2001
Illinois Turfgrass Research Report

A COOPERATIVE EFFORT OF THE
University of Illinois, Southern Illinois University,
Illinois Turfgrass Foundation, and the Chicago District Golf Association.

Turfgrass Series # 7

Table of Contents

Greetings!

The turf faculty, staff, and advisors at the University of Illinois, Southern Illinois University, and Chicago District Golf Association are pleased and proud to bring you the North Central Turfgrass Exposition (NCTE) edition of the *2001 Illinois Turfgrass Research Report*. This report contains brief summaries of turf activities conducted in Illinois. We hope the report provides you with an insight into our diverse programs and provide you with the latest in turf management techniques and technology.

We sincerely thank the **Illinois Turfgrass Foundation (ITF)** for financing the production of this report. The **ITF** is a not-for-profit group dedicated to supporting turfgrass research and education in Illinois. The **ITF** sponsors many fund-raising activities that help make this research and education possible. Without the **ITF**, it would be difficult to maintain the high-quality turfgrass research findings and educational events turf managers in Illinois currently enjoy.

We are also grateful to the many supporters of and contributors to our programs. These supporters and contributors are committed to advancing the science of turfgrass management in Illinois by supporting educational activities for the betterment of the industry. They are loyal to our programs and critical for our success.

As Advisors to the **ITF** Board, we are publishing this for attendees of the 2001 NCTE. Each Advisor conducts considerable research and education over the year. Oftentimes, the results of this research are preliminary or only describe a response for a single growing season. To provide a more meaningful message, we have developed a summary format. Each brief article provides the highlights and impacts of the author's activities. With this format, we hope it is easier to draw a "take home" message from the activities that can be more directly applied to your turf management activities.

Finally, in addition to this printed copy of the report, an electronic version was produced and is available for viewing on the University of Illinois Turfgrass Program Web Site (*www.turf.uiuc.edu*). Along with the *2001 Illinois Turfgrass Research Report*, research reports from previous years, back to 1989, are also available. We hope you find this information useful and wish you the best in the upcoming season.

2001 Golf Turf, Turf Cultivar, and Ornamental Grass Studies

Tom Voigt, Darin Lickfeldt, Luke Cella, John Tallarico, Emily Heaton, and Joyce Jones

Graduate Student Research

This past year was busy - two of the program's graduate students, both of whom received assistance from ITF, completed degrees.

First, in April, Darin Lickfeldt completed a Ph.D. with the dissertation, *Kentucky Bluegrass Blend Ecology*. In this study, Darin employed genetic techniques (RAPD markers) to determine the varietal composition of blends of 'Blacksburg'. 'Midnight' and 'Unique' Kentucky bluegrasses. Multiple turf samples were collected over two growing seasons from a fairway (Aspen Ridge Golf Course, Bourbonnais, IL) and a rough (Alpine Hills Golf Course, Rockford, IL). It was determined that even though the two stands had different initial component composition and management strategies and were 157 km apart, the two blends reached similar varietal compositions. The fairway was comprised of 14% 'Blacksburg', 46% 'Midnight', and 40% 'Unique' 37 months after seeding while the rough composition was 14% 'Blacksburg', 47% 'Midnight', and 39% 'Unique' 15 months after seeding. Since the two stands were not the same age, they may have achieved an equilibrated composition dictated by the competitive advantages of the component varieties.

Results You Can Use - *This study suggests management and location do not dictate the composition of a blend. Rather, the competitive advantages of the varieties in the blend will determine composition. Overall, using turf variety characteristics is extremely important when developing Kentucky bluegrass blends.*

In May, Luke Cella completed a M.S. Degree with a thesis entitled, *Measuring Ball Lie on Golf Course Fairways*. He evaluated quality and morphological characteristics of 25 Kentucky bluegrass cultivars to identify types that may be suited to golf course fairway planting. These measurements were conducted at Urbana, IL, and West Lafayette, IN, where the cultivars were maintained at 0.875 and 0.75 inch respectively to simulate golf course fairway conditions.

Results You Can Use - *Luke found that of the 25 cultivars examined for turf quality, thatch depth, tiller count, and leaf angle mean rankings, 'North Star', 'Limousine', 'Conni', 'Absolute', 'America', and 'Rambo' showed potential for successful fairway use.*

As part of his M.S. work Luke also developed two devices able to accurately measures ball lie on golf course fairways. The Lie-N-Eye and Lie-N-Eye II were successfully used to evaluate ball position in research plots and actual fairways.

Results You Can Use - *Lie-N-Eye II can be used to evaluate ball lie uniformity within or between fairways and can also be used as a research tool for evaluating the ball lies turf cultivars when being evaluated for fairway planting.*

Darin began working for Dow AgriSciences in April and is currently based in Atlanta, Georgia. Luke was named Superintendent at Tamarack Golf Club in Naperville in July.

Current graduate students include Sam Schmitz (working on divot repair studies also with Bruce Branham and Tom Fermanian); John Tallarico (working on ornamental grass management), and Emily Heaton (working on *Miscanthus* x *giganteus* as an Illinois biofuel also with Steven Long). Sam plans to complete his M.S. degree in Spring, 2002. John and Emily are just beginning their degree studies.

Turf Cultivar Research

Several National Turfgrass Evaluation Program (NTEP) trials are currently being conducted to identify turfgrass cultivars best suited for planting in Illinois. In Urbana, the NTEP 1998 Fine-leaf Fescue, 1998 Putting Green Height Bentgrass, 1998 Fairway Height Bentgrass, and 1999 Perennial Ryegrass Evaluations are ongoing and the 2001 Tall Fescue Evaluation (480 plots) was planted. In addition, due to heavy rains in 2000, the 2000 Kentucky Bluegrass Evaluation (519 plots) was replanted. In Savoy, Illinois, the 1999 On-Site Perennial Ryegrass Gray Leaf Spot Evaluation is being conducted on the U. of I. Blue Course (since being planted in September, 1999, there has been no incidence of gray leaf spot on any of the 134 entries).

Table 1. 2001 NTEP on-site bentgrass trial - quality data.

Cultivar	April Quality[1]	May Quality[1]	June Quality[1]	July Quality[1]	Aug. Quality[1]	Sept. Quality[1]	Oct. Quality[1]	2001 Quality Mean
Penn G-1	7.3 ef	7.0 cd	8.0 de	7.7 d-f	8.0	8.0	8.7 f	7.81
Penn A-1	7.7 f	6.0 b-d	8.3 e	8.3 f	7.3	8.0	8.3 ef	7.71
Penn G-6	7.7 f	7.3 d	7.7 c-e	7.7 d-f	7.0	8.0	8.3 ef	7.67
Penn A-4.	7.7 f	7.3 d	7.7 c-e	7.7 d-f	6.7	8.7	8.0 d-f	7.67
L-93.	7.3 ef	6.7 cd	7.3 b-e	7.3 c-f	7.0	8.3	8.0 d-f	7.43
Providence	7.3 ef	6.3 b-d	7.3 b-e	7.3 c-f	7.0	7.0	7.7 c-f	7.14
Imperial	7.0 d-f	6.0 b-d	8.0 de	7.3 c-f	6.3	7.7	7.3 c-e	7.10
Trueline	6.7 c-f	6.3 b-d	7.3 b-e	8.0 ef	7.0	6.3	8.0 d-f	7.10
LCB-103	6.3 b-e	6.3 b-d	7.3 b-e	7.7 d-f	6.7	7.7	6.7 bc	6.95
Putter	6.7 c-f	6.3 b-d	7.0 b-d	7.3 c-f	7.0	7.3	7.0 cd	6.95
SR 1119	6.7 c-f	6.3 b-d	7.3 b-e	6.7 a-d	6.3	7.3	7.0 cd	6.81
SR 1020	5.7 a-c	6.3 b-d	7.3 b-e	7.0 b-e	6.0	7.7	7.0 cd	6.71
Backspin	6.0 a-d	5.0 ab	6.7 a-c	7.0 b-e	6.7	7.7	7.0 cd	6.57
Cato	6.0 a-d	5.0 ab	6.7 a-c	7.3 c-f	6.3	7.3	7.3 c-e	6.57
Viper	6.3 b-e	5.7 bc	6.3 ab	6.3 a-c	6.3	7.3	6.7 bc	6.43
Century	5.3 ab	4.0 a	6.7 a-c	6.0 ab	6.3	7.0	5.3 a	5.81
Penncross	5.0 a	5.0 ab	5.7 a	5.7 a	7.0	6.3	5.7 ab	5.76
Crenshaw	5.0 a	4.0 a	5.7 a	6.7 a-d	6.7	7.3	5.0 a	5.76
LSD 0.05	1.3	1.5	1.1	1.3	NS	NS	1.3	

[1] Mean of ratings for three replications where 0 = dead turf, 5 = minimally acceptable turf quality, and 9 = perfect turf.

Results You Can Use - *At North Shore Country Club in Glenview, Illinois, the NTEP 1997 On-Site Bentgrass Putting Green trial just completed four years of evaluation (Tables 1 and 2).*

This high-maintenance trial is being conducted on a USGA green. Thanks to North Shore for hosting this research and to Dan Dinelli, Jerry Dinelli, Dan Garling, and Derrick Robbins for providing high quality conditions.

Table 2. Mean quality data for NTEP on-site bentgrass trial - 1998-2001.

Cultivar	1998 Quality Mean[2]	1999 Quality Mean[2]	2000 Quality Mean[2]	2001 Quality Mean[2]	Four-Year Quality Mean
Penn A-1	7.3	7.6	7.8	7.7	7.60
Penn A-4.	7.6	7.3	7.0	7.7	7.39
Penn G-6	6.8	7.5	7.6	7.7	7.39
Penn G-1	6.8	7.2	7.2	7.8	7.25
L-93.	7.1	7.4	7.0	7.4	7.23
LCB-103	6.9	7.0	6.6	7.0	6.86
SR 1119	7.0	7.0	6.6	6.8	6.85
Backspin	7.1	7.0	6.7	6.6	6.84
Providence	6.5	7.0	6.7	7.1	6.84
Trueline	6.5	7.0	6.7	7.1	6.83
Imperial	6.8	6.9	6.4	7.1	6.80
SR 1020	6.8	7.0	6.4	6.7	6.73
Putter	6.4	7.0	6.5	7.0	6.71
Cato	6.4	6.8	6.1	6.6	6.47
Viper	6.4	6.6	6.3	6.4	6.43
Century	7.3	6.2	6.0	5.8	6.33
Crenshaw	6.7	6.6	6.0	5.8	6.27
Penncross	6.1	5.8	5.8	5.8	5.87

[2] Mean of April - October evaluations where 0 = dead turf, 5 = minimally acceptable turf quality, and 9 = perfect turf.

1996 NTEP Low Maintenance Tall Fescue Trial

Results You Can Use - *The1996 NTEP Low Maintenance Tall Fescue Trial was concluded at the end of the 2000 growing season. Tall fescue cultivars that have performed acceptably in trials in Urbana (Table 3) were not irrigated, have been maintained at 3.0 inches, and have received 1 to 2 pounds of nitrogen per 1,000 square feet per year.*

This list should be used to guide turfgrass cultivar purchases and should not be considered all-inclusive; cultivars not listed may not have been tested in Urbana trials or may perform well when grown under different management and/or environmental conditions. Seed of some cultivars may no longer be available nor be available in all areas.

Table 3. Top-performing tall fescue cultivars in Urbana[3].

Adventure	Cafa 101	Finelawn 88	Mesa	**Regiment**	Thoroughbred
Alamo	**Carefree**	Finelawn Petite	Monarch	**Safari**	Tomahawk
Apache	Chieftan	**Genesis**	Montauk	Silverado	**Tomahawk E+**
Apache II	**Crossfire II**	Jaguar	Mustang	**Shenandoah**	Trailblazer
Austin	**Dasher**	Jaguar II	**Mustang II**	SR 8200	Trailblazer II
Aztec	Duke	Legend	Olympic	SR 8210	Trident
Bonanza	Eldorado	Leprechaun	Pyramid	SR 8300	Vegas
Bonanza II	**Empress**	Lexus	Rebel	SR 8400	Virtue
Bonzai Plus	Falcon	**Lion**	Rebel II	Sundance	Wrangler
Brookston	**Falcon II**	**Marksman**	Rebel Junior	**Tarheel**	
Bullet	Finelawn	Marathon	Rebel 3D	**Titan 2**	

[3] Table 3 lists cultivars from all previous NTEP tall fescue trials. Cultivars in **BOLD** type were added following the 1996-2000 trial.

Ornamental Grass Studies

In 2001 several ornamental grass studies were conducted. In two different studies, the preemergence herbicides were evaluated; in the first, Gallery (isoxaben) and Snapshot (trifluralin + isoxaben) were applied at different rates to fifteen different grasses, while Ronstar (oxadiazon) and Preen (trifluralin) were evaluated in the second. Results of these studies will be available in the *2002 Illinois Turfgrass Research Summary.*

In the *C-FAR Ornamental Grass Management Study,* sixteen ornamental grasses were planted during Summer 2000 in Godfrey, Lemont, and Urbana, Illinois to determine their tolerance to these sites, as well as to spring or autumn foliage removal. Again, results of this study will be available in the *2002 Illinois Turfgrass Research Summary.*

Results You Can Use - *Several little-used entries in this trial warrant mention and should be used in more Illinois landscapes. These grasses include Calamagrostis brachytricha - (Korean Feather Reed Grass), Briza media (Common Quaking Grass), Schizachyrium scoparium 'Blaze' (Blaze Little Bluestem), Sesleria autumnalis (Autumn Moor Grass), and Sesleria caerulea (Blue Moor Grass).*

In another ornamental grass study, Joyce Jones (working in Andy Hamblin's lab) has been examining the genetics of ornamental switch grasses to determine relationships and similarities among these plants. Joyce is also using genetic markers to determine if cultivars of the popular switch grass, 'Heavy Metal', are identical when obtained from different nursery sources.

Thanks!

Your support of our research, outreach, and teaching activities is invaluable! We appreciate all that is done to benefit our turf program and would be unable to progress without your support.

Precision Turf – Myth or Reality?

Tom Fermanian, Hye-yun Jeong, Siddhartha Narra, and Mark Schmidt

Similar to the past few years, the overall objective of our research group is to develop the technology necessary for a future successful "precision turfgrass management" system. A functional precision turfgrass management system has three major components. First, turf management needs or problems must be identified within the individual area where they exist. These individual areas may be as small as a few square feet or as large as an entire fairway, but are rarely similar in shape or size. Secondly, the identified needs must be translated into appropriate cultural procedures to remedy the situation. The third component is the accurate application of the identified cultural practices to each individual area. It is our hope that turf equipment manufacturers will focus on the third component, while we will concentrate on development of the first two components for the foreseeable future.

Initially, many of the research projects will be exploratory and only loosely related to the direct application of the first two precision turf components. As we gain greater insight into the needs of each area, new projects will become more focused. Several of the described current projects were undertaken to test the feasibility of their use in a precision turf system. Similarly, two of the projects are extensions of earlier research.

Both the "Perennial Ryegrass Selection Web Site" and "Measuring Creeping Bentgrass Carbohydrates" projects will be completed within the next six months. Two new projects will replace these activities, beginning next summer. While one of the new projects is still in the conceptual design stage, a second project will focus on direct electronic sensing of soil moisture and turf fertility needs.

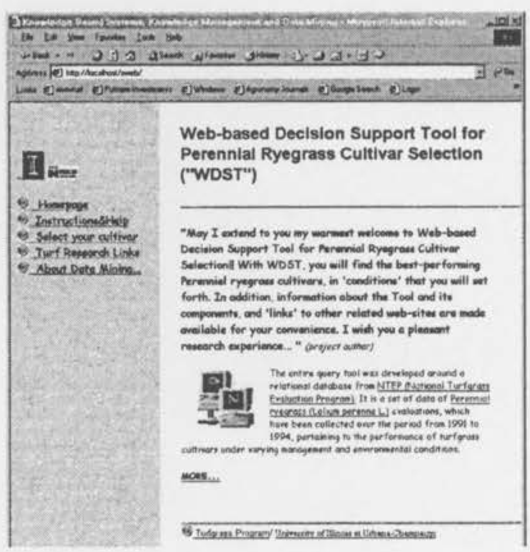


Figure 1. Home page for the perennial ryegrass cultivar selection tool.

Selecting Perennial Ryegrass Cultivars

A web-based cultivar selection tool (Figure 1) is currently being developed by Miss Hye-yun Jeong, a master's candidate. This tool is the culmination of an extensive evaluation and modeling of perennial ryegrass cultivar performance over four years (1991-1994) in the National Turfgrass Evaluation Program (NTEP) trials conducted across the United States. The results of the NTEP trials were first processed through a number of steps to provide a consistent format for performance modeling through database mining techniques.

The selection tool will eventually be available at (*http:// www.turf.uiuc.edu*). Numerous other studies have shown relationships among cultivar performance and cultivar resistance to diseases, weeds, insects and environmental stresses. Users of this tool should be cautioned that the results will be limited to those cultivars available within the evaluated NTEP trials. Many newer cultivars may perform at a higher level, so consult recent lists of suggested perennial ryegrass cultivars for a larger set of potential cultivars.

Measuring Creeping Bentgrass Carbohydrates

A field experiment was conducted over the past four years at the Landscape Horticulture Research Center inn Urbana to determine seasonal changes in total nonstructural carbohydrates (TNC) or storage sugars accumulated in bentgrass clippings. The experimental area was composed of eight creeping bentgrass cultivars, each mowed at three different heights. Different mowing heights were imposed on each cultivar as a controllable plant stress. This study is being conducted in part as the master's thesis research of Siddhartha Narra.

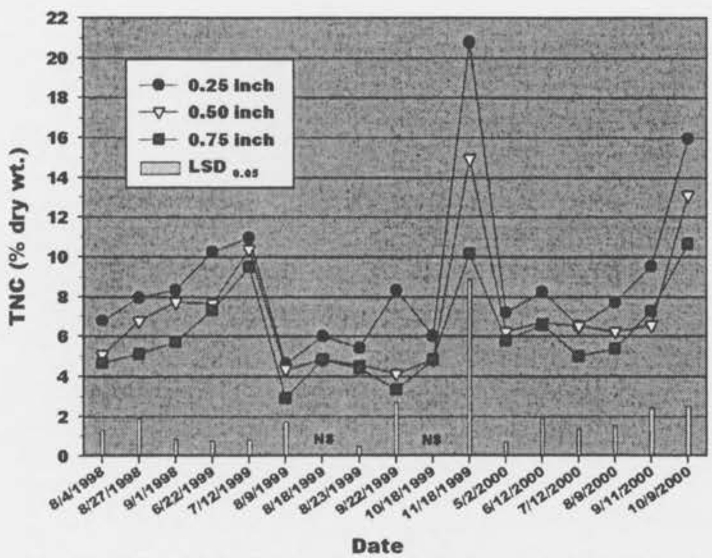


Figure 2 Mean total nonstructural carbohydrates averaged over eight creeping bentgrass cultivars

While the preliminary findings of this study have been reported in previous Illinois Turfgrass Research Reports, we have now collected four years of clippings and will report the results of the first three seasons. A final report will appear in next year's Report. Weather-related data (air & soil temperature, photosynthetic active radiation, precipitation) have also been collected throughout the study and will be analyzed for potential correlation with each measured parameter. The results of these analyses will be presented in the final report.

Turfgrass quality, dry clippings weight, and TNC were evaluated either biweekly or once a month over three growing seasons. An analysis of quality and clippings weights indicated some seasonal trends, however, neither measured parameter provided any interesting insights relating to plant stress. The more consistently measured parameter was TNC, which presented the same general trend in each of the three seasons, but at different degrees of intensity.

For almost every date of evaluation, TNC levels in plots mowed at 0.25 inches were observed to be significantly greater than the measured TNC of plots mowed at higher heights (Figure 2). While this did not support our original hypothesis that lower mowing heights would accumulate less TNC, there is a possible explanation. Mowing at the lowest height probably cut more lower blade and stem tissue than plots mowed at higher heights. Several previous studies have reported the highest concentration of TNC towards the base of shoots or in crown tissue. Another consideration may have been higher photosynthetic rates at the lowest mowing heights due to reduced shading of lower stems. These differences tended to be greatest during spring and early fall months.

Probably the most interesting observation was the very high accumulation of TNC during the late fall period. This was during a period of cool temperatures with little vertical growth of the turf. This situation of relatively high photosynthetic activity with little growth allows for the continuing accumulation of TNC in blade tissue with very little utilization.

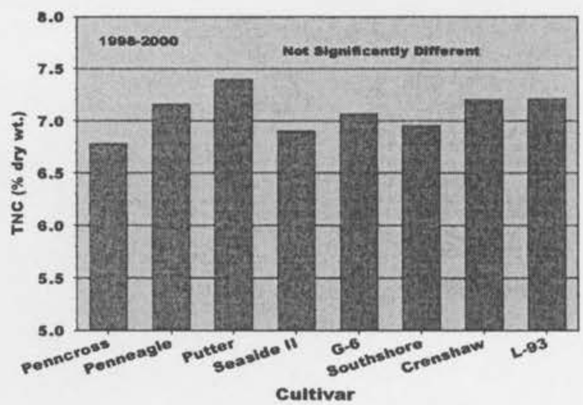


Figure 3 Mean total nonstructural carbohydrates of eight creeping bentgrass cultivars from 1998 to 2000.

One of our original objectives for this study was to develop a consistent baseline of TNC levels found in fairway height creeping bentgrass across the season. While there were some yearly differences, very similar values were found each season.

It would be very difficult to use this TNC baseline to observe deviations in a future precision turfgrass management system if the TNC concentrations were very different among cultivars. Over the three years of data collection with approximately 18 dates, no significant differences were observed among the evaluated cultivars (Figure 3). This consistency among cultivars is critical for blended fairways or turfs of unknown cultivar composition.

Where do we go from here? There is still one season of data to be evaluated. We feel the trends will stay consistent, however. It appears that there is a predictable fluctuation in TNC levels in creeping bentgrass with some annual fluctuation. It is also important to note that TNC accumulation is similar among creeping bentgrass cultivars. These two points may be useful in a future precision turfgrass management system.

Another important finding of this study was that accumulated TNC did not consistently correlate with general plant stress. There appears to be too many factors involved to use TNC as a single factor in predicting stress. Ideally, it would be best to predict plant stress through a single measurement that could be directly scanned without disturbing the turf. This is a direction we will pursue in several follow-up studies to be initiated in 2002.

Collecting spatial data

In any precision turfgrass management system it is likely that both directly sensed information and data collected from human evaluators will be used as input to the system. The collection of subjectively derived data from the golf course manager can be costly in terms of time. For this method of data collection to be widely accepted, it is important to minimize the number of data points that are required to be collected.

If a broader spatial distribution of an observed problem or situation can be developed through geostatistical analysis, it would make a very complicated analysis simple to conduct for the end user. This data collection system would not only suggest the minimum number of collection points required, but would give some indication of where to collect data.

A study has been initiated as a portion of the Ph.D. thesis research of Mark Schmidt (Figure 4.) to examine a range of statistical analysis approaches to analyze data collected with a spatial dimension. Data consisting of quality, cover and density was collected over five locations. The preliminary results of this investigation should be available by next year.

Figure 4. Mark Schmidt, Ph. D. student with data collection equipment.

Controlling Turfgrass Pests

The authors of *Controlling Turfgrass Pests* (Prentice-Hall, Inc.) are currently preparing a third addition of the book. In addition to updating pest management techniques and materials, some of the more recently recognized pests have been added. If all goes well, the book will be available during the spring of 2002.

Turf Soils Research at Southern Illinois University Carbondale 2001 Research Update

She-Kong Chong, Richard Boniak, Jeremy Clark, and Sam Indorante

Project (1): Nursery Green Research

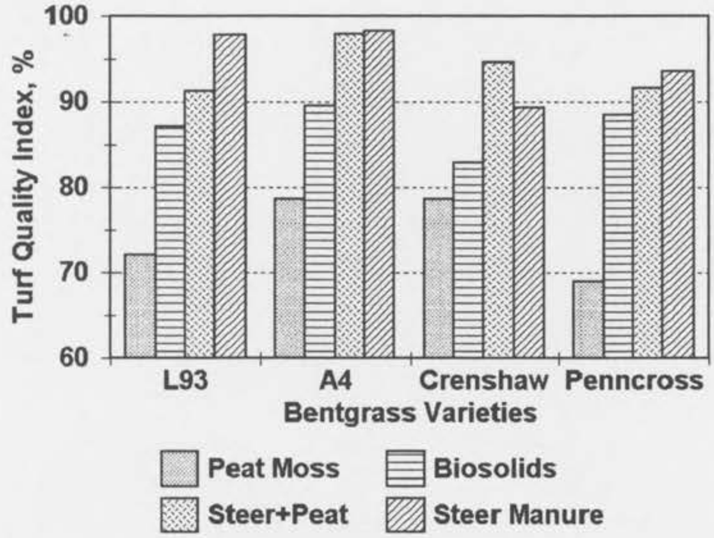
Investigators: Chong, S.-K. and R. Boniak SIUC, S. J. Indorante, USDA-NCRS, K. Renfro, Hickory Ridge Golf Course, Carbondale.

On April 17, we had the second annual golf outing to promote this project. About 50 people participated in this special activity. We appreciate all the support received from golf related industries, golf enthusiasts, general public, and particularly the nursery research committee. We particularly would like to take this opportunity to thank the Southern Illinois Golf Course Superintendent Association for their support in the golf outing event and their kind corporation. At this time, we have received most of the materials needed to construct the green. We appreciate very much the contributions by Mr. Dan Dinelli at North Shore country club, Ms. Kathy Renfro at the Hickory Ridge golf course, Mr. Gordon Montgomery at the AgriLife, Inc, the Munie Outdoor Services, and Mr. Sam Burkey at the Burkey Construction, Inc. Unfortunately, the construction of the green was delayed due to weather condition.

Leaching Study

Sand Mixes Study

Before field establishment, these sand mixes are presently tested in the green house. The objective is to examine how bentgrass responses to these selected sand mixes were selected. The amendments used in the sand mixes included Canadian sphagnum peat moss (PM), treated steer manure (SM), Biosolid/Yard wastes (BY), and the mix of PM +SM. The experiment was conducted in a soil core with 3.1 inches in diameter and 15 inches long. Each amendment was replicated 5 times. Four different varieties of bentgrass: A-4, L-93, Penncross, and Crenshaw were tested in this study. In order to assure the selected mixes meet the USGA recommendations, both physical and chemical properties have been tested in the laboratory. The cores were packed followed the USGA specification. Mr. Jeremy Clark is overseeing this greenhouse project. He started his MS degree program at SIUC on June 1, 2000. Preliminary results indicated that L93 and A4 did well on sand mixes amended with steer manure. Sand mix amended with peat moss had the poorest rating among all the treatments.

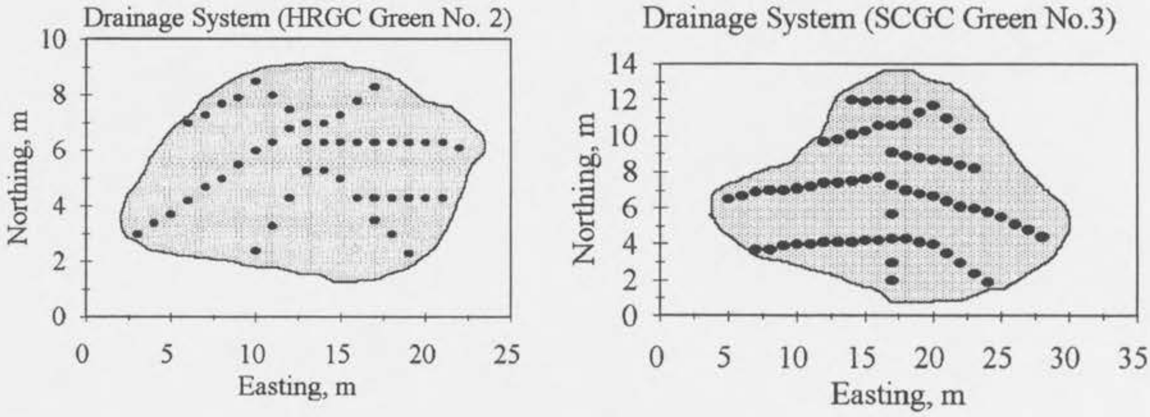


Preliminary results of turf quality established on sand mixes added with various amendments

Project (2): Mapping the Drainage System in Golf Greens Using a Ground Penetrating Radar

Investigators: Boniak, R. and S.-K. Chong, SIUC, and S.J. Indorante and J.A. Doolittle, USDA-NCRS

Good golf green drainage is important for healthy turf and proper playing surface. With time, golf green drainage systems can fail or become plugged up due to improper construction and/or management. Unfortunately, many golf green drainage maps are either unavailable or incorrectly marked. Locating a drainage system in a green is a very time consuming and frustrating job. Many golf course superintendents invested many hours in locating these pipes when drainage problems arose. Correcting the drainage problems can be destructive to the green and expensive when location of the present system is unknown. Ground penetrating radar (GPR) is a non-invasive tool for locating subsurface features. In this study, a SIR system 2000 GPR was used to map a USGA green and a California style green. Results indicated that GPR could accurately locate the drainage tiles in a golf green with minimum time and disturbance. Results indicated that GPR could accurately locate the drainage tiles in a golf green with minimum time and disturbance. The radar is an effective non-invasive tool for locating and mapping drainage system in golf green. It requires three persons to conduct the measurement. For a 500 m^2 green, it takes about one hour to scan. The cooperation in this study provided by Mr. Erik Anderson at the Stone Creek golf course, Makanda, and Ms Kathy Renfro at the Hickory Ridge golf course, Carbondale, are greatly appreciated.



Subsurface tiling systems at the HRGC Green No. 2 and SCGC Green No. 3 using ground penetrating radar

Project (3): Utilization of Coal Combustion Residual to Improve Physical Properties and Nutrient Efficiency of a Fine-Textured Soil for Golf Course Fairway Turf Growth

Investigators: J. Clark, Boniak, R. and S.-K. Chong, SIUC

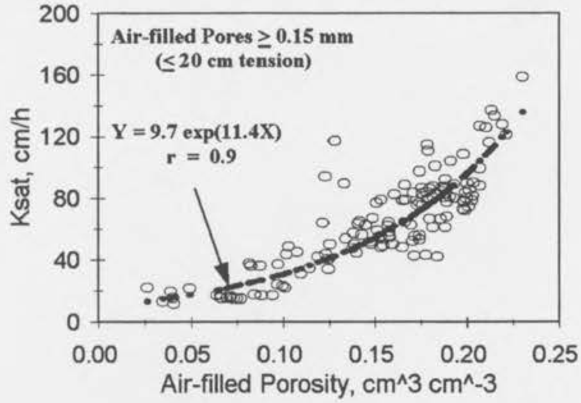
The objective of this study is to examine the feasibility of using coal combustion residual (bottom ash) as an amendment to improve turf growth in high traffic areas. A green house study has been established to determine the optimum rate of coal combustion bottom ash (CCBA) for turf growth. The CCBA used in the test was obtained from the SIUC power plant. The amounts of amendment used were 0 (as a control), 10, 20, 30, and 40%. Each application rate (treatment) was replicated 4 times. Zoysiagrass (*Zoysia* sp.) was used as a test grass because of its excellent wear resistance and tolerance to a wide range of soil pH. Turf quality index and clipping dry mass are being collected and evaluated statistically for comparison. The goal of this project is to turn these large-volume of coal combustion coal waste into a useful material, but also provide additional alternative for golf course superintendents for their future selection of amendment in turf management.

Project (4): Tilth of Green Sand Mixes Amended with Various Organic Composts

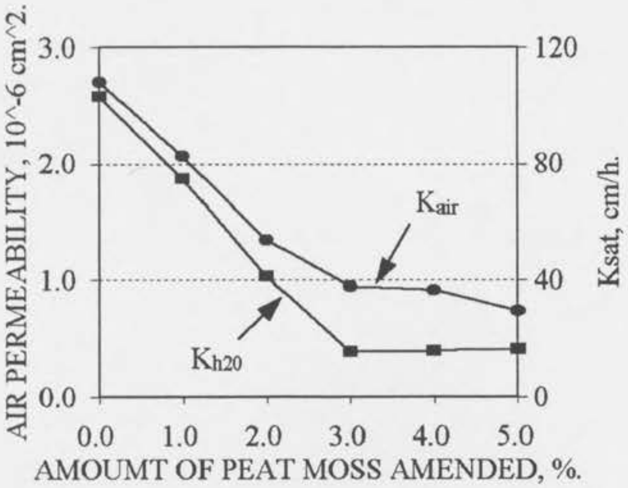
This project is to evaluate the tilth of sand mixes suitable for turf growth in the transition zone. A USGA sand was used in this study. The amendment selected included:

- Reed sedge peat moss
- Sphagnum peat moss
- Irish shamrock peat moss
- Earthworm casting
- Aged sawdust
- Municipal waste
- Yard waste
- Treated steer manure
- Ecolite
- Profile

In the experiment, there were 45 sand mixes (treatment) were studied. Sand mix was added with amendments that varied from 1 to 5%. Three soil cores (replication) were constructed for each treatment following the USGA recommendation. Soil physical properties studied included total porosity, air-filled porosity, hydraulic conductivity (both saturated and unsaturated), and air permeability. Results showed that most of the sand mixes tested met the USGA recommendations, except those amended with peat moss higher than 0.02 g g^{-1}. As the amount of amendment increased, the macro-pores in the sand mix decreased. Results also showed that saturated hydraulic conductivity were exponentially related to macro-porosity of the sand mixes. Green house study indicated that root length increased as saturated hydraulic conductivity, K_{sat}, increased.



Relationships between air-filled porosity (> 0.15 mm) and saturated hydraulic conductivity



Both air permeability and hydraulic conductivity decreased when the amount of peat moss in the sand mix increased

For further information, please contact Dr. She-Kong Chong, Plant, Soil and General Agriculture, College of Agriculture, Southern Illinois University Carbondale, Mail Code 4415, Carbondale, IL 62901-4415. Tel. (618) 453-1793, or e-mail: skchong@siu.edu

The Southern Illinois University Turfgrass Program: Teaching and Research Serving the Industry

Kenneth L. Diesburg

Teaching and Students

This year we had 18 students in the introductory turfgrass class and 14 in the advanced, professional turfgrass management class. Dr. She-Kong Chong has assembled a fine set of courses in golf course green construction and maintenance, and irrigation. Many of our students participated in our internship program, which can place students almost anywhere in the world where there is golf. Usually the interns are happy working within the continental United States with the majority working in Illinois. We strive to prepare our students for the rigors of becoming professional turfgrass managers. Our SIU Student Chapter of the GCSAA has 14 members. They conducted another golf fundraiser this fall to cover the expenses of attending the GCSAA International Turfgrass Show and Conference in Orlando. Two of them, Zachary Anderson and Alan Wall won GCSAA Scholarships, which will be presented at the show.

Of our three graduate students we had last year, Richard Boniak has received his Masters Degree and is continuing for his Ph. D. Denise Pingel, and Jeremy Clark continue to work toward their Masters Degrees.

Outreach

We tried a different approach for field day this year with good results. The usual tour of the plots was preliminary to a special topic, titled `Understanding Take-All Patch', which qualified for a CEU. After lunch we visited the new Stone Creek Golf Course south of Carbondale to observe the 14 cultivars on display in the practice putting green. Even with a limited mailing to within three hours drive of Carbondale, we drew as many attendants as usual (35). And we held their interest to the very end of the field day. We will continue this format, and improvement thereon, in future years.

Research

Your membership in the Illinois Turfgrass Foundation (ITF) is essential to the ongoing turfgrass research at Southern Illinois University. I thank you every day for the support you give me through the ITF. I work every day toward returning your support with better tools for managing turfgrass and greater quality turfgrass varieties.

Zoysiagrass Breeding

We made significant progress toward the development of improved seeded varieties for both southern and northern Illinois. As I suspected would happen, many of the 300 selections from last year had not gotten large enough to produce seed heads of sufficient number for harvest. But a lot of data were gathered from the four polycrosses at Carbondale and the winter screening at Urbana. Thirty of the 300 selections died at Urbana from intolerance to winter conditions. Several other plants were eliminated as parents because of disease. Another 600 new plants were established in the nursery for future selection. Selection criteria are texture, color, compactness, pile thickness, stay-green, winter hardiness, freedom from disease, spreading ability, seed production, and seedling vigor.

Plant Growth Regulation

Now that my job is finished in the development of `Proxy' growth regulator, I have joined the national effort toward the development of a herbicide/growth regulator/management program in the suppression of annual bluegrass in short-clipped bentgrass and Kentucky bluegrass. The goal is to find a way to inhibit annual bluegrass growth and seed head production, allowing bentgrass or bluegrass to gradually out-compete annual bluegrass without lowering the turfgrass quality of the annual bluegrass. Best treatments found, so far, are: (1) Proxy alone at 10 oz/1000 sq. ft. and (2) Proxy at 3 oz with Prograss at 1 oz. With those treatments, bentgrass compactness was increased 169% over the nontreated check, while annual bluegrass seed head development was inhibited 50%, with a 67% increase in annual bluegrass turf quality at 21 days after treatment.

Tall Fescue Breeding

My tall fescue cultivar `Pyramid' is approaching the end of its life cycle in the market. Sales from O.M. Scott & Sons in 2001 topped 1.4 million pounds of seed from over 1000 acres of production in Oregon. It had been scheduled to be plowed out at the end of this year. But excellent seed yield and market conditions have delayed the plowing. Maybe we will get a few more years out of it. Meanwhile, three potential successors to Pyramid are being tested in the new Tall Fescue Trial of the National Turfgrass Evaluation Program and a privately arranged testing program, both established this fall, 2001.

National Turfgrass Evaluation Program

Southern Illinois University and the University of Illinois both participate in this program. These trials are invaluable in identifying the best varieties for our respective regions. At Southern we have the Kentucky Bluegrass (sun and shade), Tall Fescue, Perennial Ryegrass, Bermudagrass, Buffalograss, and Zoysiagrass Trials. Our transition zone has a unique value. It is the northern region for bermudagrass adaptation. And it is the southern region for Kentucky bluegrass adaptation. The differences are dramatic among cultivers of these two species in turfgrass performance during seasonal stresses.

I hope you can see the value in supporting our turfgrasss research. The industry, as it exists today, is the result of its teamwork with university research through the 20th century.

Accomplishments of Twenty Years of Research on Patch Diseases of Turfgrass!

Henry T. Wilkinson and Randall T. Kane

Introduction

For the past twenty years Hank Wilkinson and Randy Kane, along with the help of many students and staff at the University of Illinois, have studied patch diseases of turfgrass. Much has been accomplished during that time. It is important to recall what the state of knowledge was concerning patch diseases twenty years ago. It is only then that the accomplishments the turfgrass industry is using today can be fully appreciated.

Patch Diseases 20 Years Ago

In the early 1980s there was only one true patch disease described correctly. That was take-all patch, a disease of bentgrass, and it was originally identified in Washington State by Professor Roy Goss. It had also been described in England on bentgrass, and on wheat and other cereal grasses world-wide. Both Randy and I studied take-all disease on wheat in graduate school, prior to coming to Illinois. At this time, there was a disease of Kentucky bluegrass that was causing havoc from coast to coast in the United States. It was characterized by a "frog-eye" appearance in a turf. Prior to the 1980's, no turfgrass pathologist suspected that this disease, which was incorrectly named "Fusarium blight," was a patch disease, and in many ways similar to take-all patch. In the mid-1980s this disease was re-named "summer patch," and the fungus that caused it was identified in Rhode Island as *Magnaporthe poae* (a newly discovered fungus). In the early 1980s, a disease similar to summer patch was also attacking Kentucky bluegrass in the more northern region of the United States. It was named "necrotic ring spot," and the fungus that caused it was identified as *Leptosphaeria korrae*. That was the state of knowledge concerning patch diseases in the early 1980's. Patch diseases were a major problem in Illinois then, and while they continue to be a serious threat, the research of the past 20 years has brought them under control. If you look over your shoulder at the past 10 years, you will see that there have been few serious outbreaks from patch diseases in Illinois. This is, in part, due to our research accomplishments.

New Patch Disease Identification in Illinois

We have discovered 11 new diseases, including 7 patch diseases, during the past 20 years (Table 1.). The most significant of these are summer patch, take-all patch and necrotic ring spot. In addition, we determined and proved that the fungus that causes summer patch will attack both Kentucky bluegrass and annual bluegrass. This discovery led us to determine the impact of soil temperature on summer patch (see **Rapid Identification of Patch Diseases** below). The first step in studying a "new" disease is to determine what caused it. We invested a lot of years in determining what fungi cause the patch diseases in Illinois. Once this was known, we continued our research into determining what conditions predispose turf to patch diseases, and what cultural and chemical practices would effectively reduce disease severity. As we identified more and more patch diseases, we were asked to assist other states with patch problems. Consequently, we have identified centipedegrass take-all in Georgia; necrotic ring spot in Washington, Idaho and Montana; and Bermudagrass take-all in Missouri. Most recently, working with Dr. Andy Hamblin we have identified a new patch disease in Illinois, bentgrass dead spot. Will more patch diseases develop in Illinois? Probably, but thanks to the many supporters of our programs, we are ready to identify the diseases and develop management programs for them.

Table 1. Patch diseases of Illinois

Disease Name	Pathogen	Grasses Attacked
Summer Patch	*M. poae*	Kentucky bluegrass, Annual bluegrass
Take-all Patch	*G. graminis* var. *avenae*	Creeping bentgrass
Necrotic Ring Spot	*L. korrae*	Kentucky bluegrass
Bentgrass Dead Spot	*O. herpotricha*	Creeping bentgrass
Zoysia Patch	*G. incrustans*	Zoysiagrass
Spring Dead Spot	*G. graminis*. var. *graminis*	Bermudagrass
Zoysia root rot	G. graminis var. graminis	Zoysiagrass

Determining When Patch Disease Is Active Each Year

We have led the nation in the accurate prediction of patch disease development (Table 2.). Based on the activation temperatures, we developed a very effective program for using cultural practices and fungicides to manage both summer patch and take-all patch. The use of these temperatures for timing the application of fungicides has been the difference between success and failure.

Table 2. Turfgrass disease activation temperatures and infection sites.

Disease Name	Activation Temperature (°F)	Infection Site
Necrotic ring spot	45-61	roots
Summer patch	68-70	roots
Take-all patch	55-60	roots

Rapid Identification of Patch Diseases in Turf

We have the most experienced and effective program in the world for the identification of patch-causing fungi in turf. Additional to our expertise, Ms. Dianne Pedersen has 12 years of experience in diagnosing over 1,000 patch diseases. Further, we have developed very specialized tools to determine if your turf is affected with a patch disease and, if so, which fungus is causing it. For example, we have developed DNA tests that will rapidly determine if you have take-all patch. Similar tests are available for summer patch. Equally important, we have used DNA science to determine if there is more than one kind of summer patch or take-all patch in Illinois. The answer is yes, and we are now conducting more research to determine if these differences need to be considered in terms of managing patch diseases. We are very proud that we are a leader in patch disease expertise. Further, our diagnostic services have always been absolutely **FREE** for the Illinois turfgrass industry.

Identifying and Developing Plants Resistant to Patch Diseases

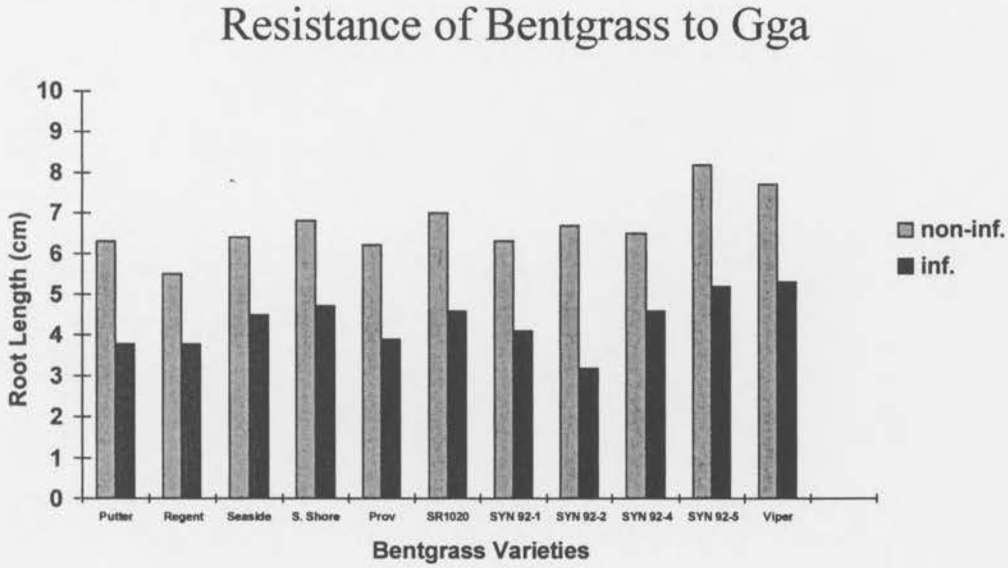
Cultural practices and good fungicide programs can go a long way in reducing the severity of patch diseases, but ultimately grasses with improved genetic resistance are needed. We started a program to improve turfgrass resistance over 10 years ago, and have made tremendous progress. We have evaluated over 5,000 different bluegrasses and bentgrasses for resistance to patch diseases in Illinois. We now have data that allows us to recommend which varieties are resistant and which are more susceptible. In addition, we have developed laboratory tests to determine if a new plant is resistant to patch disease, and subsequently we passed our technology on to plant breeders (Figures 1. and 2.). We developed a bluegrass plant with greater resistance to summer patch. Most recently, our efforts were rewarded by the University of Illinois when they recognized the importance of turfgrass breeding and hired Prof. A. Hamblin to breed better turfgrasses.

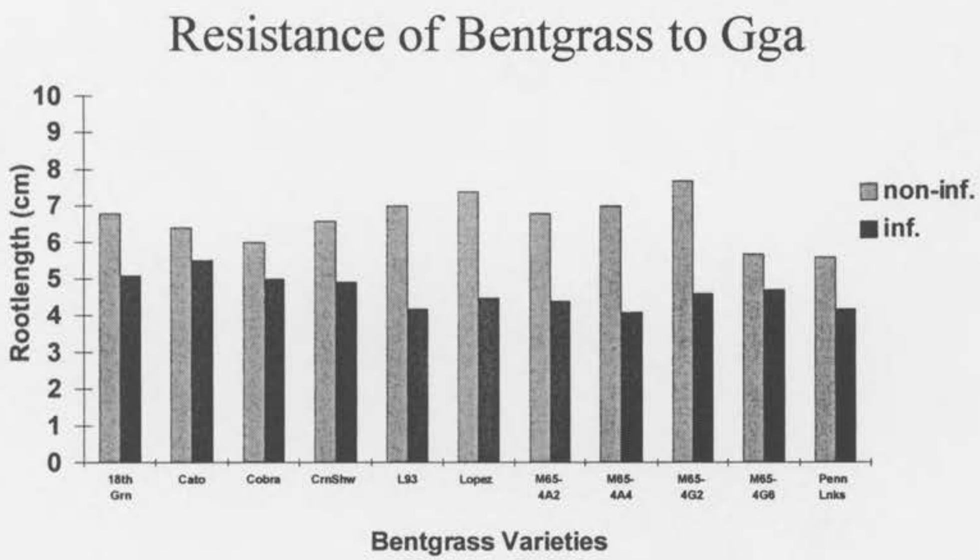
Factors That Predispose Turf to Patch Disease

Over the years, we have come to recognize 28 factors that affect both the development and severity of turfgrass diseases (Table 3.). The research that we do and the information we have gained from other scientists is organized according to these factors. For example, our research on summer patch in Kentucky bluegrass can be summarized in Table 4.0. You will notice that while we have learned a lot, we do not know everything: more research is necessary. In general, patch diseases start developing each season long before you see the disease. Soil temperature is the single, most important factor that determines when disease becomes active. The second most important factor is soil moisture. What we learned about soil moisture and patch diseases is this: they like it damp, but not saturated; infrequent watering that keeps only the top 1-2 inches of soil wet is ideal for severe disease development.

Poa Decline in Summer

Summer patch on annual bluegrass was a puzzle to us for a number of years. Originally, turfgrass pathologists described how annual bluegrass died in the summer from excessive heat. In our research we found that annual bluegrass would grow, even if the soil temperature reached 85° F. Further research told us that it was not just heat but summer patch that combined to defeat annual bluegrass in the summer. If annual





Figures. 1 and 2. Susceptibility of creeping bentgrass to Take-All

bluegrass is heavily infected in the spring and summer by the summer patch pathogen, and if the soil temperature is above 80° F for about 2 weeks, the annual bluegrass will die.

Fungicides for Managing Patch Diseases

We have spent 19 years testing and evaluating fungicides for their efficacy in reducing the severity of summer patch. This research convincingly explained why summer patch was mistakenly called Fusarium blight. When you see summer patch in July-September the grass is dead, and upon examination you often find it colonized by Fusarium fungi. However, pathologists could not reproduce summer patch symptoms

Table 3. Factors That Can Affect Turf Disease Management

1. Mowing
2. PGR (growth inhibitors)
3. Clippings
4. Top-dressing
5. Irrigation
6. Fertilization
7. Overseeding
8. Sodding
9. Herbicides
10. Shading
11. Surfactants
12. Nematicides
13. Aerification
14. Compaction
15. Soil reaction (pH)
16. Weeds
17. Mixtures
18. Blends
19. Drainage (runoff)
20. Organic amendments
21. Soil amendments
22. Biological agents (living)
23. Growth stimulators
24. Heat
25. Irradiation
26. Humidity (dew)
27. Air circulation (drying)
28. Fungicides

using just Fusarium fungi. The real cause of summer patch was discovered by the research of several university laboratories, including ours. Summer patch starts in the spring when the soil temperature is about 70° F. The fungus will infect and shorten the grass roots. Later in the season, the infected grass (with short roots) is stressed when the soil temperature increases: the short roots cannot absorb water fast enough to keep it cool. If the stress is too great the grass will die, but if the stress is not enough kill the grass, then Fusarium fungi will also attack the weakened, stressed grass and push it over the edge.

Like many other scientists, we found that a class of fungicides known as DMIs could be very effective if applied at the correct time and in the proper amount. It was our research that developed effective fungicide programs to control summer patch. These programs are available by contacting us.

Table 4. Factors that affect Summer Patch management

1. Mowing: <1.5 inches--more disease; > 3 inches--less disease
2. PGR (growth inhibitors)
3. Clippings
4. Top-dressing: can reduce disease severity
5. Irrigation: light water increases severity
6. Fertilization: overuse--more disease
7. Overseeding: ryegrass not susceptible
8. Sodding: till soil to reduce disease
9. Herbicides
10. Shading
11. Surfactants
12. Nematicides: some will reduce disease
13. Aerification: reduces disease severity
14. Compaction: can reduce disease severity
15. Soil reaction (pH): <5--less disease
16. Weeds
17. Mixtures: will reduce severity
18. Blends: some varieties more resistant
19. Drainage (runoff): good drainage--less disease
20. Organic amendments
21. Soil amendments
22. Biological agents (living): bacteria can reduce disease
23. Growth stimulators
24. Heat: 70 F--disease starts
25. Irradiation
26. Humidity (dew)
27. Air circulation (drying)
28. Fungicides: effective when used properly

Is More Patch Disease Research Needed?

Yes, we have made much progress in reducing the severity of patch diseases, but they still infect and weaken our turf. One thing we know for sure, even when you cannot see these diseases, they are attacking the turf. The main direction research needs to go is advanced genetic resistance. We have been researching how to develop genetic resistance to take-all patch for nearly 10 years. It is going to be a long and difficult fight, but victory will mean better turf.

2001 Research Update

Bruce Branham, Brian Horgan, Joe Meyer, and Amy Soli

Much progress was made on our research program during 2001. Graduate students are responsible for most of the research that is conducted in my program. Brian Horgan completed his PhD degree in May and accepted a position at the University of Minnesota as an assistant professor of turfgrass science with a research and extension appointment. Brian follows closely on the heels of David Gardner who completed his PhD degree in May of 2000 and is now an assistant professor at The Ohio State University. It is gratifying to see our graduates beginning their own programs at other excellent institutions. Amy Soli completed her postdoctoral program in late August and is now in New Jersey. Joe Meyer completed the field research portion of his MS program this summer and should complete his MS degree early in 2002. Joe's research has focused upon the use of ethofumesate (PROGRASS™) and, specifically, how to improve its efficacy in the field. The Illinois Turfgrass Foundation has supported Joe Meyer throughout his graduate program. We thank the ITF for their support. The results of his research are highlighted in this report.

Besides the work on ethofumesate, we have continued to study the use of dazomet (BASAMID™), and conducted two trials during 2001. Brian Horgan completed his work on denitrification. In addition, we conducted over 25 weed control and PGR trials during 2001. This report will highlight the results of those studies.

Ethofumesate Research

Ethofumesate has been widely used for control of annual bluegrass in golf course turf. Typically, ethofumesate is applied in the fall to control annual bluegrass over the winter. This approach has been quite variable both in terms of the degree of annual bluegrass control and the amount of injury sustained by the turf. We began experimenting with applications made in the spring and summer in 1997. This approach appears promising in that results seem more consistent, but rates of application need to be considerably higher than what is needed in the fall. We have also observed that rough bluegrass, Poa trivialis, is susceptible to single, high rate applications of ethofumesate. When comparing the two turfgrass species routinely used on golf course fairways to the two weedy bluegrass species, annual bluegrass and rough bluegrass, we see that creeping bentgrass is the most tolerant of single applications of ethofumesate, and rough bluegrass is the most sensitive (Table 1). These applications were made in mid-May.

When ethofumesate is applied at this time of year, it is apparent that Kentucky bluegrass (KB) is similar in sensitivity to ethofumesate as annual bluegrass and rough bluegrass. Rates of application above 3 lbs ai/A are currently not labeled by the manufacturer; however, should the label be changed, this would give turf managers an opportunity to control rough bluegrass in creeping bentgrass turf.

Table1. Tolerance of four grass species to single applications of ethofumesate at 42 days following treatment.

Ethofumesate Rate (lbs ai/A)	Creeping bentgrass	Kentucky bluegrass	Annual bluegrass	Rough Bluegrass
Control	8.3	9.0	6.0	7.7
3	8.5	9.0	8.0	7.7
6	8.7	8.8	6.3	6.7
9	8.3	6.2	7.0	4.7
12	8.8	5.0	4.0	4.0
15	7.0	3.2	3.3	3.3
18	5.7	2.7	3.7	2.0

Other research trials conducted by Joe Meyer for his MS degree include a KB cultivar sensitivity trial, a trial to determine the effect of spray volume on ethofumesate efficacy, and the effect of rainfall when it occurs just following an ethofumesate application.

We have consistently found that KB cultivars vary greatly in their sensitivity to herbicides. This is true for ethofumesate as well as other herbicides that have marginal safety on KB. We conducted a study to determine the effect of repeated applications of ethofumesate to control annual bluegrass in KB. Ethofumesate was applied at 3 lbs ai/A every 3 weeks beginning in mid-May and continuing until injury became too severe on some of the KB cultivars. This study showed that the cultivars varied significantly in their tolerance to ethofumesate. Some cultivars showed essentially no injury while others were severely injured. Based upon the injury observed, the cultivars were grouped into four categories (Table 2). If you are intending to use KB in an area with a history of annual bluegrass infestation, choosing cultivars from the tolerant or moderately tolerant classification will reduce injury potential should ethofumesate be used to control annual bluegrass.

Table 2. Kentucky bluegrass cultivar sensitivity to ethofumesate.

Tolerance classification	Kentucky bluegrass cultivars
Very susceptible	Limuosine, Total Eclipse, Northstar
Moderately susceptible	Rambo, Explorer, Ram 1, ZPS 309
Moderately tolerant	Rugby II, Absolute, Wildwood, SR 2000
Tolerant	SR 2109, Moonlight, Liberator, America, Odyssey

Dazomet Studies

There are several reasons to consider renovating a golf course green, tee, or fairway area. Often, poor quality turf is cited as a primary reason. The poor turf quality usually is related to two problems. First, older, poorer performing cultivars are often present, but secondly, annual bluegrass is almost always a significant weed problem. Many golf turf managers have tried to renovate fairways by using ROUNDUP™ to kill all the existing vegetation and then reseeding with improved cultivars of the desired turf species. This approach yields less than satisfactory results because annual bluegrass seed in the soil always reinfests the area during the establishment phase. The golf turf manager who struggles to manage annual bluegrass finds that following a ROUNDUP renovation; the annual bluegrass problem is still there. Another approach is to sterilize the soil in order to kill most of the annual bluegrass seed bank and establish a nearly pure stand of the desired turf species.

Several options exist for soil sterilization, but one that is particularly suited to use on golf course fairways is dazomet (BASAMID™). Dazomet is a granular product that can be applied with a drop spreader and then breaks down in soil to form a gas, methyl isothiocyanate or MITC, that is the toxic agent. The application can be covered with a tarp to hold the gas in the soil, or irrigation can be used to provide a water seal without a tarp. It is the water seal method that makes the use of dazomet attractive for golf turf managers.

We have conducted four studies over the past two years to better understand how to use this product under turf conditions. This past year we conducted one trial in mid-May and a second trial in early September. Both trials contained two separate experiments, one that tried to determine the best rate of dazomet to use and a second that used a constant rate of dazomet but varied how the soil was prepared for the application. Following the applications, bentgrass was seeded into the plots at 0,1, 3, 5, 7, or 9 days following dazomet application. At 7 days after dazomet was applied, two 4" cores were collected from each plot for analysis of viable annual bluegrass seeds remaining in the soil following treatment. To analyze these samples, they were first sectioned into 0-1, 1-2, and 2-3 cm depths. The soil sections were then dried in a forced air-drying oven, roughly ground with a meat grinder to a coarse powder, and placed in the greenhouse in a flat on top of a layer of sterilized soil. These flats were then put under mist irrigation for 21 days and the number of annual bluegrass seedlings that germinated at the end of 21 days were counted as estimates of viable annual bluegrass seeds remaining.

We are still analyzing the results of these studies but some information is available. When these experiments were started in 2000, we seeded bentgrass at 5, 7, or 9 days after dazomet application. We expected to observe some injury to bentgrass seedlings at the 5 day after application seeding date. However, these were not only not injured, they gave the best bentgrass establishment. At each subsequent trial we moved our seeding date closer to the time of dazomet application. In May of 2001, we seeded at 1, 3, 5, 7 or 9 days after dazomet application. Much to our amazement, the 1-day after application seeding established well and showed no significant injury from the dazomet. In September of 2001, we seeded the plots on the same day we applied the dazomet. Much to our surprise, the seed that was planted on the day we applied the dazomet still established with little injury (Table 3). These readings were taken approximately 4 weeks following seeding, so the reason the 0 and 1 day have better establishment is that they have simply had another week to grow than the 7 and 9 day seeding treatments. The remarkable point to draw from this is that even when seeding at the time of the dazomet application, the dazomet is not killing all of the bentgrass seeds, in fact, it appears that very few of the bentgrass seeds were actually killed by the dazomet.

What is the dazomet doing to annual bluegrass seed? The data in table 4 show the number of viable annual bluegrass seeds determined in our greenhouse test and then the percent control achieved based upon the amount of annual bluegrass seed germinating in

Table 3. Effect of dazomet on creeping bentgrass establishment. Bentgrass was seeded into the plots at various days after dazomet application.

Number of Days after Basamid Application	% Bentgrass Establishment 10/18/01
0	54
1	66
3	58
5	43
7	35
9	36

the plots that received no dazomet. The May experiment have been analyzed and these results show good but not excellent control of annual bluegrass seeds (Table 4).

Table 4. Effect of dazomet rate on annual bluegrass seed bank in the soil.

Rate (lbs/A)	Viable Poa seeds/sample	% Control
0	70	0
150	50	29
225	58	17
300	30	57
375	13	81
450	20	71

What does this mean? It emphasizes the fact that research often seems to raise more questions than it answers. However, dazomet treatment clearly reduces the number of viable annual bluegrass seeds in the soil, and this translates into less annual bluegrass establishing along with the creeping bentgrass. Why does dazomet not control creeping bentgrass when the bentgrass is seeded at the same time as the dazomet is applied? This is a mystery , but it may be related to the level of dormancy of seeds. Perhaps dazomet only controls seeds that are respiring and ready to germinate. In this sense, dazomet may act more as an agent that stuns the seeds in the soil rather than completely eliminating them. It may destroy all of the annual bluegrass seed that is capable of germinating immediately, but doesn't control the more deeply dormant seed that would not be able to germinate. Using dazomet may create a window of opportunity where the turf seed that is planted has an opportunity to germinate and establish without any competition from annual bluegrass. Further research will be necessary to answer these questions.

Thanks!

I want to personally thank the Illinois Turfgrass Foundation and its membership for supporting our research and educational programs. We could not accomplish what we have without your support. We look forward to continuing to grow our program and to earn your support in 2002.

UI Turfgrass Breeding and Genetics

Andy Hamblin

Gray Leaf Spot Research
Hofmann, N.E. and Hamblin, A.M.

The goals of our research have been:

- To identify commercial varieties with resistance to gray leaf spot.
- To find new sources of resistance in the USDA perennial ryegrass germplasm collection.
- To identify how resistance is inherited in perennial ryegrass and tall fescue.
- To find DNA markers associated with resistance to disease.

We have found this disease to be problematic to work with. The production of spores was a major obstacle. This fungus is also very adaptable and we are concerned that mutation and recombination have occurred through the process of culturing the fungus on artificial media. In addition, the disease follows very specific environmental conditions making disease occurrence unpredictable. Despite these obstacles, we feel we have made considerable progress in our research. Most of our results lend more to germplasm development, which affects breeders more directly than seed purchasers. However, this research builds our knowledge of this disease so that more efficient breeding for resistance can be possible.

Results You Can Use

Some of the most resistant perennial ryegrass varieties identified in our 2000 gray leaf spot field trials:

Pick F3	Palmer III	SR 4330
SR 4200	Brightstar II	Sunshine
Morningstar	Roadrunner	Calypso II
Racer	Secretariat	

*These results are published in Biological and Cultural Tests 2001, Volume 16.

Shifts in Varietal Composition of Kentucky Bluegrass Blends
Lickfeldt, D.W., Jones, J., Voigt, T., and Hamblin, A.M.

The goals of this research were:

- Identify DNA markers associated with Kentucky bluegrass varieties.
- Determine the varietal composition of Kentucky bluegrass blends on a golf course fairway.
- Describe the spatial patterns of varieties on a golf course fairway.

The identification of RAPD-DNA markers associated with specific Kentucky bluegrass varieties was a fairly straightforward process. We were able to identify these markers and found them to be highly reproducible. We were also able to describe this repeatability along with cost factors associated with various methods of DNA isolation. Using these methods, were able to distinguish between specific varieties that are commonly used as blends on golf course fairways. We obtained many samples using ecological procedures from two golf course fairways in Bourbonnais and Rockford, IL. We sampled both locations over two years. We found that *Unique* increased in overall percentage from what was originally planted, *Blacksburg* decreased, and *Midnight* stayed the same. In addition, the distribution of these varieties was fairly random, as opposed to being either random or clumped. This makes sense considering turfgrass ecology. It is not clear what factors caused the shifts in these varieties. It is likely that plant vigor, root and rhizome development, tillering, nutrient uptake, disease resistance, stress resistance, etc., all play active roles in this phenomenon.

Results You Can Use

Blends may not be as useful as previously thought. With the development of superior turfgrass genetics, it is quite possible that we can use the best variety rather than diluting a good variety with several less superior ones. We found *Unique* Kentucky bluegrass to be a good example of a variety that will likely do best in monoculture.

Ongoing Research

Effects of disease on Kentucky bluegrass blends
Simmons, K. and Hamblin, A.M.

Some of the questions we are asking about Kentucky bluegrass blends:

- What percentage of a resistant variety in a blend is required to give the best results?
- How much of a barrier does a resistant variety in a blend provide against movement by root-infecting pathogens?
- Does the composition of a variety change after continuous infection by Pythium leaf blight?

Genetic diversity of ornamental switch grass
Jones, J., Voigt, T., and Hamblin, A.M.

Some of the questions we are asking about ornamental switch grass:

- Are currently available ornamental switch grasses genetically diverse based on DNA fingerprinting?
- How does the diversity of ornamental switch grasses compare to forage types?
- Are the *Heavy Metal* varieties purchased from different vendors genetically identical?

We feel that these questions are important to consumers. When you go to the store to purchase grasses, we would hope that these products are really as they are labeled. Unfortunately, this is not a highly regulated process.

Effects of watering on quality and color in turfgrass species
Hamblin, A.M.

This study is primarily focused on comparing the effects of water on Texas bluegrass hybrids. Texas bluegrass is being compared with Kentucky bluegrass, perennial ryegrass, hard fescue, and tall fescue. We evaluated quality and color over 8 weeks under various water treatments: no water, 4" water per month, and 8" water per month. We also evaluated plots under natural conditions. These data are still being analyzed. Preliminary observations indicate that Texas bluegrass has comparable ability under drought conditions compared to other cool-season turfgrasses. In other research, it has been shown that Texas bluegrass has excellent drought resistance in the Southern U.S.

Inheritance of brown patch resistance
Simmons, K. and Hamblin, A.M.

Inheritance of dollar spot resistance
Hamblin, A.M.

Interseeding success of creeping bentgrass in golf course greens
Hamblin, A.M.

Race development of *Pyricularia grisea* causing gray leaf spot on perennial ryegrass
Hamblin, A.M., Hofmann, N.E., and Farman, M.

Breeding Kentucky bluegrass and creeping bentgrass for Illinois
Hamblin, A.M.

Breeding native and other grasses for Illinois
Hamblin, A.M.

-includes perennial ryegrass, switch grass, big bluestem, blue fescue, velvet bentgrass, and meadow fescue.

Acknowledgements of Industry Support

AgriLife Products, Inc.
American Sod Corporation
Aquatrols
Aspen Ridge Golf Course
Aventis
BASF Corp.
Barenbrug USA
Bayer Corp.
Beaver Run Sod Farm
Belleville Seed House
Bladerunner Farms, Inc.
CEBECO International Seeds, Inc.
Cantigny Golf Club
Carillon Golf Club L.L.C.
Central Illinois Golf Course Superintendents Association
Central Sod Farms, Inc.
Century Rain Aid
Chicago Botanic Gardens
Chicago District Golf Association
Club Car, Inc.
Coon Creek Sod Farms
Country Supply, Inc.
Cushman-Ryan
DFL Trifolium
Desert King International
Dow Agri Sciences
Dunteman Turf Farms
E-Z Go
Eagle Ridge Resort
Eco-Green Technologies, Inc.
Eco Soils
Effingham Country Club
Emerald View Turf Farm
Evergreen Sod Farm, Inc.
Forbes Seed Co.
Foxcroft Meadows, Inc.
Golf Course Superintendents Association of America
Golf Links, Inc.
Grassland Oregon
Green View Nursery, Inc.
Greener Gardens Sod Farm
Grieder Sod Farm
Griffin Industries
H & E Sod Nursery, Inc.
Helena Chemical Company
Hickory Ridge Golf Course
D.A. Hoerr & Sons, Inc.
Huber Ranch Sod Nursery, Inc.
Hunter Irrigation
Illinois Council for Food and Agricultural Research
Illinois Department of Commerce and Community Affairs
Illinois Lawn Equipment, Inc.
Illinois Turfgrass Foundation
Jackson Country Club
Jacobsen Div. Textron Co.
John Deere Co.
Kellogg, Inc. Seed & Supplies
Lange-Stegmann, Co.
LESCO Inc.
Lebanon Chemical Corp.
Legacy by Hunter
Lewis Seed Co.
Lincolnshire Fields Country Club

Medalist America
Mid America Sod Producers Association
Midwest Association of Golf Course Superintendents
Modern Equipment
Monsanto Co.
Morton Arboretum
Mueller Farms Sod Nursery, Inc.
Mueller Mist Irrigation
National Grass Variety Review Board
National Turfgrass Evaluation Program
North Shore Country Club
Northwest Illinois Golf Course
Superintendents Assoc.
O.M. Scott & Sons Co.
Olympia Fields Country Club
PBI Gordon
Pickseed West, Inc.
Piper Glen Golf Courses
Pontiac Elks Club
Professional Turf Specialties, Inc.
Profile Products, Inc.
Purdue University Turf Program
Pure Seed Testing, Inc.
Quality Turf
Red Hen Turf Farm, Inc.
Riverside Golf Club
Rohm & Haas Company
St. Charles Country Club
Schaafsma Sod Farm
Schneider Turf Farm
Seed Research of Oregon, Inc.
Southern Illinois University College of Agriculture
Southern Illinois Golf Course Superintendents Association
Spraying Systems Co.
Stone Creek Golf Course
Summit Seed Company
Syngenta Corporation
Tee-2-Green Corp.
Terra International
Toro Co.
Trident Environmental Service
Turf Merchants, Inc.
Turf Producers International
Turf-Seed Inc.
U. of I., College of Agriculture Experiment Station
U. of I., College of Agriculture Extension
U. of I., Div. of Campus Recreation
Wiesbrock Turf Farms
Wisconsin Sod Producer Association
Woodridge Sod Farm

Personnel

University of Illinois

Dr. Bruce Branham
Luke Cella
Dr. Tom Fermanian
Azza Fouly
Dr. Hanafy Fouly
Chris Hamb
Dr. Andy Hamblin
Chris Henning
Shelby Henning
Nicolle Hofmann
Brian Horgan
Daryl Huffstutler
Hye-Yun Jeong Joyce Jones
James Liang
Darin Lickfeldt
Joe Meyer Kara Meyer
Siddhartha Narra
Dr. Phil Nixon
Dianne Pedersen
Carol Preston
Mark Schmidt
Sam Schmitz
Karen Simmons
Corey Spitzer
John Tallarico Dr. Tom Voigt
Ryan Welch
Dr. Henry Wilkinson
Theresa Wilkinson
Jim Wilsey
Matthew Wong
Suzi Zarlengo

Southern Illinois University

Zachary Anderson
Phil Bliler
Doug Bogard
Richard Boniak
Jeremy Clark
Dr. She-Kong Chong
Mike Cox
Dr. Kenneth Diesburg
Lynn Diesburg
Jarrett Nehring
Denise Pingel
Paul Pinnon
Dianna Reusch
Brandon Smith

2002 Illinois Turfgrass Calendar of Events

2002 Indiana-Illinois Turfgrass Short Course... February 25 – March 1, 2002

2002 Turfgrass and Landscape Field Day............................August 1, 2002

2002 North Central Turfgrass Exposition.................. December 3 - 5, 2002

For information about these events, or to obtain additional copies of this report, contact:

Tom Voigt, Extension Turfgrass Specialist
Department of Natural Resources and Environmental Sciences
University of Illinois
1102 South Goodwin Avenue
Urbana, IL 61801
Telephone: 217-333-7847
Fax: 217-244-3219
email: t-voigt@uiuc.edu

Websites from your University of Illinois Turf Program

University of Illinois
Turfgrass Program

http://www.turf.uiuc.edu/

Turfgrasses for the Midwest
TOM VOIGT & LUKE CELLA
ILLUSTRATIONS BY FLOYD GILES

http://www.turf.uiuc.edu/NCR-192/turf_midwest

Midwestern Turfgrass Weed Identification and Control

http://www.turf.uiuc.edu/weed_web/

InteractiveTurf.com
YOUR SITE FOR MODERN TURFGRASS PEST MANAGEMENT

http://www.interactiveturf.com

THE MIDWEST SOD COUNCIL

http://www.midwestsodcouncil.com/