CORNELL UNIVERSITY TURFGRASS TIMES

CUTT

Spring 2001 • Volume 12 • Number 1

Michael G. Villani Remembered

Noted turfgrass scientist Michael G. Villani, 48, died on Tuesday, May 15, 2001 at home following a lengthy illness with pancreatic cancer. He was a professor of entomology at Cornell University's New York State Agricultural Experiment Station, Geneva and a longtime contributor to CUTT.

"We have lost not only a remarkable scientist but one of the finest human beings I've ever had the pleasure of knowing," said Dr. Wendell Roelofs, chair of the Station's department of entomology. "He was the epitome of what a person thinks of when they say a wonderful human being. He was revered by his coworkers, admired by fellow scientists throughout the world, adored by his many undergraduate and graduate students whom he taught, and loved and respected by all. He lived much too short a time, but while with us, he made contributions to science and society that will last forever," continued Roelofs.

Villani rarely thought of himself. He was the consummate teacher, advisor and mentor to all. He unselfishly devoted his time in questioning, cajoling, and inspiring others to think creatively and to develop their potential. He always shared the success of his highly acclaimed program on turf insects with his staff and with other scientists around the country. "He gave far more than he got in return," commented Rick Brandenburg, professor of entomology at North Carolina State University, who recently presented Mike with the Outstanding Service Award of the Turfgrass Council of North Carolina.

Even more important than what he accomplished during his career with turf insects, was the relationship he had with his wife, Connie, and two daughters, Sara and Kate. Just as he knew the right questions to ask in his scientific endeavors and was able to instill a tremendous sense of pride in his coworkers, he was also a loving and devoted husband and father who always gently challenged his family to do their very best in whatever they are involved.

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This Times

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CUTT

Clippings

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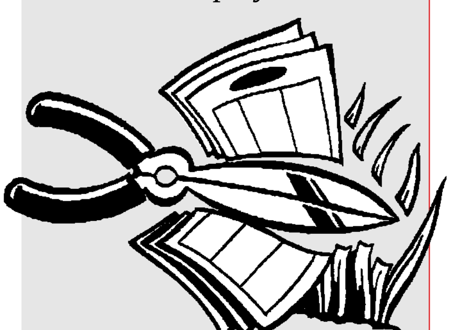
On Tuesday August 21, 2001, green industry professionals will not only benefit from viewing the latest in golf, sports and lawn turf research, but this year the landscape horticulture research with woody plants and herbaceous perennials will also be on display.



How Much are We Worth?

Have you ever stopped to consider the economic impact of the New York State turfgrass industry? You might be surprised to learn that there is very little current information available on the economic impact of the turf industry. Economic estimates from a 1977 survey ranged from $313 million to $595 million for total maintenance expenditures.

Several states throughout the US (IA, WI, VA) have been attempting to determine the economic contributions of the turfgrass industry. Recently, the state of Virginia Agricultural Statistic Service in partnership with the Virginia Turfgrass Council reported a 400% increase in maintenance expenditures from 1982 to 1998 that exceeded $1.5 billion. This exceeded the combined cash receipts of all major agricultural commodities combined! Furthermore, in Virginia a state barely 20% the size of NY, the industry created over 390,000 jobs with an annual payroll of $700 million. Clearly, a comparable analysis of the turfgrass industry in NY would fulfill a need to evaluate and assess the magnitude and economic potential of this important service sector industry.

The importance of this survey cannot be overestimated. For example, in North Carolina, when the Turf Council of NC took the results of their survey to the state legislature, they immediately appropriated $250,000 to support turfgrass efforts at NC State University and then in 1998 doubled that amount to $500,000. Can you imagine the type of applied research and educational programs we could accomplish with that type of support?

The New York State Turfgrass Association has provided the leadership for this project and has been advocating the need for this type of survey. The NYSTA Board has indicated that there are some state dollars committed. This state support combined with industry donations means that over the next 12–18 months we will be able to tout the economic successes of the turfgrass industry in NY. Stay tuned because we will be asking for your help in getting the information.

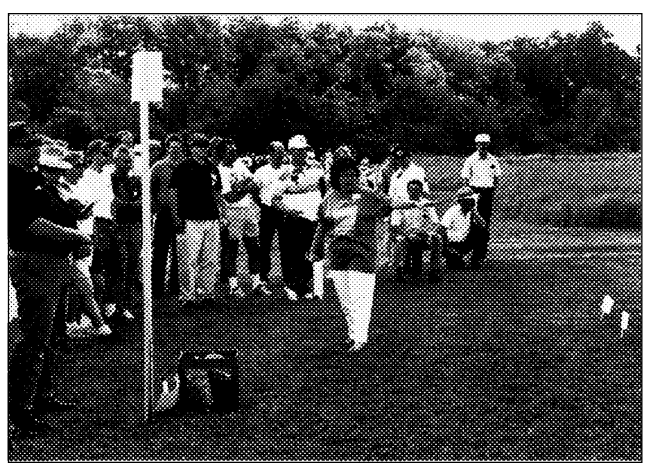
Field Day Expands!

The 2001 Cornell Turfgrass Field Day will become the 2001 Cornell Turfgrass and Landscape Field Day. On Tuesday August 21, 2001, green industry professionals will not only benefit from viewing the latest in golf, sports and lawn turf research, but this year the landscape horticulture research with woody plants and herbaceous perennials will also be on display.

We expect this to be a full day of education and fun as we continue the traditions of the Field Day Trade Show, Awarding of Gifts, and the Research Tour. Now there will be a 9-hole golf challenge, tours of Tree City USA (Ithaca, NY), and tour of the Cornell Plantations.

Registration information will be sent in June, so keep an eye out for this exciting opportunity to the finest turfgrass and landscape research in the Northeast. For more information, contact Joann Gruttadaurio at (607) 255-1792 or jg17@cornell.edu.

Cornell Field Days: Top, Frank Rossi points out characteristics of bluegrass cultivars. Bottom, Joanne Gruttadaurio leads a session.



Scanning the Journals

Mixed Turf Reduces Insect Injury

Endophytic turfgrasses that harbor fungal organisms and impart insect resistance have been an important aspect of IPM programs to reduce surface insect damage. The relationship between the plant and the fungi results in formation of chemicals that deter and in some cases kill insects that feed on turfgrass shoots. These insect pests include chinch bugs, sod webworm, and bluegrass billbug. However, if you do not have an existing population of these grasses in your turf, will overseeding with them provide protection?

Researchers at Ohio State University investigated the influence of overseeding endophyte enhanced perennial ryegrass into existing stands of Kentucky bluegrass on populations of bluegrass billbug. Two seed rates (1 or 2 pounds per 1000 sq. ft.) of a 95% endophyte infected variety (Repell II) or a commercial blend of ryegrass varieties (Triple Play) that was 63% endophyte infected.

One unexpected result was the apparent discrepancy between stated endophyte infection level and actual infection level determined in the lab prior to seeding, i.e. in every case infection level was less than labeled. In addition, there were no discernible differences between seeding rates. In general, bluegrass billbug populations were reduced when there was at least 35% endophyte enhanced perennial ryegrass in the stand. Ryegrass populations greater than 35% did not reflect any further reduction in bluegrass billbug damage.

This study demonstrates the importance of applying an integrated approach to insect management. However, there were a number of varietal characteristics other than endophytes that researchers indicated were involved in the billbug population shifts. There is much to be learned about the inherent potential of the turfgrass varieties on the market.

From: Richmond, D.S., H.D. Niemczyyk, and D.J. Shetlar. 2000. Overseeding endophytic perennial ryegrass into stands of Kentucky bluegrass to manage bluegrass billbug. J. Economic Entomology, 93:1662-1668.

Primo and Supina Bluegrass in Shade

Increased interest in developing covered stadia with natural turf has spawned a new generation of research on the influence of low light on turfgrass performance. Specifically, the critical questions are how much useful light will reach the turf, do turfgrasses differ in their performance under traffic, and are there management practices that can enhance performance.

Michigan State University and the University of Wisconsin-Madison have conducted the lion share of research in this area with their specialized facilities and expertise. Drs. Stier and Rogers investigated the performance of Supina bluegrass and Kentucky bluegrass under light levels experienced inside stadia such as the Pontiac Silverdome. Traffic treatments were imposed and the effect of Trinexepac-ethyl (Primo) was evaluated.

Under trafficked conditions, Supina bluegrass treated with Primo at 0.05 oz. per 1000 square feet provided acceptable turf quality for up to 5 weeks. Kentucky bluegrass treated with Primo remained acceptable for only 2 weeks during the study. The Kentucky bluegrass plots experienced a severe infestation of powdery mildew that significantly limited performance throughout the study.

Clearly the light levels in this study would be considered extremely low. However, the performance of Supina bluegrass under these hostile conditions indicates the potential for this species to be used in other heavilly trafficked shaded environments, such as golf tees. Also, it appears that the use of Primo enhances the performance of Supina bluegrass under low light.

From: J.C. Stier and J.N. Rogers III. Trinexepac-ethyl and iron effects on supina and Kentucky bluegrasses under low irradiance. Crop Sci. 41:457-465.

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Villani Remembered

continued from page 1

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The Beginning

Born in San Antonio, TX, Villani was awarded his bachelor of arts degree from the State University of New York Stony Brook magna cum laude in 1979 and his doctorate degree in entomology in 1984 from North Carolina State University, Raleigh. He also attended Hobart College for two years as an undergraduate and was active in its lacrosse program.

Villani came to the Geneva Experiment Station in 1985 as an assistant professor of entomology. He was promoted to associate professor in 1991 and to full professor in 1999. His specialty was soil and turf insect ecology.

Professional Achievements

Mike's principal professional interests were in the area of the interrelationships between turfgrass insects and the soil environment. His projects on soil insects placed Geneva in the worldwide limelight as the center of excellence for this type research. Highly regarded as a practicing entomologist, Villani developed a unique radiographic technique to study the behavior of soil insects. His research included the impact of soil heterogeneity on insect behavioral patterns. This included the study of predatory/prey and pathogen/host interactions with the soil. Additionally, he intensively studied and made recommendations regarding the use of Integrated Pest Management (IPM) strategies for controlling insects. Among these strategies were the impact of soil physical properties on chemical and microbial insecticides, use of pheromones in grub monitoring and management, use of fungal pathogens, and the use of nematodes to help control turf insects.

Villani served as coauthor with Dr. Haruo Tashiro, professor emeritus of entomology at Geneva, on a revision of Tashiro's book on Turfgrass Insects of the United States and Canada. Also a coauthor on the revised book was Patricia J. Vittum, associate professor of entomology at the University of Massachusetts. This book was considered "the bible" of the turfgrass industry and is the manual of choice among golf courses from Pebble Beach to Silver Creek.

Awards and Honors

During his career, the distinguished scientist received numerous awards and honors. In addition to the Outstanding Service Award from the Turfgrass Council of North Carolina in January 2001, he received a Citation of Merit (their highest award) from the New York State Turfgrass Association in 1999, the National Recognition Award in Urban Entomology from the Entomological Society of America in 1997, the Distinguished Achievement Award in Urban Entomology from the Eastern Branch of the Entomological Society, and several others.

He was a member of the Entomological Society of America and the International Turfgrass Society, served on the scientific and technical advisory boards of Earthgro Composting and Turfgrass Trends Digest. He was coeditor of Environmental Entomology and served on numerous committees both within the College of Agriculture and Life Sciences at Cornell University and nationally.

Villani spent 20 percent of his time on extension-related activities. In doing so, he had many outreach programs on the national scene. He and his highly dedicated staff also spent numerous hours working with elementary students in the City of Geneva teaching them about the exciting science of insects.

Locally and Personally

Mike also served in the Community as a coach for Geneva's Little League softball Programs, a consultant with Geneva City officials on lawn care and the beautification of Geneva, and as a member of the Greens' Committee at the Geneva Country Club.

Villani is survived by his wife, Connie; two daughters, Sara (18) and Kate (14); his parents, Salvatore and Concetta Villani, East Meadow, NY; a sister, Susan (Tom) Capasso, East Meadow, NY; two brothers, Thomas (Elizabeth), Point Lookout, NY, and John (Gilda), Durham, NC; niece Marie Capasso, nephews Andrew Capasso and Christopher Rodriquez Villani; and several aunts, uncles, and cousins.

A memorial service will be held on Sunday, June 3, 1:00 PM, at the New York State Agricultural Experiment Station, Jordan Hall, North Street in Geneva, NY. Memorial contributions in Villani's name may be made to: Geneva High School Girls Soccer & Softball Programs; The Mike Villani Graduate Student Research Fund in Entomology (checks made to Cornell University; mailed to The Mike Villani Fund, Cornell University, Development Office, 272 Roberts Hall, Ithaca, NY 14853), or to the Finger Lakes Community Cancer Center.

Linda McCandless, NYSAES

Michael G. Villani
1953—2001

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The Mike Villani Graduate Student Research Fund in Entomology at Cornell University;

or to the Finger Lakes Community Cancer Center.

What Are Those Microbes?

A Healthy Ecosystem

In turfgrass management, soil health issues are becoming more important as managers are forced to manage turf under less-than-ideal agronomic practices.

Ideally, the analysis of soil and rhizosphere microbial communities should involve not only determinations of microbial biomass and diversity, but also determinations of microbial growth, distribution, function, and the nature of interactions among species.

Microbial characteristics of soils and plant rhizospheres (where plant roots grow), are being viewed increasingly as sensitive indicators of soil health since there are clear beneficial relationships between microbial diversity, soil and plant quality, and ecosystem sustainability. In turfgrass management, soil health issues are becoming more important as managers are forced to manage turf under less-than-ideal agronomic practices. Furthermore, it is becoming more and more apparent that plant species and varieties strongly influence the types of microorganisms that predominate in the rhizosphere. Indirectly, therefore, turf varieties may also influence the microbiology surrounding soil health parameters.

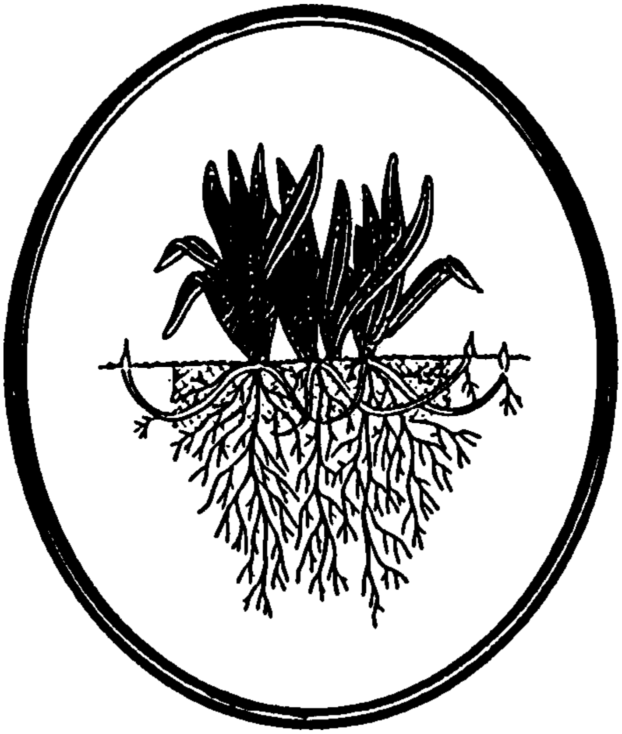
Most studies of soil and rhizosphere microbial properties have been conducted traditionally at relatively crude levels, in which biomass, respiration rates, and enzyme activities have been examined, with little attention given to specific community-level or organism-level responses. While these measurements provide important insights for understanding the role of microbial processes in soil health, they tell us little about specific qualitative and quantitative community-level changes since many microbial processes are shared among a diversity of organisms and they lack the specificity to describe a particular microbial ecosystem.

Since microbial community-level interactions in soils and rhizospheres are complex, with individual species relying on the presence and function of many other interacting species as well as the plant itself, changes in the structure of rhizosphere microbial communities can serve as important and sensitive indicators of both short and long-term changes in soil and plant health. Ideally, the analysis of soil and rhizosphere microbial communities should involve not only determinations of microbial biomass and diversity, but also determinations of microbial growth, distribution, function, and the nature of interactions among species.

As straightforward as soil microbial community analyses may seem, two of the long-standing challenges in soil microbiology continue to be the development of effective methods for determining which microorganisms are present in a given habitat such as soil or the rhizosphere, and determining the function(s) of these microorganisms in the field. These problems have been made worse by a number of technical difficulties including the problems separating microorganisms from the soil matrix and from plant tissues, the morphological similarities among many organisms found in soils and plant rhizospheres, and changing microbial taxonomies. Furthermore, the microscopic nature of these important organisms has made direct visualization more difficult than with other biological components of a turfgrass ecosystem.

Traditionally, the analysis of soil or rhizosphere microbial communities has relied on culturing techniques using a variety of culture media designed to maximize the recovery of different microbial populations. This is particularly the case for the limited studies in turfgrass soils. In many contemporary studies of soil microbial communities, these techniques have uncovered new microorganisms associated with various soil quality parameters. Although there have been recent attempts to devise suites of culture media to maximize the recovery of diverse microbial groups from soils, it has been estimated that less than 0.1% of the microorganisms found in soils are culturable using current culture media formulations. This is based on comparisons between direct microscopic counts and microbial populations recovered on conventional culture media. Therefore, for studies of the composition of natural microbial communities such as those found in turfgrass soils and rhizospheres, culture techniques, used alone, are generally inadequate. A combination of both culture-dependent and culture-independent approaches are now widely accepted as the best approach to microbial community analysis.

Because of the inherent limitations of culture-based methods of community analysis, soil microbial ecologists are turning increasingly to culture-independent methods of analysis. Using culture-independent methods, the structure of communities can be inferred based on 1) the



extraction and analysis of DNA molecules from soil that are specific to certain microorganisms or microbial groups, or 2) advanced microscopic techniques. In the past 5 years, revolutionary changes have occurred in the development of culture-independent approaches for the analysis of soil and rhizosphere microbial communities. A variety of new molecular methods and approaches are now available, allowing soil microbiologists to gain access to more of the microorganisms residing in soil and plant rhizospheres and allowing for better assessments of microbial diversity in these habitats.

Research Objectives

The overall goal of our research program is to understand the nature of microbial communities in turfgrass soils. Our work over the years has focused specifically on compost amendments for improving soil quality and soil health. We have focused on disease suppressiveness induced by compost amendments as an indicator of soil health since it is an easily observable response with which we can correlate qualitative and quantitative microbiological changes. It is possible that microbial communities from both high quality and low quality soils may share many common taxa, making quantitative aspect of specific populations important in soil health. However, it is also likely that there are unique populations associated with healthy soils that cannot be found in low quality soils making qualitative microbial characteristics more important.

Our current research focuses on bacterial components of the microbial community since relationships between bacterial activities and soil health have already been established. A specific goal of our research will be to determine whether there are specific bacteria that can be correlated with healthy soils and whether quantitative relationships among predominant organisms can also explain overall reductions in disease incidence and severity in these soils.

Expected Results

We have designed a series of studies to ask questions concerning the nature of bacterial communities in healthy and non-healthy turfgrass soils. Our approach for assessing microbial community composition will allow us to identify many culturable and non-culturable microorganisms that have previously not been studied in turfgrass microbiology. Our results will provide significant new information on the bacteria associated with soil health parameters.

Despite many limitations, our research represents a novel approach to study the microbiology of turfgrass soils. We expect to find bacteria in these soils that have never been described or studied before. We also expect to identify potential associations among organisms that will serve as a guide for future experiments aimed at more carefully defining important relationships among populations of bacteria in healthy and non-healthy soils.

Eric B. Nelson

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The Lawn Reader

New Resource for Turfgrass Sleuths!

Turfgrass Problems: Picture Clues and Management Options
Eva Gussack and Frank S. Rossi, Ph.D.
Natural Resource, Agriculture and Engineering Service, Ithaca, NY
ISBN: 0-935817-62-X

In 1970, Norman J. Smith and John Cornman published "Picture Clues to Lawn Troubles" (see Figure 1). It was designed as a pocket guide to assist homeowners and commercial lawn care providers with photographs and description of common "lawn troubles" in an effort to improve diagnosis and problem solving.

Twelve years later, Marty Petrovic led the effort to revise the publication, doubling the number of problems addressed in "Picture Clues to Turfgrass Problems" (see Figure 2). The 1982 revision included many updated photographs and became an industry standard, selling over 12,000 copies over 17 years.

In 1999, Picture Clues supplies were low and the decision was made to revise the publication a third time. Eva Gussack, Extension Associate working in the Turfgrass Science Program at Cornell University with Dr. Frank Rossi began collecting new photographs and writing new text. The result is "Turfgrass Problems: Picture Clues and Management Options".

The new Turfgrass Problems is still a pocket guide, however, the authors tripled the number of problems that were addressed in the 1982 edition. The most significant improvement is the addition of several photographs for each problem from a distance and then close-up (see Figure 3). Also, each problem now has detailed written descriptions and cultural management options.

Entirely new sections have been added that address general problem solving skills such as scouting and monitoring for diseases and insects (see Figure 4). In fact, a unique approach that utilizes pest timelines has been developed as the gateway to problem solving (see Figure 5). For example, when a problem is observed, the first step is to review abiotic (nonliving) problems such as winterkill, thatch, shade, etc. (see Figure 6). Next, review the timelines for when certain problems are observed based on seasonal temperature patterns. The timelines then direct the reader to specific pages that contain "picture clues" and then descriptions of each problem. Once a proper diagnosis is made, then management options are available for solving the problem.

continued on page 10

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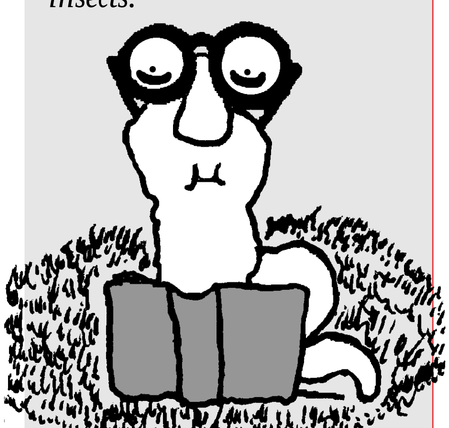


Figure 1

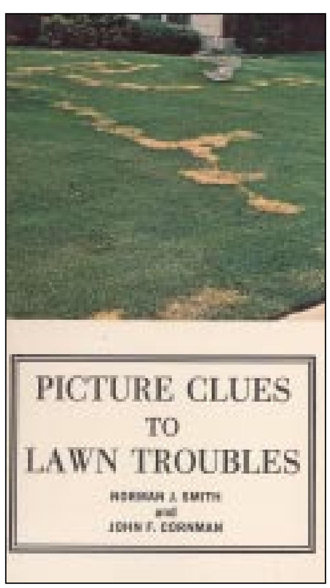


Figure 2

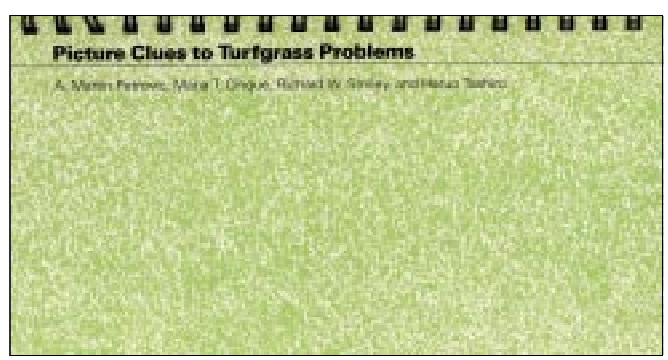
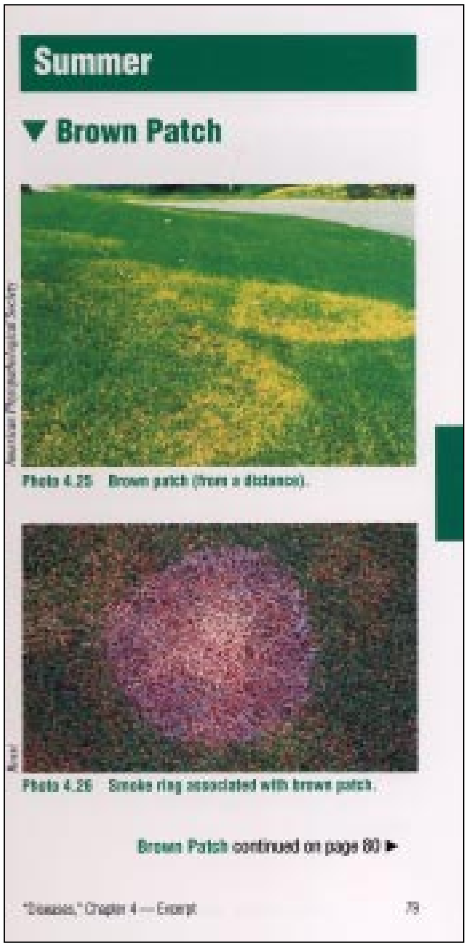


Figure 3



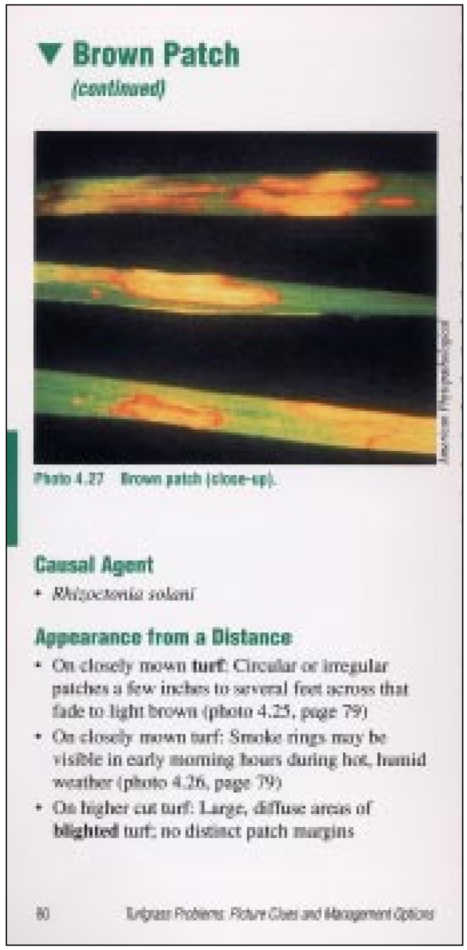
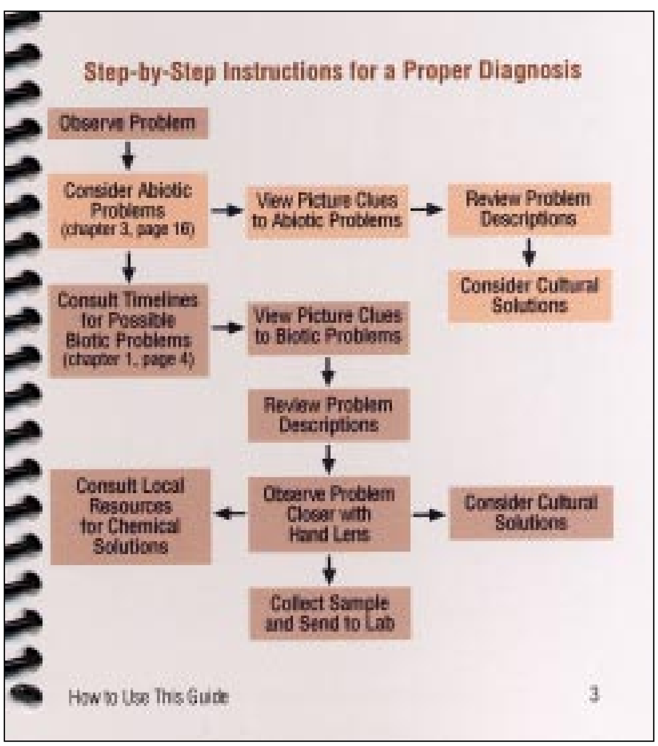


Figure 4



For information on ordering individual or more for multiple discount orders, contact NRAES at 607-255-7654, NRAES@cornell.edu, or www.nraes.org.

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The Lawn Reader

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Key words and concepts are highlighted throughout the text and then explained in the extensive glossary at the end of the book. Finally, there is a list of additional resources that problem solvers could find more solutions not adequately addressed in the book, notably chemical controls.

Turfgrass Problems: Picture Clues and Management Options will be an important addition to any turf manager's library. But more importantly it should be in every managers pocket for those times when a good sleuth is needed. Remember the key to an effective IPM program is a timely and an accurate diagnosis. It can all begin with this book!

Frank S. Rossi

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Figure 6

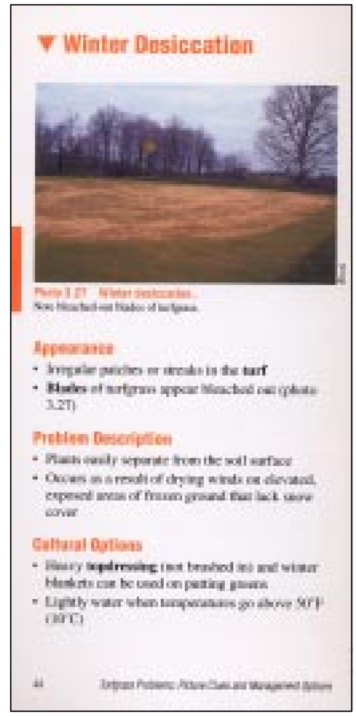
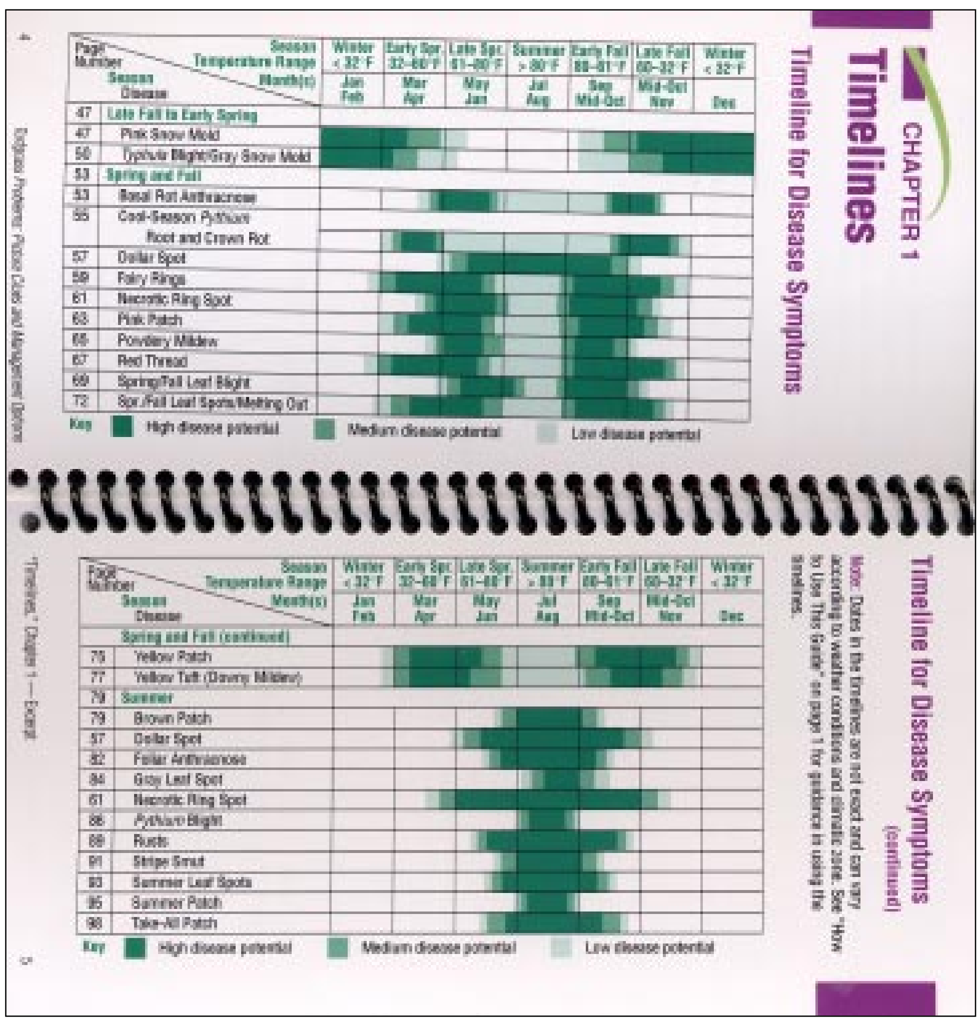


Figure 5



CUTT

Fine Tune Your Boom Sprayer for the Coming Season

Maximum economic return will be obtained with a finely tuned sprayer as it provides better disease control and is more cost-effective.

There are three factors which affect application rate:

1. Forward speed
2. Nozzle size
3. System pressure.

Forward speed affects both dose rate and volume rate – double the speed and you halve both. Remember to drive at a speed which provides a stable boom. Too fast results in boom bounce leading to incorrect nozzle height above the target. Too slow results in not applying pesticides in a timely manner, failing to cover the ground and keeping on top of pest outbreaks.

Nozzle Selection

Nozzle selection is so important. Droplets are measured in microns, 100 microns is about the thickness of a human hair. Remember large drops bounce, such droplets are over 300 microns and are created by using low pressures, too large a nozzle orifice and or worn nozzles. Too fine a droplet (less than 150 microns) will drift, resulting in damage to neighboring properties, nuisance complaints and equally important, reduced application to the target.

Select the correct nozzle for the target. Use a nozzle which creates a fine spray for fungicides and insecticides. A medium quality spray is ideal for herbicides. Coarse spray is ideal for applying liquid fertilizers and preemergent herbicides to bare soil.

Nozzle Wear

The rate of nozzle wear will depend upon the pressure used, type of pesticide being used and nozzle material. Note that ceramic nozzle tips, whilst being expensive, do last much, much longer than cheap plastic nozzles. Nozzles made from a modern polymers are also superior to cheap plastics. Brass is the worst nozzle tip to use as it wears out so rapidly.

Nozzle Abuse

Nozzle abuse is a problem caused by operators using a piece of wire to clean out a blocked tip. Rodding out a ceramic tip with a piece of wire is the kiss of death, it will damage it thus affecting flow rate and spray pattern. Remember, good filtration and agitation will prevent nozzle blockage. If a nozzle does block, replace it with a spare and blow out the blockage with an airline or use a bristle brush, *never* kiss nozzles!

System Pressure

System pressure affects flow rate, nozzle life, droplet size, fan shape and penetration into the target. Too low a pressure will result in large droplets dripping off the target. Too high a pressure results in off-target drift and poor application. Beware that some automatic electronic controllers will alter flow rate by using a butterfly valve to change system pressure. Always work within the boundaries recommended in the sprayer manual.

Good preseason maintenance and calibration is so important. Articles have been published by the author on this subject. They are also obtainable at: http://aben.cals.cornell. edu/ extension/pestapp/boom.html

Remember good pesticide application is a wonderful blend of technology and common sense. Think you are a good sprayer operator? Take the test on page 12 to find out.

Andrew Landers

The Interrelationship Between the Factors Affecting Application Rate

	Sprayer speed	Nozzle size	System pressure
Application rate	X	X	X
Spray volume	X	X	X
Droplet size		X	X

The Tool Box

There are three factors which affect application rate:
1. Forward speed
2. Nozzle size
3. System pressure.

Use a nozzle which creates a fine spray for fungicides and insecticides. A medium quality spray is ideal for herbicides. Coarse spray is ideal for applying liquid fertilizers and preemergent herbicides to bare soil.

Think you are a good sprayer operator? Take the test on page 12 to find out.

Fine Tune Your Boom Sprayer

continued from page 11

So you think you are a good sprayer operator?

(Answers may be found at the bottom)

If a nozzle does block, replace it with a spare and blow out the blockage with an airline or use a bristle brush, never kiss nozzles!

Try this test with your operators.

1. A radar type speed indicator obtains signals from
   a) a wheel mounted induction coil.
   b) the tractor transmission.
   c) the field surface.
   d) the sprayer pump drive.

2. Increasing the operating pressure of a sprayer results in
   a) narrowing the nozzle jet angle.
   b) decreasing droplet size.
   c) increasing droplet size.
   d) increasing output and droplet size.

3. Drift from a sprayer is most likely to be increased by
   a) high operating pressures.
   b) boom too near ground.
   c) high application rates.
   d) high forward speed.

4. With an automatic rate control system in operation on a sprayer, increasing forward speed causes increased output by
   a) producing larger droplets.
   b) increasing system pressure.
   c) increasing droplet size and pressure.
   d) reducing system pressure.

5. The use of 110° nozzles on a sprayer enables
   a) the boom to be raised higher above the target.
   b) nozzles to be placed closed together.
   c) boom to be set closer to the target.
   d) smaller nozzle orifices to be used.

6. The correct procedure when turning on headlands during spraying is
   a) turn off power takeoff.
   b) continue to spray.
   c) turn sprayer main control valve to off.
   d) turn sprayer boom valves to off.

7. When calibrating a sprayer to apply 20 gallons/acre results show 18 gallons/acre is being applied. To rectify this error, changes should be made to
   a) pressure.
   b) nozzles.
   c) speed.
   d) speed and pressure.

8. Sprayer calibration should be carried out
   a) by the dealer before delivering the sprayer.
   b) when poor spraying results can be seen.
   c) at the beginning of each spraying period.
   d) after at least 500 acres of spraying.

Answers
Q.1 = c, Q.2 = b, Q.3 = a, Q.4= b,
Q.5 = c, Q.6 = c, Q.7 = b, Q.8 = c & d

Employers Adjust to Workforce Changes

More and more turf industry employers report that they can't find and keep good employees. They're not alone. A slew of societal factors have combined in recent years to create labor challenges for employers everywhere. And experts predict that this situation could continue, even during an economic slowdown.

First, U.S. demographics are changing. Fewer young people are entering the workforce as the number of older Americans in the population increases. Women have taken a higher percentage of full-time jobs in the last decade. And the number of Hispanic workers entering the U.S. workforce is increasing, creating language and cultural issues for employers.

Employee expectations and loyalty have also changed. Employees are more likely to change jobs if they become dissatisfied in their current job or if wages and benefits are more attractive elsewhere. Some of this loss of loyalty stems from the tight job market of the '90s that increased competition, plus wage and benefit packages, for workers.

Yes, it's a challenging labor market for small business employers. But progressive and innovative human resource strategies can overcome the challenges.

Two human resource strategies that will serve you well in a competitive labor market are building employee commitment and creating a positive image.

Build Employee Commitment

Employees are more likely to be attracted to a business and stay with it if they enjoy their work and can be productive. As an employer, it's your job to help create this environment by doing at least four important things:

1. Create a vision and a direction for your business. Then communicate that to all employees. This creates a purpose for their work and helps them to feel part of the organization and its success. The sense of contributing to something bigger and more impor-

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The Human Dimension

A slew of societal factors have combined in recent years to create labor challenges for employers everywhere. And experts predict that this situation could continue, even during an economic slowdown.

Two human resource strategies that will serve you well in a competitive labor market are building employee commitment and creating a positive image.

Workforce Changes

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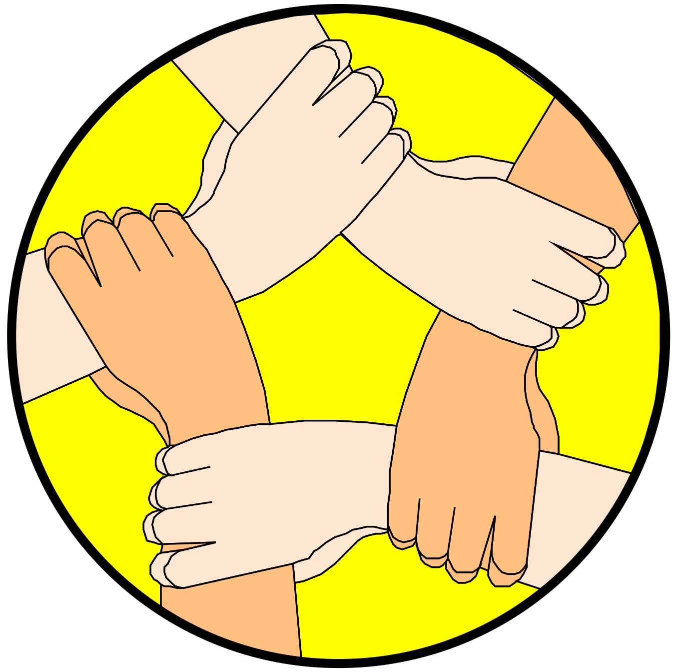
The sense of contributing to something bigger and more important than just the "job" matters to employees, especially to the younger generation.

Successful turf businesses highlight the benefits such as working outdoors, job variety and the opportunity to see results of hard work.

tant than just the "job" matters to employees, especially to the younger generation.

2. Develop and support the people you employ. Determine their training and development needs. Then work with employees to develop their personal development plan. This creates a win-win situation: employees gain valuable skills and your business benefits from a higher performance level.
3. Outline the standards for good performance and help employees meet those standards by becoming their coach and supporter.
4. Communicate the results you expect for jobs. Then provide employees with the freedom and resources to achieve those results.



Create a Positive Image

Why is it that one turf related business has a ready supply of qualified applicants, yet the one across town struggles to find and keep good employees?

The difference may be the image that a business projects to the community and to prospective employees. The following factors can help create a positive image and attract a pool of applicants:

1. Promote what's good about employment in your industry. Successful turf businesses highlight the benefits such as working outdoors, job variety and the opportunity to see results of hard work.
2. Maintain the appearance of your business. It helps create an image of excellence and acts as one of your most valuable advertisements. Most people want to work in a business that is highly regarded and has a reputation for professionalism.
3. Provide competitive wage and benefit packages. This allows you to compete for the best job candidates.
4. Employ professional human resource practices. Begin with creative, attractive recruitment ads that promote the job you're offering and your business. Professional practices include your reputation for training, developing and helping people succeed.
5. Keep employees happy. A business' current employees are its best advocates for attracting new employees.
6. Create opportunities to promote your business in your community. Building your public image enhances your ability to attract good people. Many businesses successfully use tours, open houses and public service to promote themselves and to create goodwill in the community.

The best employees always have a choice of where they work, and they'll opt to work for the best employers. If you have a reputation as a poor, or even average, employer, it'll be more difficult to find good employees. Instructors at universities, colleges and tech schools will steer their students to the better employers. Business associates will also recommend the best employees to employers whom they perceive to be good ones.

Thomas R. Maloney

Cation Exchange Capacity

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expect only a slight increase in nutrient uptake if the CEC were increased on soils with naturally good CEC (>10 cmol/kg).

Nutrient Leaching

The leaching of nutrients is bad for several reasons. First, nutrients that are leached are not available for plant use, which means your fertilizer dollar was wasted. Second and more importantly, nutrients that are leached can results in groundwater contamination and possibly surface water contamination if the groundwater feeds surface water resource. CEC can reduce nutrient (cations) leaching by absorbing the nutrients when first applied then slowly releasing the cations as the plant removes them from the soil solution. Some cations are more prone to leaching such as single positively charged cations like potassium, sodium, hydrogen and ammonium. On the other hand, divalent (2 plus charges) cations (like calcium and magnesium) are held more tightly and leach much less from the soil.

In some cases leaching of cations is a good thing, especially if the cations are sodium and hydrogen. Sodium can directly injure turf or destroy the structure of the clay in a soil if sodium dominates the CEC sites. When lime is added the calcium (and/or magnesium) ions replace the hydrogen on the CEC sites and the soil pH will rise.

pH Changes

The pH of the soil is determined by the amount of hydrogen found in the soil water. The amount of hydrogen in soil water is directly related to the amount of hydrogen on the CEC sites. At very low pH (<5.5) the amount of hydrogen in the soil water is also a function of the amount of aluminum on the CEC sites.

At the same pH, soils with a higher CEC value will require more lime to raise pH or sulfur to lower the pH than soils will lower CEC. When we apply lime to raise pH we are lowing the hydrogen ion concentration of the soil water by replacing hydrogen on the CEC sites with calcium (or magnesium if it is dolomite lime) and allowing the hydrogen ions to leave the soil, thus raising the pH. The difference in the amount of lime it takes to raise the pH from soil to soil can vary greatly and is related to CEC. If we have a clay soil with a high CEC it can take as much as 10 times more lime to raise the pH the same amount than a sand soil with a very low CEC.

CEC and Turf Growth

To increase the CEC of a soil one adds materials like clay, organic matter or other soil amendments like natural zeolites and calcine clays. Obviously if one adds clay, organic matter or other soil amendments, many other soil properties are modified like the water holding capacity, saturated hydraulic conductivity, compaction susceptibility, and fertility (both in the form of macro and micro nutrients). Therefore, to study just the impact of CEC on grass growth requires one to adjust or correct for the other changes in soil properties. To study the affect of CEC on grass growth Petri Anton chose to study a soil with a very low CEC (sand) which would most likely show the greatest effect of increasing CEC on turf growth. Sand greens profiles were amended with reed sedge peat and two natural zeolites. The CECs were 0.3, 2, 4, 6, 8 and 10 cmol/kg. To get a CEC of 6 cmol/kg, 40 per cent of the mix, by volume, was peat and the two natural zeolites. Some other natural zeolites have higher CEC values and would require much less to increase the CEC.

As CEC increased up to 300%, shoot growth of creeping bentgrass increased only 17%. Improvement in growth was attributed to better uptake of nutrients and less leaching of nutrients. We would speculate that for soils having a high initial CEC, increasing the CEC by amendments of clay, organic matter or zeolites may have the same or less effect since they already have good nutrient holding capacity

Since materials that are used to increase CEC also modify many other properties, there is likely a much greater benefit to grass growth than nutrient fate as affected by CEC. For example, Dr. Huang found by increasing the CEC from 0.1 to 10 cmol/kg by adding a natural zeolite to sand, increased water use efficiency of creeping bentgrass 30 to 60%, depending on the nitrogen application rate. The more nitrogen applied the greater the water use efficiency to produce growth. Therefore, the goal of adding soil amendments to improve turf health benefits more than just plant nutrition.

Marty Petrovic

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CUTT

Understanding the Exchange:

Turfgrass Nutrient Management and Cation Exchange Capacity

Cation exchange capacity is important to plants because it affects nutrient uptake by plants, leaching of certain nutrients, and buffering of soil pH.

We have very little information on the impact of increasing the CEC of other soils on improving nutrient uptake. In fact, I would expect only a slight increase in nutrient uptake if the CEC were increased on soils with naturally good CEC (>10 cmol/kg).

Cation exchange capacity, or CEC, is the amount of cations a soil can hold. Cations that are most important to turf include hydro-gen, calcium, magnesium, potassium, ammonium and sodium. Cation exchange sites include the surfaces of clay size particles and organic matter. The amount of CEC is dependent on the amount and nature of the clay and organic matter. Some clays have a lower CEC value like the highly weathered kaolinite which have a CEC of 3-15 cmol/kg (me/100 g of soil). Other clays like montmorillonite, which have more exchange sites, can have CEC values up to 150 cmol/kg. Fresh organic matter that is not highly decomposed has a low CEC; whereas, as highly decomposed organic humus can have a high CEC value (>150 cmol/kg).

CEC is important to plants because it affects the process of:

- Nutrient uptake by plants
- Leaching of certain nutrients
- Buffering of soil pH

Nutrient Uptake by Turf

Nutrients that are cations, like calcium, magnesium and potassium, are supplied to plants either from the soil solution or stored in the soil on CEC sites. The source of the nutrients may be from fertilizers, nutrients found naturally in the soil, or "recycled" nutrients through the decomposition of dead turf. In soil with a low CEC, such as a sandy soils with little or no clay or organic matter, the nutrients are supplied to the plant via the soil solution. Sandy soils with low CECs must be fertilized more frequently than soils with high CEC (especially if water soluble fertilizers are used) because the soil has little or no ability to retain or store cations on CEC sites.

Let's look at what is known about how CEC influences nutrient uptake in turfgrass (basically very little). We have had several graduate students at Cornell University that have studied nutrient uptake as it relates to CEC in sand based systems, in this case experimental sand greens profiles. Dr. Arthor Huang (Cornell University Ph.D. 1992) found that 16 to 22 % more of the fertilizer nitrogen was accumulated in the creeping bentgrass clippings when CEC was increased from 0.1 to 10 cmol/kg. Petri Anton (Cornell University M.P.S. 2000) found that more nitrogen, potassium, phosphorus and magnesium was recovered in bentgrass clippings when CEC was increased from 0.3 to 10 cmol/kg.

We have very little information on the impact of increasing the CEC of other soils on improving nutrient uptake. In fact, I would

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