}S^{-1}$)	50	25
Seedbed	25	15
After seedbed	25	10
Potassium ($g\ m^{-2}S^{-1}$)	100	50
Seedbed	20	10
After Seeding	80	40
Micronutrient package	weekly	monthly
Irrigation	100%ET_p	80%ET_p
Mowing Height	6mm to 3mm	6mm to 3mm
Mowing Frequency	daily	daily
Vertical Mowing	canopy only (7-10 days)	canopy only (7-10 days)
Topdressing	light-frequent (7-10 days)	light-frequent (7-10 days)
Rolling	1X/7 days	1X/14 days
Disease Control	preventative	curative/preventative
Insect Control	preventative	curative
Weed Control	curative	curative

TABLE 3. PROJECT ADVISORY COMMITTEE

SUPERINTENDENT	COURSE	LOCATION
Scott Axon, CGCS	Happy Hollow Golf Club	Omaha, NE
John Beideck	Meadowlark Hills Golf Course	Kearney, NE
C. Ron Fox	Buffalo Ridge Golf Course	Kearney, NE
John Hadwick, CGCS	G I Municipal Golf Course	Grand Island, NE
Dave Lammle	HiMark Golf Course	Lincoln, NE
Steve Merkel, CGCS	Shadow Ridge Country Club	Omaha, NE
Dan Riner	Wellington Greens	Lincoln, NE
Rick Schneider	Jim Ager Junior Golf Course	Lincoln, NE