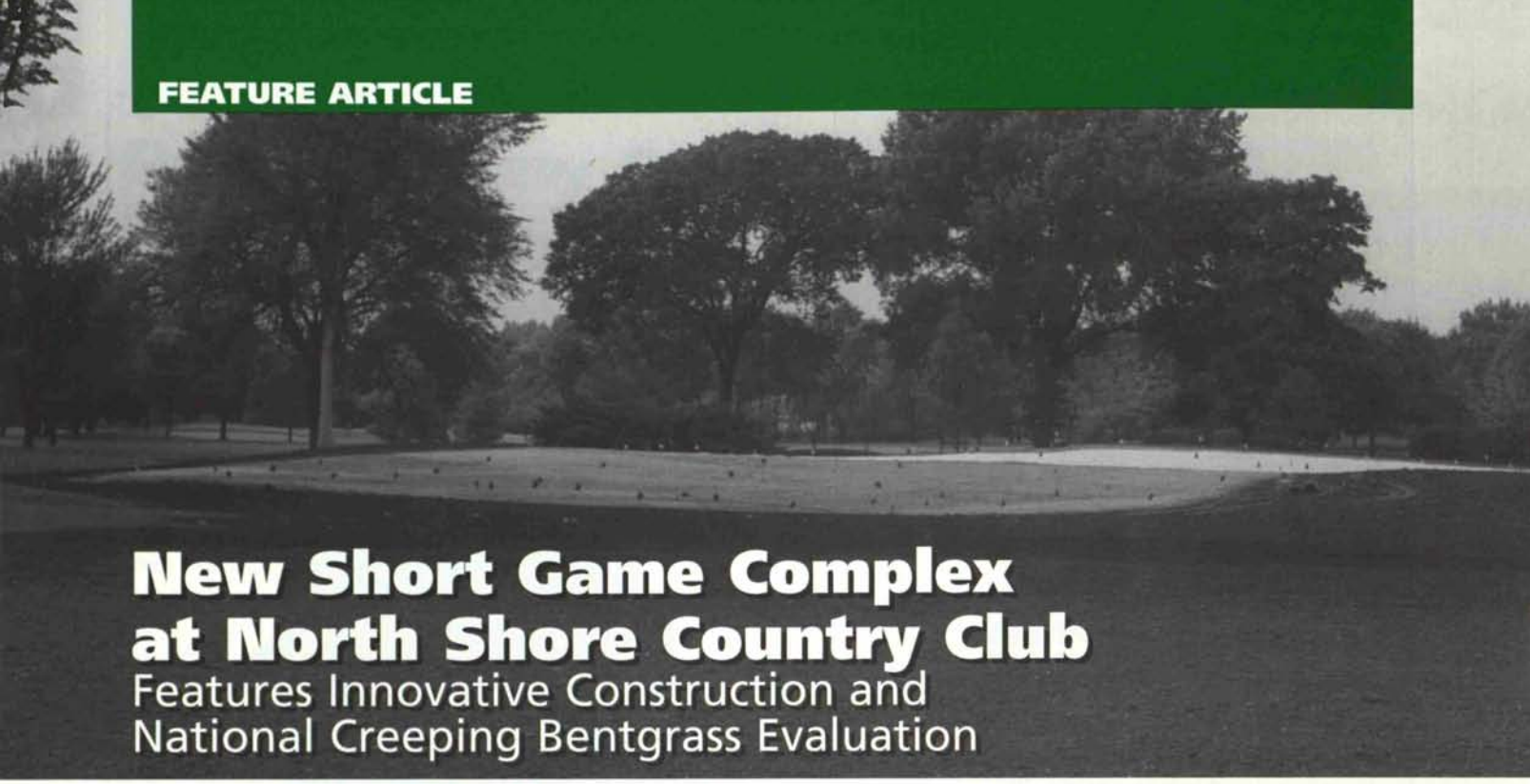

New Short Game Complex at North Shore Country Club

Features Innovative Construction and National Creeping Bentgrass Evaluation

Dan Dinelli, CGCS
North Shore Country Club, and
Tom Voigt
Extension Turfgrass Specialist
University of Illinois
Urbana-Champaign, IL

The United States Golf Association (USGA), the Golf Course Superintendents Association of America (GCSAA), and the National Turfgrass Evaluation Program (NTEP) combined resources to initiate a national research project to evaluate turfgrass varieties (cultivars) grown on USGA rootzones and maintained by host golf course facilities as in-play green surfaces.

Funding was made available to construct practice putting greens at 16 different golf courses across the United States. All of these experimental greens were constructed to USGA specifications. Northern locations sowed bentgrass varieties, southern locations Bermuda grass varieties, and in transition zone climates, both species were planted. Monitoring and evaluation will continue for at least five years, with annual reports being submitted to the NTEP who will issue annual reports of the results.

In conjunction with the University of Illinois, North Shore Country Club was selected as one of the sites for this unique study. In the summer of 1997, the officers and governors of North Shore Country Club (NSCC), lead by Mr. Van Salmans, green chairperson, approved the construction of a short game practice facility to augment the USGA putting green.

Short Game Practice Facility

The short game practice facility consists of a 7,200 square foot putting green, a 14,098 square foot creeping bentgrass fairway measuring 55 yards long and 28 yards wide, and two greenside bunkers. It is understood by the membership of NSCC this is a functional complex with several research objectives.

General purposes of the short game practice facility include:

1. Maintain a functional short game practice facility and putting green to the standards expected at North Shore Country Club, while recognizing the research potential of such a site. Regular maintenance on the USGA green will include periodic straight sand topdressing and daily mowing at 120 to130 thousands of an inch. The fairway will be mowed at one-half inch and will undergo regular mowing, aerification and established maintenance practices.

2. Monitor the performance of 21 different creeping bentgrass varieties for putting green use on USGA rootzone profiles, including 18 NTEP entries, and two blends.

3. Monitor the performance of a creeping bentgrass blend (L-93/SR-1119) grown on 20 amended putting green rootzones within the context of a USGA rootzone profile.

4. Monitor the impact of forced gas exchange in

(continued on page 14)

(continued from page 12)

the putting green rootzone and turf canopy utilizing the SubAir system.

5. Monitor 13 bentgrass varieties at fairway height, grown on a yardwaste compost amended site.

6. Compare and contrast organic soil amendments to native soil for fairway use.

7. Evaluate a bluegrass blend for use on green surrounds.

The major emphasis of the practice facility is to observe turfgrass performance, integrating cultivars and rootzone amendments with management techniques. Field observations, along with detailed monitoring will help develop a better understanding of turfgrass science and ecology. Information gained will further IPM strategies and foster a holistic philosophy of turfgrass management towards maintaining high-quality playing conditions.

Disease susceptibility, nutrient requirements, infiltration rates, moisture stress, and moisture retention will be noted. Possible areas of interest and potential study include, but are not limited to: segregation with genetic dominance in varieties, color, texture, density, thatching tendency, recuperative potential, wear tolerance, heat and cold tolerance, ball roll speed, growth habit, localized dry spot severity, nematode assay (beneficial and plant parasitic), resiliency for desired ball bounce, microbial ecology, turfgrass-microbe interactions, stability of soil amendments, dynamics of percolation rates over time, fluctuations of soil and turf canopy gases, i.e., oxygen, carbon dioxide and methane, relative soil temperatures, *Poa annua* encroachment, inoculation potential of beneficial microorganisms, winter hardiness, fate of rootzone amendments over time, and root mass.

Putting Green

The putting green site is unique. *Functionality:* This will be a functional green receiving approach shots and being used by the members for putting. This activity will produce ball marks, wear, and compaction and offer daily stresses seen on in-play greens at many golf courses.

Comparison: On one green, under consistent management and similar environmental conditions, field evaluations of bentgrass varieties and amended rootzone mixes can be made. The effects of the SubAir system can be documented.

(continued on page 16)

Off-site mixing for the green rootzones mixes at the Feltes Sand & Gravel Co.

All work is done by hand to prevent cross contamination of soil mixes.

All of the various rootzone cells are backfilled by hand.

(continued from page 14)

Unique Climatic Zone: The test facility is located in USDA growing zone 5B. This represents the Chicago region, a unique region that is prone to weather patterns influenced by Lake Michigan.

Bentgrass Blends: Blends of turfgrass varieties are frequently thought of as advantageous, offering genetic diversity for adaptation potential. Blends of bentgrass with similar growth requirements and growth characteristics like texture, growth habit, and color will be grown and evaluated relative to their respective varieties in pure stands.

Plot Size: On the putting green, each variety was planted in a random order, replicated three times in 5 foot by 10 foot plots. Plots this large offer better sampling and ability to measure ball roll speeds via modified or standard stimpmeter readings.

Putting Green Rootzone Evaluation: Relative performance of creeping bentgrass varieties grown on two popular rootzones, native soil "push-up"-type rootzones, and USGA sand based rootzones within the same climatic environment and under similar management practices can be made. At North Shore Country Club, several bentgrass variety trials already exist, maintained to putting green standards in "push-up"-style rootzone profiles, with an amended upper 3-inch layer of high sand content via frequent sand top-dressing. In total, there are 17,852 square feet of "push-up" green, consisting of twenty-six varieties of creeping bent, one velvet bentgrass, seven blends of bentgrass, and one creeping species of *Poa annua var. reptans* (Hausskn.) Timm. The new USGA green has many of the same varieties.

Variety Trial

TABLE 1

Established varieties of bentgrass under USGA and "push-up"-type construction regimes.

Existing Variety Trials on "Push-Up" Rootzones

A2	Lopez
Biska	Penn A-4
Cato	Penneagle
Century (Syn 92-1)	Pennlinks
Cobra	*Poa annua var. reptans*
Crenshaw	Putter
G2	Regent
G6	South Shore
Imperial (Syn 92-5)	SR-1019
L-93	SR-1020
SR-1119	SRX-1120
SR-7200*	SYN 92-2
SRX Dinelli	SYN 92-4
SRX-1119	Viper

* *Denotes a velvet bent*

Existing Variety Blends on "Push-Up" Rootzones (50/50 Ratio)

L-93 / SR-1019	SR-1019 / Penn A-4
L-93 / SR-1020	SR-1019 / Putter
SR-1019 / SR-1020	SR-1019 / Regent
SR-1019 / Cobra	

Varieties Established on a USGA Rootzone

Backspin	Penncross
Cato	Providence (SR-1019)
Century	Putter
Crenshaw	SR-1020
Imperial	SR-1119
L-93	SRX-1120*
LCB-103	SRX-1 BPCB*
Penn A-1	SRX-1 Dinelli**
Penn A-4	Trueline
Penn G-6	Viper
Penn G-1	

* *Denotes a velvet bent*

** *Indicates variety not included in official NTEP trial*

Variety Blends Established on a USGA Rootzone (50/50 Ratio)

L-93 and SR-1119	SR-1020 and SR-1119

Early Evaluations of the On-Site NTEP Study

On September 17, the green was evaluated for percent cover (Table 2). On September 24, seedling vigor was determined. A final evaluation was conducted on October 22 (Table 2). Table 2 shows that by October 22, the varieties had made dramatic improvement; some plots were approaching 100 percent cover by this date. It is hoped that the green will be ready for use in late spring or early summer of 1998.

During the next four growing seasons, these creeping bentgrasses will be evaluated once each season for spring greenup, density, and leaf texture. On a monthly basis, the plots will be evaluated for overall turf quality, and ball roll distance.

(continued on page 18)

(continued from page 16)

TABLE 2

Evaluations following 1997 seeding of creeping bentgrasses at North Shore Country Club.

Cultivar	Percent Cover 9/17/97a	Seedling Vigor 9/24/97b	Percent Cover 10/22/97a
L-93	18.3 c–e	5.0	85.0
Putter	23.3 e	5.7	78.3
Cato	8.3 ab	4.0	60.0
Crenshaw	18.3 c–e	5.0	78.3
LCB-103	8.3 ab	4.0	65.0
Penncross	20.0 de	5.3	81.7
Backspin	13.3 a–d	5.0	71.7
Trueline	15.0 a–e	4.7	73.3
Providence	15.0 a–e	4.3	75.0
SR 1020	6.7 a	3.7	68.3
SR 1119	6.7 a	3.7	63.3
Viper	8.3 ab	3.7	71.7
Century	11.7 a–d	4.7	71.7
Imperial	18.3 c–e	5.0	60.0
Penn A-1	10.0 a–c	4.7	73.3
Penn A-4	11.7 a–d	4.3	68.3
Penn G-6	6.7 a	3.7	66.7
Penn G-1	16.7 b–e	4.7	71.7
LSD 0.05	8.5	NS	NS

a. Percent cover is represented as mean of the three replications and is a visual estimate of the percent of the plot covered by living seedlings.

b. Seedling vigor is represented as mean of the three replications and is also a visual estimate of the percent of the plot covered by living seedlings combined with plant height representing the relative speed to a mature sod. It is based on a scale of 1-9 where 1 = completely open ground and 9 = maximum plot coverage.

USGA Rootzone Trial

A list of 20 different rootzone mixes used in the construction of USGA profile putting green plots, their composition and a brief explanation of each are shown below (Table 3). More detailed information on amendments is available. All amendments, unless noted, were professionally blended off-site at Feltes Sand & Gravel. With one exception, the same USGA approved sand was used in all mixes. For ease of construction and to minimize cross contamination, a non-replicated plot design was constructed, plot sizes 14 feet by 15 feet each. All quantities shown in Table 3 are for a single plot. Random sampling from these large plots may be performed for statistical analysis. All 20 rootzones were permanently divided with a 80 mil high-density polyethylene, extending from the top of the pea gravel bed to the surface, creating a 12-inch deep rootzone. For identification, one-half inch rebar was permanently placed at each corner of the plot. The entire green was GPS mapped with differential. GPS is a satellite global positioning system that offers accuracy to within 18 inches of a permanent location. All plots were seeded with a 50/50 blend of L-93 and SR-1119 creeping bentgrass and sown at 2 lbs./1,000 sq. ft.

TABLE 3

Rootzone amendments used for putting green construction.

1. *Straight Unamended Feltes Sand*
   Meets USGA particle size and performance recommendations. This sand is the parent material used in the remaining rootzone mixes. One exception noted.

2. *85/15, Feltes Sand and Sphagnum Peat*
   This rootzone mix represents what would be typical of most spec greens mix. It was tested to meet USGA performance recommendations, C:N ratio of 65/1, pH 4.3, 8.3% humic acid, 8.6% fulvic acid, CEC 74.8 meq/100 grams.

3. *90/10, Feltes Sand and Dakota Peat*
   This rootzone mix meets USGA performance recommendations. This is the same rootzone mix for the NTEP bentgrass trials. Dakota Reed-Sedge Peat has a C:N ratio of 23:1, pH 6.6, 21.1% humic acid, 12% fulvic acid, CEC 118 meq/100 grams. Reports indicate a higher microbial activity for reed-sedge peat.

4. *90/10, Feltes Sand and Dakota Peat Plus Chip Humate (250 lbs.)*
   The chip humate was supplied by Soil Life Systems and is derived from Leonardite consisting of 80% humic acid, 15% humin, and 5% inert. Chip humate was tilled into the top 6 inches of the rootzone.

5. *90/10, Feltes Sand and Dakota Peat Plus 22.5% Profile (1750 lbs.)*
   Profile is a porous ceramic with a CEC of 33.6 meq/100g. Porosity 74%, capillary 39%, non-capillary 35%. Profile is marketed as a soil modifier, adding permanent pore space. Profile

(continued on page 20)

(continued from page 18)

may assist in balancing capillary pore space for holding moisture and non-capillary pore space for gasses.

6. *90/10, Feltes Sand and Dakota Peat Plus 15% (v/v) Profile and Zeopro (350 lbs.)*
   Zeopro tilled into the top 6 inches (see description No. 7 for ZeoPro).

7. *90/10, Feltes Sand and Dakota Peat Plus 10% (v/v) Zeopro (1150 lbs.)*
   ZeoPro is a zeoponic material developed from a clinoptilolite form of zeolite. A zeoponic material is a nutrient-charged zeolite combined with a synthetic calcium apatite. ZeoPro is marketed as a soil amendment/slow release fertilizer which modifies the physical characteristics, adds cation exchange capacity and adds an efficient nutrient release mechanism to the rootzone. It has a CEC of approximately 100 meq/100g (800-1200 meq/liter). It carries a nutrient charge of 0.1% exchangeable ammonium, 0.05%-0.5% phosphorous (as calcium apatite), and 0.6% exchangeable potassium.

8. *90/10, Feltes Sand and Dakota Peat Plus 10% Axis (600 lbs.)*
   Axis is a calcined diatomaceous earth with 81% total porosity and a CEC of 27 meq/100g. Axis is marketed as a permanent soil amendment adding porosity with low bulk density (0.42 g/cc), and the capability of holding 142% of its weight in water.

9. *90/10, Feltes Sand and Dakota Peat Plus 10% Axis and Zeopro (350 lbs.)*
   Zeopro tilled into the top 6 inches.

10. *90/10, Feltes Sand and Dakota Peat Plus OptiMil® (100 lbs.)*
    OptiMil® is a agglomerated particle composed of 42.5% SAND-AID, a granular Sea Plant Meal (1-0-1), 42.5% Milorganite (6-2-0), and 15% sunflower hull ash. OptiMil®_has an analysis of 3-1-4 and a C:N ratio of 12:1.

11. *90/10, Feltes Sand and Dakota Peat Plus OptiMil® (100 lbs.) and Emerald Isle Experimental Microbial Enhancement Material*
    Trichoderma harzianum and an experimental material produced by Emerald Isle, Ltd., were raked into the top 2 inches of the rootzone. The Emerald Isle experimental material is a vitamin B, amino acid bio-stimulant, and an endomycorrhizal fungi.

12. *90/10, Feltes Sand and Dakota Peat Plus SAND-AID (60 lbs.)*
    SAND-AID is a granular Sea Plant Meal (1-0-1) with a C:N ratio 21:1 and a CEC of 300-500 meq/100g. SAND-AID can increase water holding capacity up to 12%.

13. *90/10 Feltes Sand and Dakota Peat Plus 60 lbs. SAND-AID and Emerald Isle Experimental Microbial Enhancement Compound*
    Trichoderma harzianum and an experimental material from Emerald Isle (see rootzone No. 11 for a description of this material) raked into the top 2 inches of rootzone.

14. *90/10, Feltes Sand and Dakota Peat Plus Paramagnetic Rock (300 lbs.), Hard Rock Phosphate (40 lbs.), and Greensand (40 lbs.)*
    Paramagnetism is a low-level energy, physical force that has been shown to have beneficial effects on life forms. The paramagnetic rock used is a very fine grained basalt of a volcanic origin from Havelock, Ontario, Canada. Paramagnetic reading of 8700 x 10^{-6} cgs (micro gauss). Chemical and physical characteristics of paramagnetic rock are shown below:

PARAMAGNETIC ROCK

Element	Oxide Form	
Silicon	SiO_2	45.3%
Aluminum	AI_2O_3	22.3%
Iron	Fe_2O_3	9.8%
Calcium	CaO	8%
Sodium	Na_2O	2.6%
Potassium	K_2O	.5%
Magnesium	MgO	1.5%
Sulfur	SO_3	0%
Resident inert material	1.6%	
Solubility in water	nil	

Particle size gradation, 2.36mm (#8) 100 ave, 1.18mm (#16) 995 ave, 600um(#30) 69.1 ave, 300um (#50) 4.3 ave, 50um (#100) 2.4 ave, 75um (#200) 1.8 ave.

(continued on page 22)

(continued from page 20)

Hard (Black) rock phosphate (phosphate ore): 4% available phosphoric acid, 30% total phosphoric acid. Typical analysis dry: Bone phosphate of lime (BPL), 66.6%. Phosphate as P_2O_5, 30%. Calcium as CaO, 48.7%. Iron, .6%. Aluminum, .4%. Floride, 3.6%. Magnesium, .6%. Carbon, 3%. Sodium, 1%. Sulfur, 1.2%. CaO/P_2O_5 ratio, 1.6.

Greensand: Greensand is a marine potash with silica, iron oxide, magnesia, lime, phosphoric acid, 22 trace minerals, Espoma Greens and (0-0-0.1) soluble potash. Greensand is derived from natural deposits of glauconite of marine origin, composed primarily of iron-potassium silicate.

15. *90/10 Feltes Sand and Yardwaste Compost by Greencycle*
Characteristics of compost are: 42.6% moisture, 50% total organic matter, 28.5% humus, 50% ash at 750° centigrade, pH 7.0, electrical conductivity of 6.4 mmhos/cm, total exchange capacity 49.79 meq/100 g, soluble sulfur 147 ppm, easily extractable phosphorus 603 ppm, calcium 5033 ppm, magnesium 1276 ppm, potassium 4329 ppm, sodium 162 ppm. Carbon/nitrogen ratio 15.01/1. Microbiological analysis available.

16. *90/10 Feltes Sand and Biosolid by Metropolitan Water Reclamation District of Greater Chicago*
Characteristics of biosolid are 27.10% humus, pH 7.4, total exchange capacity 36.92 meq/100g, soluble sulfur 1937 ppm, easily extractable phosphorus 2327 ppm, calcium 3465 ppm, magnesium 1669 ppm, potassium 855 ppm, sodium 466 ppm. Microbiological analysis available.

17. *90/5/5 Feltes Sand and Yardwaste Compost and Biosolids*

18. *Feltes Sand and Hydrozone (10 lbs.)*
Hydrozone is a water-absorbing polyacrylamide copolymer with cation exchange capacity that absorbs 35 to 60 times its weight in water. Hydrozone is a permanent soil amendment.

19. *Feltes Sand and Hydrozone (5 lbs.)*

20. *90/10 Lakeshore Sand and Frenzer's Local Peat/Humus*
This is the only cell utilizing a different sand for rootzone construction. Lakeshore dunes sand is subangular, medium spherically shaped. Sand size distribution is slightly fine, testing 1.0% very fine, 31.3% fine, 60.1% medium, 3.1% coarse, 0.3% very coarse, and 0.1% gravel. Frenzer peat/humus is 25.5% ash at 700° centigrade, 74.5% total organic matter and 57.9% moisture, 6.9 pH, electrical conductivity of 1.6 mmhos/cm.

Early Evaluation of Amended Rootzone Plots

Amended rootzone plots were seeded on September 13, 1998. These plots were rated 14 days after seeding. Results are shown below as a percentage of cover. The blend of L-93 and SR-1119 covered quickly and shows good vigor.

Table 4

Percent cover of amended rootzone plots seeded with creeping bentgrass.

Rootzone	Percent Cover 9/27/98	Rootzone	Percent Cover 9/27/98
1	10	11	70
2	30	12	30
3	30	13	30
4	90	14	90
5	40	15	100
6	40	16	60
7	40	17	100
8	30	18	20
9	30	19	10
10	50	20	80

Subair System

The putting green was designed and built with four distinct gentle slopes. This configuration allows better acceptance of approach shots from four different areas around the green. These contours also provide four distinct surface and subsurface drainage patterns. Two separate subsurface drainage systems were installed. One system drains a single quadrant of approximately 1,500 sq. ft. The companion system which drains the remaining area of the green was designed to accommodate the SubAir system. A continuous permanent barrier of 45 mil polypropylene was installed to separate these drainage fields. This barrier extends from the clay base of the green to the surface of the green. This separation allows for the study of the impacts of forced gas exchange by SubAir through the drainage system of the putting green.

The SubAir operates in either vacuum or pressure mode, pulling or pushing atmospheric air

(continued on page 24)

(continued from page 22)

through the rootzone. Excess water, carbon dioxide, methane, hydrogen sulfide, and other gasses can be purged. Increased concentrations of oxygen can be obtained within the rootzone to encourage the growth of microbial populations, and assist in gas exchange with plant roots. The effect of air exchange on the temperature and gas concentration in the verdure may also be documented.

Fairway

The fairway was constructed to test the performance of 13 varieties of creeping bentgrass and 6 different rootzone amendments. Plots were randomly selected and are 5 feet x 5 feet, including three replications. All varieties (Table 4) were seeded at 25 grams per plot, or 2.2 lbs./1000 sq. ft.

Six plots were established to test rootzone amendments (Table 5). Each plot was approximately 2,300 square feet Amendments were applied to native soil and disked into the top 4 to 6 inches. A 50/50 blend of L-93/SR-1119 was seeded at 2 lbs./1000 sq. ft.

Table 5

Bentgrass varieties for evaluation at fairway height.

Cobra	Penntrio
Dominant	Regent
Highland	Seaside II
L-93	South Shore
Mariner	SR-1019
Penncross	SR-1020
Pennlinks	

Table 6

Soil amendments applied to six fairway rootzone trials.

1. 3-in. yardwaste compost
2. 3-in. yardwaste compost plus 100 lbs./1000 sq. ft. paramagnetic rock
3. 2 in. biosolids
4. 2 in. biosolids plus 100 lbs./1000 sq. ft. paramagnetic rock
5. 3 in. yardwaste compost plus 2 in. biosolids
6. 3 in. yardwaste compost plus 2 in. biosolids plus 100 lbs./1000 sq. ft. paramagnetic rock

Note: A 3 in. application equates to approximately 390 cu. yds. of material per acre.

In addition to bentgrass varieties, a bluegrass blend (Table 6) is being evaluated for use on green surrounds. Evaluation will include turfgrass quality, low mowing (one inch) tolerance, color, disease resistance, wear tolerance,and recuperative ability. The blend was sown at 1.5 lbs./1000 sq. ft.

Table 7

Composition of bluegrass blend utilized for green surrounds.

14.84% Limousine	13.89% Award
14.71% Eclipse	13.88% Nuglade
13.90% Alpine	13.84% Rugby-II
13.76% America	

Acknowledgments

Planning and constructing this green with all the trials was an extensive undertaking, demanding many hours of work and forethought. Sincere appreciation is given to those who assisted. Special thanks to Rick Feltes from Feltes Sand & Gravel Co., Elburn, Illinois. (630-365-9181) who gave freely the off-site custom mixing of the different rootzone amendments; to Van Salmans, green chairman, and to the membership of North Shore Country Club; the USGA, GCSAA, and NTEP; Dr. Hank Wilkinson and Dr. Tom Voigt, University of Illinois; Dr. Randy Kane, CDGA; Dan Salsinger, GSI; Vick Koelper, Koelper Golf Course Construction; Rick Jacobson, Jacobson Golf Course Design; Bill Middleton, Emerald Isle, Ltd.; Mr. and Mrs. Repenning, GreenCycle; Richard D. Andrews and James W. Shaw, Zeoponix; Dr. Lea Brilman, Seed Research; Dr. Tom Granato, Metropolitan Water Reclamation District of Greater Chicago; Paul Vermeulen, USGA; Steve McWilliams, Turf Diagnostics & Design; Douglas Murray, Murray Pest Management; Bob Womack, WMC Products, Inc.; Dr. Paul Rieke, Michigan State University; Lou Haines, Soils Management; Gary Schinderle, Golf Enviro Systems, Inc.; Paul Tabor, Sportsturf Consultants; Rich Brandel, Organica, Inc.; Axis; Donald Michaels, Conserv FS; Tony Altumn and Jim Reed, Altumn Irrigation Design; and John Leibold, Leibold Irrigation.

Lastly, I would like to acknowledge the grounds crew at North Shore Country Club for their hard work and attention to detail, Jerry Dinelli for helping with the green and ensuring the golf course wasn't ignored, giving me the freedom to do research for the green, and Darrick Robbins for editing this paper.