CORNELL UNIVERSITY TURFGRASS TIMES

CUTT

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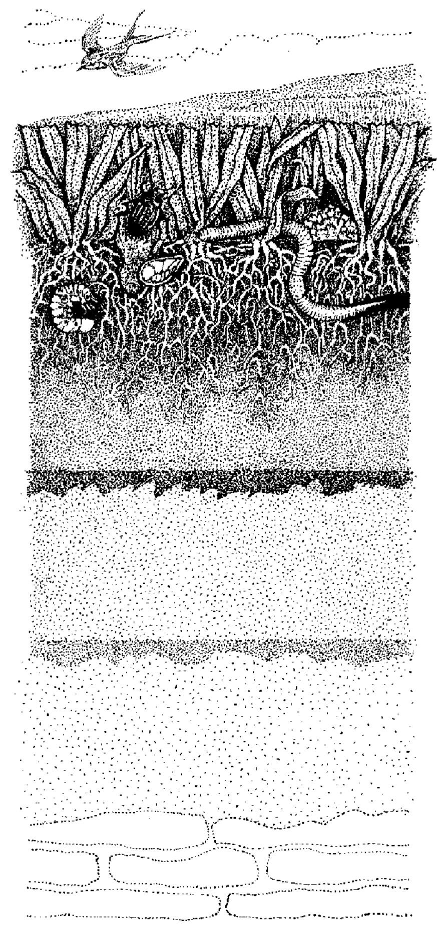

Establishing and Trafficking New Bentgrass Putting Greens

Golf turf managers are pressured from the golfing community to reduce the establishment time of playing surfaces. To this end, accelerated grow-in procedures are implemented that eventually permit play on surfaces that are less than prepared to receive traffic. Research hassuggested that accelerated grow-in procedures and premature traffic results in a turfgrass stand that is more prone to damage from pests, in particular, diseases.

New cultivars of creeping bentgrass are available and mark a significant improvement in visual quality, growth habit and ability to tolerate close mowing. The ability to lower cutting heights is critical for golf turf managers who are required to provide ball roll distances consistently greater than 10 feet.

The goal of our research at Cornell University is to determine optimum putting green establishment programs that lead to a more stress tolerant, disease resistant stand of turf, less reliant on pesticides. ■

More specifically, our objectives are to evaluate newly released creeping bentgrass cultivars established under various procedures; evaluate microbial seed treatment on seedling survival and suppression of seedling disease; and assess the impact of establishment procedures and traffic on the incidence of foliar and root diseases in the mature turfgrass stand.

Putting Green Establishment Procedures

A 20,000 square foot experimental golf green was constructed at the Cornell Turfgrass Research and Education Center in Ithaca, NY in 1997. The green was constructed to conform to California specifications. Unamended sand (pH

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This Times

Short Cutts

CUTT Wins National Award

Since its inception almost a decade ago, under the leadership of Dr. Norm Hummel, *Cornell University Turfgrass Times* has been committed to excellence in keeping you abreast of the latest turfgrass research and education programs available in New York State. In addition, with sections such as "Scanning the Journals" and "Short Cutts" we make you aware of the latest findings from around the turf world, and their implications for turfgrass managers in New York. More recently, we have added regular program updates from each of the Cornell Turfgrass Team members and the increasingly popular "Human Resource Update" section from Team members Dr. Bob Milligan and Tom Maloney.

Our commitment to excellence was recognized in 1998 with the **Certificate of Excellence for Extension Education Materials from the American Society of Agronomy**. *CUTT* was selected from over 30 entries to receive this prestigious award! The award recognized the technical expertise with the variety of topical material covered, in an in-depth, easy-to-read format that was enjoyable to read. Furthermore, while there is a wealth of information available across the country, *CUTT* was recognized for layout and design, under the direction of Kenn Marash, creative director for Ghostwriters, inc. of Harford Mills, NY. Therefore, we believe it is truly a Team effort that involves generating the information (research), synthesizing the information (extension education) and then delivering the information in a contemporary format (layout and design).

American Society of Agronomy

1998 Educational Materials Contest

Certificate of Excellence

Presented to:

F.S. Rossi, A.M. Petrovic, M.C. Millani, E.B. Nelson, R.A. Milligan, and T. Maloney, The Cornell Turfgrass Team

in recognition for the development of outstanding agronomic educational material in the category of

Newsletter

"Cornell University Turfgrass Times"

Awarded this 19th day of October 1998
ASA Annual Meeting, Baltimore, Maryland

ASA Division A-4 Chairman

We hope you continue to enjoy the work and benefit from our information. We look forward to serving you with the same level of excellence for the next decade!

1999 New York State Turfgrass Association Board of Directors

Another successful New York State Turf and Grounds Exposition concluded in Syracuse, NY with the election of a new Board of Directors for 1999. The Executive Board includes; Anthony (Tony) Peca Jr., of Batavia Turf Farms as President, John Fik, CGM Grounds and Landscape Manager for Hobart and William Smith Colleges serves Vice-President and Joe Hahn, CGCS, Golf Course Superintendent at the Country Club of Rochester, is the Secretary/Treasurer and Stephen Smith of PIE Supply is Immediate Past President. The Directors include Michael Maffei, CGCS, Golf Course Superintendent at Back O'Beyond (second term ends in 2001), Ken DeCerce of Services Galore (first term ends 1999), John Rizza of Turf Partners (second term ends 1999), Bob Scott of Dow Agrosciences (second term ends in 2000), Jim Seaman, Golf Course Superintendent at Shaker Ridge Country Club (first term ends 1999), James Diermeier, CGM, Grounds and Landscape Manager at Reader's Digest Association (first term ends 2000), Angelo Ranieri, CDF, Superintendent of Buildings and Grounds for the Susquehanna Valley Central School District (first term ends in 2000), Steve Griffen, of Saratoga Sod Farm (first term ends 2001), Steve Hyde of The Scotts Company (first term ends 2001).

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Explaining Bentgrass Summer Decline

A few years ago, golf course superintendents experienced an unusual phenomenon. It was typical for *Poa annua* (annual bluegrass) to suffer during the summer, however, many superintendents noted that their bentgrasses (even a few of the new cultivars) were declining. University researchers immediately interested in this problem noted several pathogens associated with bentgrass as it began to decline. It followed then that fungicides were being recommended as the cure for “Summer Bentgrass Decline.”

Researchers at Kansas State University tested the response of two bentgrass cultivars (Penncross and Crenshaw) from a physiological perspective (photosynthesis, growth, quality, etc.) rather than a pathological (disease) perspective. The experiment was conducted in a controlled environment room; the two cultivars were maintained on a sand-based medium. Plots experienced high temperature (95°F day/77°F night) and/or low aeration (accomplished by flooding the plugs). In other words, plots were grown at optimum temperature (95°F day/77°F night) and poor soil aeration, high temperature and poor soil aeration, high temperature and optimum aeration, and optimum temperature and optimum aeration (control plot). Photosynthesis was measured to evaluate the plant’s ability to produce energy for growth at these extreme conditions. Results indicated that both Crenshaw and Penncross produced less energy under high temperature. Respiration (how the plant burns energy) was significantly higher for Penncross than for Crenshaw. This suggests that while most cultivars will produce less energy under high temperature, some may more effectively manage the energy already available. This could be responsible for severe root decline noted for Penncross under high temperature in a previous study. In that study, Crenshaw was able to maintain a greater live root mass as compared to Penncross.

For turf managers in northern climates, this is important research for areas with poor air movement, poor drainage and experiencing summer heat stress. Still, the well documented dollar spot susceptibility of Crenshaw may limit more northern adaptation. It is worth noting that the solution to “Summer Bentgrass Decline” is not fungicides, but rather species adaptation and improved growing conditions.

From: Huang, B., X. Liu and J.D. Fry. 1998. Shoot physiological responses of two bentgrass cultivars to high temperature and poor soil aeration. Crop Science 38: 1219-1224.

Do Humic Substances (Humates) Help?

There has been an increasing influx of “new” technologies from microbial inoculants to hormones. Recently, a significant amount of interest has been directed toward the use of humates for improving turfgrass management systems. Humic substances (humic or fulvic acids) are defined as “ a category of naturally occurring, biogenic, heterogeneous organic substances that generally can be categorized as being yellow to black in color, of high molecular weight and refractory”. The benefits of these types of materials have been reported in agricultural crop production. Primarily, the benefits have been associated with enhanced rooting and nutrient uptake.

Researchers at North Carolina State University compared the effect of foliar applied humic substances or sand-incorporated humate on Crenshaw creeping bentgrass. In addition, a solution culture experiment was conducted to more precisely monitor nutrient uptake in response to applications of humic acid. Rooting was increased on average 26% in top 5 inches in the plots in pots that incorporated humic substances as compared to untreated plots. In fact granular humate incorporated into the sand increased root mass by 29% as compared to untreated, Sustane or peat derived humic acid. In general, foliar applied humic acid had no effect on rooting.

Nutrient uptake studies demonstrated the ability of the incorporated humic substances to enhance nutrient uptake in sand culture, but was less obvious in solution culture. Nitrogen, Calcium, Magnesium and Iron uptake was not influence by the humic substances, however, phosphorus (P) and potassium (K) tissue levels indicated a significant increase in uptake. Interestingly, uptake of sulfur (S) was reduced by the humic substances as compared to the untreated plot.

The researchers concluded that there are significant benefits of having humic substances available in the root zone. The known benefits of organic matter were clear. In contrast, there was no effect of foliar applied humic substances and the lack of increased uptake in solution culture suggest that there is no benefit to humic substance use when the plant is supplied with an adequate amount of nutrients.

From: Cooper, R.J., C. Liu, and D.S. Fisher. 1998. Influence of humic substances on rooting and nutrient content of creeping bentgrass. Crop Science 38:1639-1644.

Scanning the Journals

A review of current journal articles

This suggests that while most cultivars will produce less energy under high temperature, some may more effectively manage the energy already available. This could be responsible for severe root decline noted for Penncross under high temperature.

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Establishing Greens

continued from front cover

Figure 1

Light, frequent topdressing is vital during grow-in to manage the surface accumulation of organic matter.

The high shoot density of the new cultivars, SR1119, L-93 and Penn G-1 acts as a "sieve" to topdressing particles greater than 0.25 mm.

7.8) was placed above subsurface drainage, in direct contact with the native subsoil. Drain lines were cut into subsoilon 10-foot centers This system is widely used when economics prohibit the incorporation of organic matter into the rootzone. Interestingly, a preliminary microbial screening of the sand rootzone indicated a plethora of activity often thought to be nonexistent under these situations.

Planting

Plots were established on July 29, 1997 (year 1) and repeated in a separate area on the green on May 13, 1998 (year 2) with four commercially available bentgrass cultivars (Penncross, L-93, SR 1119, Penn G-1) at four or five seed rates (0.25, 0.5, 1, 2, 4 lb. PLS/M) and treated with a fungicide (Mefenoxam), one of two or three microbial inoculants (*Azospirillum brasilienses, Enterobacter cloacae, Pseudomonas aureifaciens*), or untreated. Data were collected in the first 12 weeks for seedling survival, visual cover, tillering and growth habit.

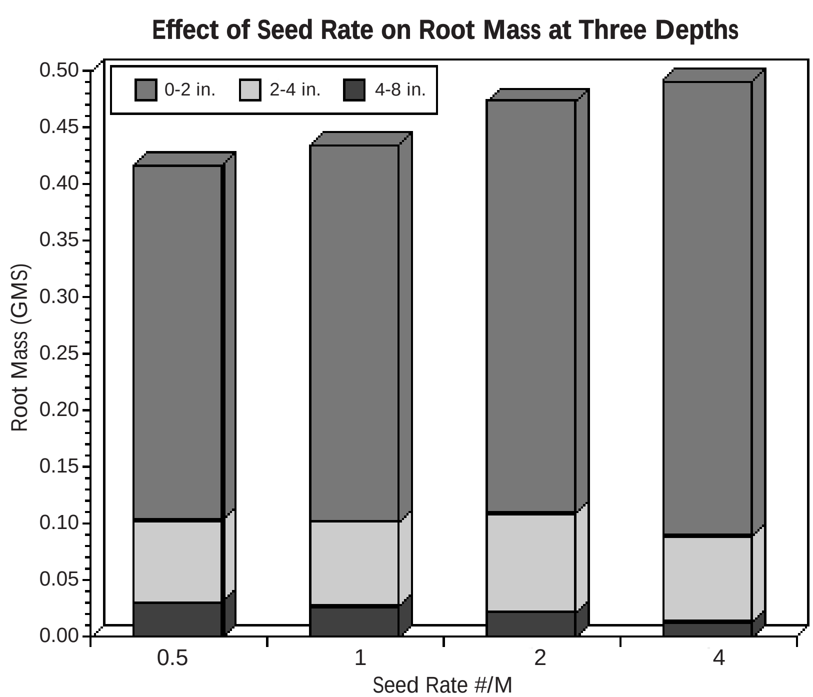
Grow-in Management

Grow-in fertility of the plots established in 1997 amounted to 6.5 lb. of actual nitrogen (N) per 1000 square feet, 3.5 lb. of phosphorus (P) and 5.5 lb. of potassium (K). Fertilizer applications were made as turf color and growth indicated. It was noted that high seed rate plots required substantially more N from a color perspective then the plots seeded at the recommended rate. Once established, in 1998 the plots were foliar fed with 0.125 lb. of N weekly supplied as urea and potassium nitrate. Irrigation was used to keep the sand surface moist during the establishment phase of the study (a formidable challenge with straight sand greens). Irrigation water maintained a pH of 8.2 throughout the growing season.

In year two, the mature plots were put under championship management conditions in cooperation with David Hicks, Golf Course Superintendent of Cornell's Robert Trent Jones Golf Course and were opened for simulated play on May 31, 1998. During the season, cutting heights were reduced from 0.156" to 0.125" and finally down to 0.095" for two weeks in August.

Cutting height reductions were performed in conjunction with an aggressive sand topdressing program that was implemented every three weeks (see Figure 1). In fact, topdressing commenced prior to mowing as a means of managing the organic matter accumulation associated with seedling bentgrass. The high shoot

Figure 2



density of the new cultivars, SR1119, L-93 and Penn G-1 acts as a "sieve" to topdressing particles greater than 0.25 mm. Attempts were made to apply dry sand, brush the material and then follow with irrigation. Mowing practices were suspended for the day following topdressing and still, a significant amount of material remained on the surface.

The traffic simulated approximately 25 to 30,000 rounds of golf per year, typically what is expected on the average daily fee course in upstate NY. In addition, rooting was investigated by sampling the untreated and fungicide seed treatment plots with a Noer Profiler (1.25" x 4" x 12"), sectioned at 0-2", 2-4" and 4 to 8" depths. The roots were washed free of sand and oven dried. Ball roll data were collected using a modified stimpmeter.

Results of Second Year Plots

Pest Issues

As a result of the mild winter experienced in 1997-8, there was a low incidence of pink and gray snow mold on the experimental area. This was surprising as previous research has indicated that seed rate can have a significant impact on susceptibility to snow mold. It appeared that three of the four cultivars used in the study exhibit a significant amount of tolerance to snow mold. Although, where snow mold was observed, recovery was slow.

Throughout the second year of the experiment, diseases, insect damage, algae, and drought stress symptoms were observed on the plots. Some stress appeared to be related to the traffic, however, except for turfgrass quality ratings (see Table 1) there were not significant differences associated with the traffic treatment. Also, except for the initial seed treatment fungicide, no pesticides have been applied to the plot area.

Rooting

Plots established in 1997, at seed rates greater than 2 lb. per 1000 square feet (2x the recommended rate) exhibited more severe wilting com-

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Figure 3

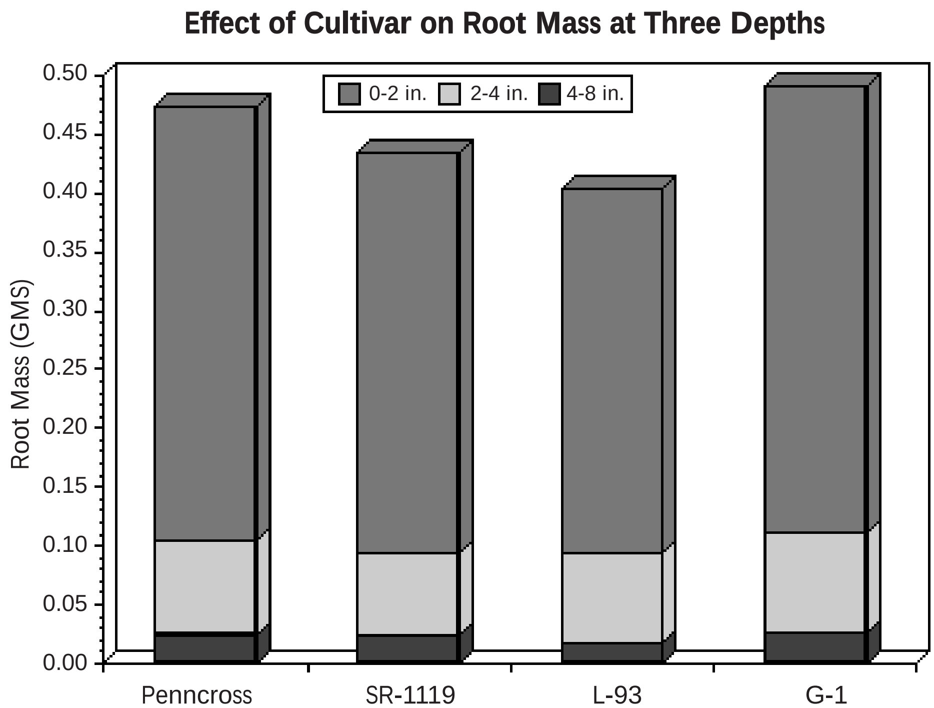

Figure 4

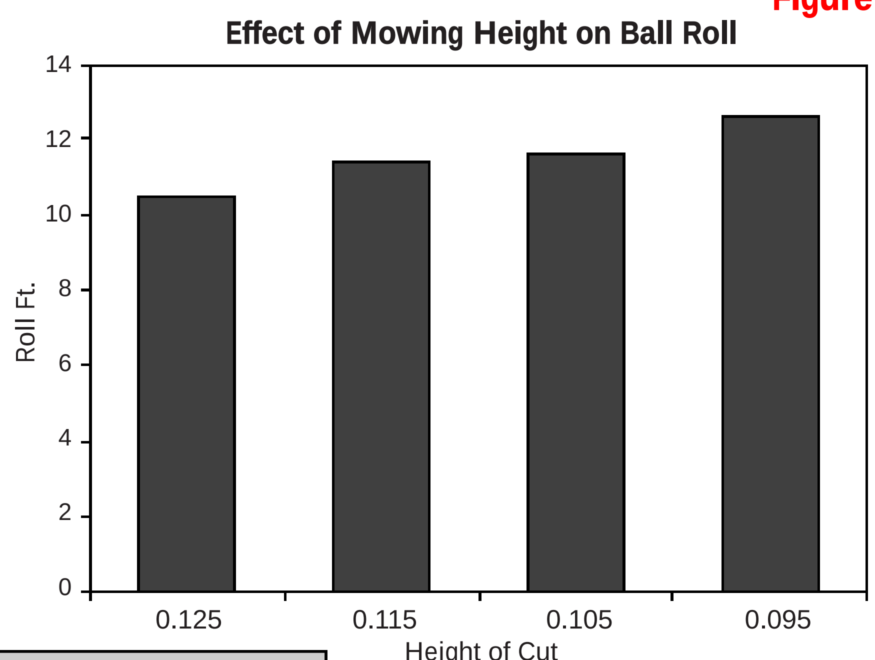

Table 1. Influence of cultivar, cutting height and traffic on turfgrass quality.

	Cutting Height 0.125"		Cutting Height 0.095"	
Cultivar	No Traffic	Traffic	No Traffic	Traffic
Penncross	6.2	5.0	4.1	2.5
SR1119	7.2	5.9	6.6	5.3
L-93	7.6	6.3	7.4	5.8
Penn G-1	7.5	6.6	7.7	6.0
lsd (0.05)	0.8	1.0	0.7	0.6

Quality ratings from 1 to 9, where 1=dead turf, 6=acceptable, 9=best.

Why Manage the Root Zone Microbes?

IPM Corner

Soil microbial inhabitants generally thrive when given nutrients, organic matter, air circulation, and adequate moisture with good drainage.

In areas with chronic low moisture, the bacteria and fungi that survive best are the ones which form stable dormant structures. This limitation changes the general population diversity and activity cycles with rainfall.

Turf management may look simple to an outsider. Just mow, irrigate, fertilize, and treat occasionally with commercial products for pest control. However, balanced care of the turfgrass ecosystem takes into account the health of the many microorganisms in the root zone, as well as turf appearance. The populations of beneficial fungi and bacteria can change dramatically in both species composition and activity. Key factors that favor healthy soil include the use of organic amendments such as compost, slow release fertilizers, aeration, and irrigation. It is best to avoid the problems that can develop when the root zone is disturbed by compaction, heavy fungicide use, and overfertilization with soluble nitrogen.

Benefits from taking care of the root zone

Soil microbial inhabitants generally thrive when given nutrients, organic matter, air circulation, and adequate moisture with good drainage. Grass plants benefit from the same treatment. And since growing plant roots stimulate the activity of many soil microorganisms, it is easy to see that healthy turf and high microbial activity can complement each other. The benefits of an active microbial population include nutrient cycling and availability, thatch decomposition, and disease suppression. The question is, given real world considerations, how do mowing, aerifying, topdressing, and pest control affect the turfgrass soil ecosystem?

A key component of golf course care is the intensive management necessary to have a grass surface ready for season long play. Heavy traffic can lead to compaction, a problem to plants and microbes alike. High visual quality expectations are difficult to meet at times, especially when microclimates favor disease, or during very hot weather. But sometimes the short term solution to a problem will not be a benefit in the long run. Integrated pest management requires an understanding of the relationships between cultural practices and total plant health.

Mowing

Cutting grass leaves off regularly is a drastic cultural practice. In a natural setting, grass plants flower and set seed without losing their photosynthetic leaves, the source of sugars for new growth of roots and shoots. When grass is cut, there is a temporary cessation of root growth. Taller grass has a deeper root system, giving the plants more drought resistance and surface area for nutrient uptake. Experts think that some grasses, such as bentgrass and annual bluegrass, were adapted to grazing by animals over evolutionary time. As a result, they have become adapted to close mowing height. Since soil microbes thrive on the exudates of growing roots, it follows that higher cutting heights favor a larger, more active microbial population by increasing the root system.

Grass clippings

Returning grass clippings to decompose provides an excellent nutrient source: the fertilizer analysis of clippings is 5-3-1. The clippings begin to decompose within a week, if conditions favor microbial activity. The nitrogen from clippings can be found in new grass leaves within two weeks when conditions are right. The organic matter promotes microbial growth, with bacteria and fungi converting complex nutrients to simple, soluble compounds that roots can absorb. Organic matter and nutrient recycling are critical to healthy turfgrass, so don't bag the clippings and take them away!

Cultivation and aerification

Compacted soil layers, poor drainage and bare, dry patches in turf indicate the need for cultivation or aerification. Areas that don't show such serious problems can benefit from cultivation too. Equipment that removes cores, slices the turf, or drills holes will improve the soil environment for microbes. Better air circulation and drainage will enhance microbial activity, possibly encouraging deeper rooting.

Irrigation

When the soil becomes dry, the beneficial microorganisms cannot maintain the same rate of growth and reproduction. In areas with chronic low moisture, the bacteria and fungi that survive best are the ones which form stable dormant structures. This limitation changes the general population diversity and activity cycles with rainfall. If the root zone is deep and the grass is mowed tall, the turfgrass ecosystem will be more stable during drought.

Fertilization

Too much fertilizer can result in burning, but more subtle problems can also arise. If fertilizers are applied at the wrong time, fast, succulent growth will result that is more susceptible to diseases. A high concentration of soluble nitrogen can reduce the activity of nitrogen fixing bacteria. Judicious use of slow release fertilizers or light, frequent fertility programs lead to healthy turfgrass and a healthy root zone. Natural microbial processes in the soil release nutrients gradually for uptake by the roots. If the carbon to nitrogen ratio is high, such as in dry, brown leaf litter, the microbes need additional nitrogen to continue to decompose the organic matter, degrading cellulose to usable compounds and humus. Without nitrogen fertilizer, the microbes might win the competition with the grass roots for nitrogen, and inadvertently cause yellowing of the turf.

Topdressing

Topdressing of compost, sand, sludges, and/or slow-release fertilizer can make a significant difference in the microbial population. Topdressing provides cover that alters the microclimate in the thatch. In addition, biological control products (derived from suppressive soils) and composts can supply additional microorganisms to enrich the turf grass ecosystem and provide competition with soil pathogens. Combining the application of topdressing with cultivation ensures that materials will penetrate to the soil level.

Application of fungicides

The products available to control fungal diseases can be very effective in stopping the growth of fungi. In studies with applied beneficial inoculants, certain fungicides can completely prevent growth and reproduction.

Soil respiration is considered a sign of the health and fertility of soil. For a short time after fungicides are applied, there is a reduced consumption of oxygen and release of carbon dioxide by the mixed population of soil microorganisms. This reduction in respiration is the result of the chemical toxicity toward the many susceptible species of fungi and bacteria, both target and nontarget. Fortunately, the respiration recovers quickly.

In summary, the turfgrass manager has a powerful set of tools to use in promoting a healthy root zone. Soil microbes are a valuable resource. Nutrient cycling and disease suppression are two very important natural processes. Since the cultural practices that benefit microbes also promote healthy turfgrass, it behooves the manager to make careful investments and decisions.

JANA LAMBOY
NEW YORK STATE IPM PROGRAM
CORNELL UNIVERSITY TURFGRASS TEAM

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The Language of Pheromones

Program Update

Although we know that many insect species employ sex pheromones to attract mates, the confirmation of the presence of a sex pheromone is just the first in a long series of steps need to use this pheromone in a practical pest management program.

An important new area of research in my group is the study of pheromones for turfgrass insect monitoring. Pheromones are chemical signals that are released by one individual and stimulate a reaction in other individuals of the same species. Insects of the same species can communicate with one another by emitting small quantities of chemical substances from their bodies into the air. The released pheromone travels through the air until it is intercepted by antenna (or possible other body part) containing sensory receptors that recognize the pheromone as coming from a member of its own species. While in some cases pheromones are single compounds, in many instances an insect pheromone will be a blend of two or more compounds that are produced and released in a specific ratio by the insect. In such cases an alteration in either the structure of the individual compounds or the relative amount of any compound in the blend will cause the pheromone to become inactive.

Information transmitted through pheromone release include:

- The presence of a willing individual (usually a female) advertising her presence to distant members of the opposite sex (usually a male).
- The presence of high quality food or a valuable area to mate or take shelter
- The presence of danger such as predators or parasites or other unwanted intruders in the area.

Although we know that many insect species employ sex pheromones to attract mates, the confirmation of the presence of a sex pheromone is just the first in a long series of steps need to use this pheromone in a practical pest management program. These steps include the verification of the pheromones presence, isolation, identification, and synthesis of compounds and determining proper blend ratios in the laboratory, testing of release rates in the field, optimization of trap placement and design in the field, and finally incorporation of the pheromone into an established turfgrass pest management program. Possible uses of pheromones in turfgrass pest management programs include confirming the presence of exotic or endemic insect pest species, pinpointing the source of an insect population, estimating the size of an insect infestation, and improving the timing of insecticide applications.

MIKE VILLANI
CORNELL UNIVERSITY TURFGRASS TEAM

Turfgrass, Soil and Water Quality Program: 1998, A Year of Transition

From our previous research with natural zeolites, we found them to increase the amount of fertilizer nitrogen in the clippings while reducing nitrate leaching. These results suggest they can be used to enhance establishment in sand based turf systems.

The best way to sum up 1998 is to say it was a major year of change. My depart ment changed its position on staff support for faculty resulting in a 50% cut in support staff that I have had for over 15 years. Fortunately, the department has shifted part of Jeff Barlow's time to serve the technical role in my program. Jeff brings with him a strong turfgrass background and has served as our in-house IPM specialist for the past several years.

Results from this year field studies were interesting. The impact of nutrient pretreated zeolite amendment of sand in the greens construction phase was remarkable. If you attended this summer's field day you got to see first hand how effective the natural zeolite was in improving establishment. Applying a natural zeolite (Zeopro) that was pre-loaded with fertilizer (N-P-K) to sand at a rate of 10% by volume, compared to the traditional sand to peat mix (80/20 by volume), resulted in a dramatic improvement in the establishment rate of creeping bentgrass. Within 30 days after seeding, the Zeopro amended sand greens had 80% turfgrass cover compared to only 25% for the sand-peat mix greens. Samples of the drainage water have been collected for analysis to determine the extent of nutrient leaching (nitrate, phosphorus and potassium) as influenced by amend type. From our previous research with natural zeolites, we found them to increase the amount of fertilizer nitrogen in the clippings while reducing nitrate leaching. These results suggest they can be used to enhance establishment in sand based turf systems.

Sewage treatment facilities are one of the contributors of phosphorus in surface waters, which can lead to algal blooms resulting in unsafe drinking water, fish kills and poor quality recreation waters. One option for the disposal of sewage effluent is to land apply it. We have very few sites in the northeastern US that land apply sewage effluent. This summer we were involved with a project with the Lake Placid Resort Club involving using the Village of Lake Placid sew-

Program Update

If Not for You...

Research, especially field research is an extremely expensive endeavor, requiring substantial funding for the collection of sufficient data test a given hypothesis with a reasonable amount of certainty. For the past several years we have been surveying golf course fairways and home lawns in central New York in an effort to predict which environmental and historical factors influence the distribution and persistence of scarab grubs in turf. These studies suggest that Japanese beetles tend to prefer well managed irrigated turfgrass that is close to vegetation suitable for adult feeding. They appear to prefer loamy soils in full sun. By comparison, European chafers are found in lower maintenance turf sites, without irrigation, and with sandy, well-drained soil textures. They are also commonly found surrounding small trees that serve as aggregation sites for mating pairs. Black turfgrass ataenius grubs were often found on high organic soils and turfgrass with heavy thatch.

These studies have required the collection and processing of thousands of individual soil samples totaling several tons of soil over the four year duration (and counting) of this project. We have been well funded for this study through state and local agencies as well as a strong financial backing from the New York State Turfgrass Association. There are crunch times however when field work needs to be done. That is when we need to call out the volunteers to help in the field who assist our studies by taking sample and processing samples without pay (we do however supply each of our volunteers with a new grub shirt for their efforts). Below is a list of individuals who have worked on the scarab project since 1995. Those individuals who have volunteered their time to help make this work possible are identified by an asterisk next to their name. We are deeply indebted to these people for their generosity.

Mark Adonna	Fred Albertelli	Leslie Allee*	Bill Arehart*
Ken Bell*	Asia Bonnaci*	Bonnie Carney	Chris Casey*
Nancy Consolie	Frank Consolie	Tom Consolie*	Dan Dalthorp
Karen Dean*	Ariel Diaz*	Ariel Casablanca*	Preston Dinkle
Jim Engle*	Kerrie Frisinger	Jody Gangloff*	Chris Gerling*
Tim Gibb*	Gisela Godoy	Jennifer Grant	Bob Hazel*
Rachel Herring*	Carol Herring*	Mary Lou Hessney*	Wendy Heusler
Mark Higgins*	Steve Hitchcock	RJ Jarecke	Vera Krischik*
Jana Lamboy*	Chris Lenzo	Ken Millington	Brian Minns*
John Minns Jr.*	Kandi Nelson*	Jason Nyrop*	Jan Nyrop*
Rick Piccioni	Carlos Portillio*	Amy Roda*	Chad Reissig
Paul Robbins	Alfredo Rueda*	Cliff Sadoff*	Malia Sommerville*
Julie Stavinsky*	Rich Stigberg*	Aaron Teichner*	Maher Tawadros*
Iris Velazquez	Mike Villani	Karen Wentworth	Livy Williams
Jim Willmott	Luann Wilsey		

Mike Villani
Cornell University Turfgrass Team

age effluent to irrigation 18 of the 45 holes of this golf course. This project involved the Village of Lake Placid (Paul Guttmann), the Lake Placid Resort Club (Joe DeForest), NYSERDA (Larry Pakanes) and Cornell University. The Village reduced its phosphorus discharge into the Chubb River by 25%, which the golf course had very good looking-functional turf the entire summer. Issues of concern in this project are: would the phosphorus in the sewage effluent irrigation water increase the phosphorus in the turf soil to the point that phosphorus would runoff from the golf course and enter the Chubb River as before; and would the use of sewage effluent irrigation water that contains salts cause damage to the turf. Based on sampling the river and observations of the turf quality, it appears that sewage effluent irrigation of this golf course did not increase the level of phosphorus in the river and did not injure the turf from salt. It should be noted that this was an unusually wet summer so the amount of irrigation was limited and salts would be washed out of the soil. We plan to continue this project next year and will sample impact of phosphorus runoff at a much closer location to the irrigated portion of the golf course.

A. Martin Petrovic
Cornell University Turfgrass Team

These studies suggest that Japanese beetles tend to prefer well managed irrigated turfgrass that is close to vegetation suitable for adult feeding. They appear to prefer loamy soils in full sun.

Based on sampling the river and observations of the turf quality, it appears that sewage effluent irrigation of this golf course did not increase the level of phosphorus in the river and did not injure the turf from salt.

How To Be A Great Boss

Human Resource Update

As with the coach of an athletic team, the "great boss" is now on the "sideline" providing the resources and the encouragement the employee requires.

Individual performance expectations are defined as the conditions or results of satisfactory work. They should be discussed and agreed upon before the performance period begins.

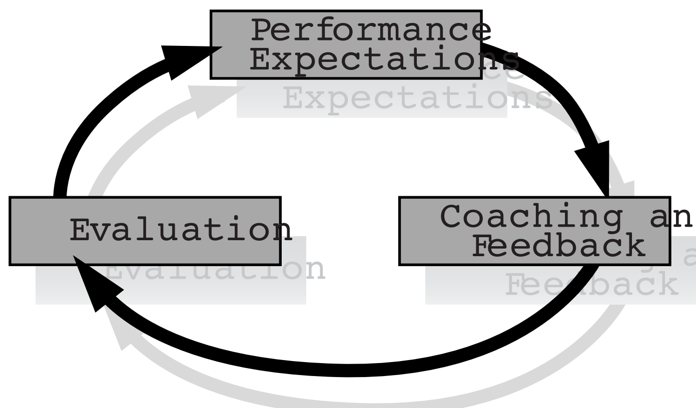
The keys to the supervisor's success in this environment are empathy and trust. Empathy to understand the employee, to know how and when to provide support.

We often think of a "great boss" as one who is nice all of the time. If we analyze the idea of a great boss, we get a much different picture. Think of the following situations:

• Sally is frustrated because she is unsure how well she is doing in her job. Her supervisor tells her she is doing fine but somehow she isn't certain he means it.

• George is working hard and seems to be performing very well, but he doesn't see how his hard work contributes to the business. His supervisor tells him he is doing fine just keep it up.

In both situations the supervisor is being a nice person but not a great boss. How can a supervisor be a great boss? The performance management process diagrammed below is a great tool to become a great boss. We will discuss each of the three components of the process.



Performance Expectations

Individual performance expectations are defined as the conditions or results of satisfactory work. They should be discussed and agreed upon before the performance period begins. The should be consistent with the mission, objectives, and goals of the business. These specific outcomes provide a target for the employee to shoot for. Effective performance expectations have the following four characteristics:

• **Measurable**: Truly result-oriented performance expectations must contain measures by which performance can be judged. Measures may include dollars, percentages, numbers of items, ranges, etc.

• **Time**: Productivity is often determined by how quickly desired results can be achieved. The employee and the manager should be clear on just when results are expected.

• **Attainability**: Performance expectations must be within the individual's and the organization's reach if they are to be an effective performance management tool. If either internal or external business constraints prevent attainability, they may serve to demotivate rather than motivate the individual.

• **Available resources:** The individual or team striving to meet the performance expectation must know what resources including time are available to them.

Coaching and Feedback

Once the performance expectations are established, they serve as the accountability for the employee. It is now the employee's responsibility to fulfill these expectations. The supervisor becomes a coach providing the support the employee needs to succeed. As with the coach of an athletic team, the "great boss" is now on the "sideline" providing the resources and the encouragement the employee requires. The keys to the supervisor's success in this environment are empathy and trust. Empathy to understand the employee, to know how and when to provide support. Increasing levels of trust so that the employee will freely seek support when needed.

The key skills required by the "great boss" now become interpersonal skills. "Great bosses are individuals who listen. A valuable tool here is listening. Active listening is a special listening skill where we listen to and focus on both the content and emotional aspects and provide feedback on both. Other critical interpersonal skills include understand what motivates people, providing large quantities of feed back, "I" statements, and other communication techniques.

Evaluation

Evaluation can be both ongoing and a performance appraisal at a specific interval such as a year. Continuous evaluation can also be an important part of the coaching and feedback. Evaluation, usually in the form of a performance appraisal must be provided at the time that was established for fulfillment of the performance expectations. This is a time when three things should be accomplished:

• The "great boss" and the employee should discuss what is going well.

• They should talk about what can be done better.

• Based on performance and the first two items, new performance expectations should be

Establishing Greens

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pared to recommended seed rates. Root sampling indicated that as seed rate increased, the amount of surface rooting increased with a concomitant reduction of rooting below the 4" depth (see Figure 2). There was a significant cultivar effect for rooting. The "high shoot density, upright growth habit" of Penn G-1 resulted in the greatest amount of surface rooting (see Figure 3).

A substantial amount of below-ground competition was evident at the high seed rates. This effect was noted when fertility was reduced and plants became chlorotic. It appears that there is a greater need for additional resources to sustain high plant populations that result from high seed rates. In addition, the excessive accumulation of organic matter at the surface could pose serious long term consequences, especially if not addressed with a judicious topdressing program.

Cutting Height

Cutting height had a significant impact on ball roll distance (Figure 4). Results indicate that up to 3.5 feet can be gained in ball roll distance by reducing cutting height from 0.125 to 0.095. Yet, it is important to note, except for Penn G-1, no other cultivars were able to maintain acceptable quality at the close cutting height under traffic treatments. Furthermore, as cutting heights were lowered to 0.125" and below, many plots exhibited significant reductions in surface density. Plots established at the recommended seed rate or below exhibited a 25 to 50% greater incidence of algae as compared to high seed rate plots, especially for the more prostrate growth habit cultivar, Penncross. As cutting heights were increased above 0.125" in early fall, algae was not evident. In addition, there was a surprising increase in the incidence of take-all patch (*Gaumenomyces* spp.) associated with the low seed rate plots.

Results from First Year Plots (established 1998)

Seedling Growth

Consistent with data from 1998, visual observations indicated that the higher seed rate plots exhibited more rapid germination independent of cultivar and seed treatment. This includes the seedling survival assessment which for the second year indicated a substantial difference in the percentage survival based on the pure live seed count, again independent of cultivar and seed treatment. This response is consistent with previously observed results from a golf course fairway study with different bentgrass cultivars. The efficiency of the increased seed rate approach is extremely low when viewed in this light, regardless of the fungicide or microbial inoculant.

However, unlike plots established in 1997, the 1998 plots demonstrated visual symptoms of *Pythium* spp. Plots with seed rates greater than 1 lb. per 1000 square feet had a 50% higher incidence as compared to the 0.5 and 0.25 lb. rate. In addition, the microbial seed treatments reduced *Pythium* to a level similar to the fungicide treatment at the 4 lb. (4x) seed rate.

Visual cover ratings recorded at six weeks after establishment when averaged across culti-

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These smaller plants are less likely to produce stolons that are necessary for traffic tolerance and recuperative ability following surface disruption.

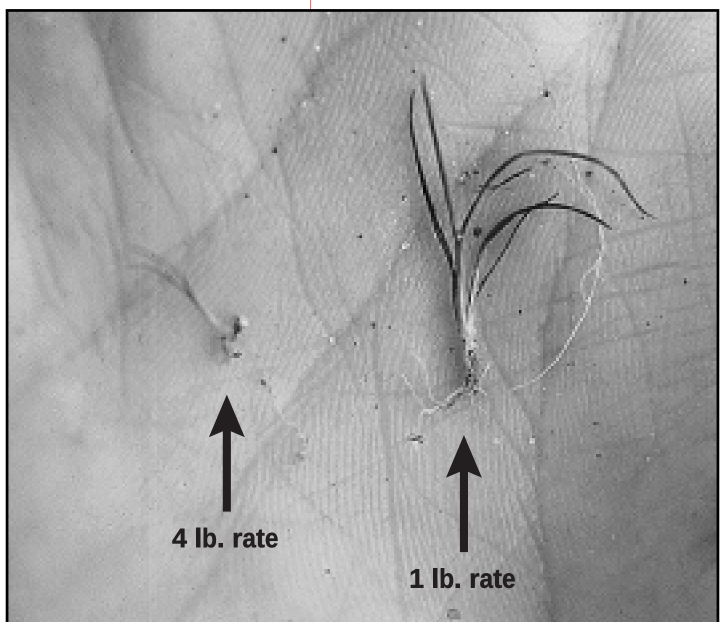

Figure 5

Individual plants established on the same date at different rates. The 4 lb. rate plot is 100% dense while the 1 lb. rate plot is about 80%. Which would you rather open for play?

established for the next time period. Training and professional development opportunities can be identified to help meet the new expectations.

At this point we are back at performance expectations and the process continues.

Sally and George

We now return to Sally and George. Sally's supervisor was telling her she was doing fine but she's still frustrated by the lack of a clear understanding of her performance level. If she had a "great boss" using this performance management process, she would be clear on her expectations and her progress relative to those expectation would clearly provide information on how well she was performing. George's supervisor is telling him to not worry about how his work contributes to the business and just keep up his good work. If George had a "great boss' using our process, the performance expectations would be derived from and clearly tied to the goals and the mission of the business or organization.

Robert A. Milligan
Cornell University Turfgrass Team

The recent trend in golf turf management to accelerate establishment systems appears to be substantially flawed. The manager and golfer are lured by rapid development of surface density, yet, upon close observation there is a collection of small, weak plants that, based on our data persist into the second year.

Establishing Greens

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vars and seed treatments were not significantly different in response to seed rate. This was consistent with results from 1997. Furthermore, the increased plant density associated with the high seed rates results in plants with one half the number of tillers as compared to recommended rates. These smaller plants are less likely to produce stolons that are necessary for traffic tolerance and recuperative ability following surface disruption (Figure 5).

Implications

The most significant, but easily overlooked implication of this two year research project, is the low disease incidence in response to the most severe management and traffic stress. The cultivars selected, lest Penncross, represent significant improvements in disease tolerance and demonstrate the importance of the genetic component of IPM, i.e. selecting pest resistant species and cultivars. In addition, the excellent growing environment established at the research center (proper root zone selection, site placement for maximum air movement and light penetration, precise cultural management) demonstrates the importance of these factors to the maintenance of healthy plants, more able to tolerate pest infestations.

The recent trend in golf turf management to accelerate establishment systems appears to be substantially flawed. The manager and golfer are lured by rapid development of surface density, yet, upon close observation there is a collection of small, weak plants that, based on our data persist into the second year. This was most obvious in the significant below-ground competition evident in the root sampling data. High seed rate plots produce a higher proportion of roots at the surface to exploit resources. This surface rooting will require a higher frequency of resource applications (fertilizer and water) as well as organic matter accumulation that could result in decreased infiltration. Previous research has shown that reduced infiltration as a result of surface organic matter accumulation will create an anaerobic layer that will further restrict rooting and create an ideal disease environment.

As a result of this research, we have identified possible disease tolerance of certain creeping bentgrass cultivars (genetic component of IPM); the role of seed rate in reducing disease incidence; and the reduced need for fungicides in the seed bed when utilizing recommended seed rates. The consequences of high seed rates persist into the second year, especially evident in the rooting response, where greater surface rooting is likely to result in reduced stress tolerance.

FRANK S. ROSSI, ARTHUR SCHAUB AND ERIC B. NELSON
CORNELL UNIVERSITY TURFGRASS TEAM

Short Cutts

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The Executive Director of the New York State Turfgrass Association is Elizabeth (Beth) Seme. Academic Liaisons are Dominic Morales of SUNY Delhi, Bob Emmons of SUNY Cobleskill and Frank Rossi of Cornell University. Mr. Horst Pogge serves on the New York Greengrass Board. If you have any questions about NYSTA activities, programs or interest in serving on the Board, contact Tony Peca at (716) 343-2828 or Beth at (800) 873-8873.

Advanced Short Courses Draw Rave Reviews

The Cornell Turfgrass Program embarked on a new direction for the 1999 Short Course schedule. As you may have read in previous issues of *CUTT* and from conferences around the state, we did not conduct the two-week Turfgrass Management Course. Rather, we introduced a new series of Advanced Short Courses to address specific needs of Sports Turf managers and Golf Course Superintendents. These course were held over the first two weeks of January on the Cornell University campus.

The Sports Turf course attracted about 30 managers from as far away as Washington, Texas and Wisconsin. In addition, several managers from New York State colleges, universities and school districts attended. The 1999 course focused on design, construction and maintenance of sports turf areas and internationally known speakers shared "state-of-the-art" information. Several speakers commented that this was the most comprehensive, in-depth education for sports turf managers, they had ever seen."

The next week, 50 professionals in the golf course management industry attended the Golf Turf Short Course. The 1999 course focused on Innovative Pest Management, Science and Practice. Speakers included Drs. Bruce Clarke of Rutgers University, Joe Vargas of Michigan State University, Pat Vittum of UMass and, of course, your Cornell University Turfgrass Team (Rossi, Villani, Nelson, Landers, and Weston). A comprehensive exam at the end, allowed GCSAA Certified Golf Course Superintendents to receive over 3 CEU's toward certification. The course was praised by attendees for the interactive format that enabled them to develop decision-making skills needed at their facilities.

Stay tuned for future offerings of Short Course Activities in 1999, 2000 and beyond.

Times Have Caught Up With *CUTT*

After almost ten years of quietly bringing you current and useful turfgrass information from research labs, education programs, field studies, and the collective minds of the Cornell University Turfgrass Team, *CUTT* has been honored to receive a Certificate of Excellence from the American Society of Agronomy (see article on page 2.)

Following the traditional and well-worn path of most extension publications, *CUTT* has been made available since its inception at below-cost rates. As anyone who has kept up with trends in government and education sectors knows, tax dollars to support public outreach efforts have steadily been shrinking. And, as anyone with a business sense realizes, a publication cannot continue in existence if it cannot meet its financial needs.

The expertise involved with *CUTT* comes with a price that has not been adjusted since the very first issue was published in the Spring of 1990, despite the fact that the average issue is 50% larger and, as in the case of this issue, often contains twice the number of pages as earlier issues. In the meantime, University budgets have declined, and layout, printing and mailing costs have risen. As a result of the increased cost of doing business, we are forced to increase the subscription rate for *CUTT* from $8.00 per year ($2.00 per issue) to $20 per year ($5.00 per issue). This change will be reflected in your next renewal statement.

We trust that you will continue to enjoy and benefit from our Award Winning Publication; we look forward to your input and support as we soon begin our second decade. Remember, too, that a subscription to *CUTT* is a membership benefit of joining the New York State Turfgrass Association. If you have any questions or want subscription details, please feel free to contact our Team Assistant, Ms. Kelly Woodhouse, at (607) 255-3090.

FRANK S. ROSSI
NEW YORK STATE
EXTENSION TURFGRASS
SPECIALIST
EDITOR-IN-CHIEF OF
CUTT

Several speakers commented that the Sports Turf Short Course was the most comprehensive, in-depth education for sports turf managers, they had ever seen.

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Joann Gruttadaurio, Director of Education, elegantly organizes and delivers course material to Short Course attendees.

Pest Watch

continued from back cover

Maxx. This was expected given the labeled control achieved with these fungicides in the field. However, *S. homoeocarpa* was also extremely sensitive to the herbicides Trimec, Dacthal, Barricade, and MCPP as well as the insecticides Merit, Dursban, and Proxol, and the fungicides Subdue Maxx and Chipco 26019. Subdue sensitivity is rather unusual since this fungicide has specific activity against oomycetes such as *Pythium. Rhizoctonia solani* was also highly sensitive to Subdue. This unusual behavior in culture suggests that the formulation contained materials toxic to a broader range of fungi than the target oomycetes for which Subdue is registered. *R. solani* was also highly sensitive to the fungicide Prostar and the insecticide Merit. *R. solani* was highly tolerant of the herbicides Trimec and Banvel.

Such compatibility was essential in order to establish the direct toxicity of various chemical pesticides to these turfgrass pathogens and allow bioassays with these pathogens and pesticides to be interpreted properly. Any bioassays in subsequent parts of this study could be interpreted erroneously without knowing the direct impacts on pesticides on the activity of the pathogen.

Objective 2: Evaluate the efficacy of microbial inoculants in the field with and without pesticide applications.

Plots were established on a creeping bentgrass/*Poa annua* putting green at the Robert Trent Jones Golf Course at Cornell University. Treatments were arranged in a split plot randomized complete block design. Subplots consisted of no superimposed treatments or conventional golf course management treatments. Inoculant treatments were randomized within three replicate blocks within each major subplot. Control plots consisted of untreated turf (no inoculant treatment) within each pesticide block. Inoculants were applied to 2 ft X 2 ft plots at 14-day intervals at rates of shown in. Unless stated otherwise, inoculants were applied in 2 gal water/1000 ft^2. Treatments were first applied on 6/30/98. Plots were rated between 7/16/98 and 8/11/98 on a scale of 0-10 where 0=no symptoms and 10=100% of the plot area symptomatic. Only fungicides were applied to the plots under conventional golf course management through the course of the study.

The most obvious treatment effect from the field study was a significant block effect. In other words, disease severity was significantly greater in plots receiving no additional management than in those receiving conventional golf course management practices. However, in no case were there significant treatment effects in plots under traditional golf course management practices. Also, there were significant replicate effects at all rating dates (ANOVA not shown). Consistently, the replicate closest to

Turfgrass Management Short Course Returns to Long Island

For the third year of our commitment to the Green Industry on Long Island, we will be offering the Cornell Turfgrass Short Course on Long Island from February 15-26, 1999. This is the traditional two week course for industry professionals that addresses the broader areas of turf management, with breakout sessions on golf, sports and landscape management. Valuable hands-on laboratory sessions will be offered for students to identify grasses, weeds and insects, understand soil physical properties, and learn equipment calibration.

This course has educated over 1,300 turfgrass professionals from around the world and is regarded nationally as one of the best educational experiences available in the turfgrass industry. For more information on the L.I. Turfgrass Short Course, contact the Director of Educational Programs for the Cornell Turfgrass Team, Joann Gruttadaurio at (607) 255-1792. To enroll, return the course registration form below.

Register now to reserve your place!

If you choose to pay by installment plan, you may pay for the course by check or credit card. If you are paying by check, you will be invoiced for the remaining payments as they become due. If you are paying by credit card, the card number provided will be automatically charged. Payment deadlines follow:

Long Island Turf Short Course: February 15-19 & 22-26, 1999

☐ Full payment of $995 enclosed

☐ Yes! I want to pay using the Installment Plan
$395 due with this Registration Form
$300 due January 5, 1999
$300 due February 5, 1999

Name: ____________________

Address: ____________________

City: __________ State: ______ Zip: ______

Phone: __________ Email: __________

Method of payment:

☐ Check (payable Cornell University) __________ amount enclosed

☐ Purchase Order/Requisition
PO#: __________

☐ Credit Card: ☐ VISA ☐ MasterCard

card number: __________

exp. date: __________ today's date: __________

signature: __________

Return this form to: Cornell University Long Island Short Course, P.O. Box 6740, Ithaca, NY 14851

the outside of the putting green differed significantly in disease intensity. This replicate was dropped from subsequent analyses.

A number of different diseases appeared on plots throughout the 1998 season. In mid July, following the first application of treatments, small reddish-brown patches appeared on plots. These symptoms were subsequently diagnosed as *Pythium* root rot. Following one application, none of the treatments was effective in reducing symptom expression below that of untreated plots, despite the fact that disease ratings ranged from 1-6. This indicates the considerable level of variability throughout the experiment.

Toward the end of July, *Pythium* root rot symptoms had disappeared and brown patch symptoms were apparent. A number of significant treatment effects were observed at both the 7/30 and 8/6 rating dates. Most importantly, the experimental inoculant RD-107 showed a significant suppressive effect toward brown patch on the 7/30 date. Additionally, Bac Pac, Daconil Ultrex, EcoSoil B-1b, Roots 1 and 3, and Super Bio showed significant reductions in symptoms over the untreated control. By 8/6, brown patch symptoms were beginning to disappear (as indicated by ratings of untreated plots). At this date, only the Super Bio treatment was significantly less diseased than the untreated control plots.

Anthracnose became prevalent on experimental plots toward mid August. However, none of the treatments significantly reduced disease severity over that in untreated plots. Despite this, plots treated with Bio-F, Daconil Ultrex, Roots 3, and Super Bio all showed numerically reduced levels of disease compared with treatments such as Actinovate and Root Shield.

General Summary

Results from this study reveal a number of important findings. First, and somewhat surprising, is the fact that a number of pesticides commonly used in golf turf management have significant toxicities to nontarget pathogens. This is best exemplified by the activity of Daconil against *P. graminicola*, Trimec and Merit against *S. homoeocarpa*, and Subdue Maxx against *R. solani*. These finding complicate the interpretation not only of bioassay results, but of field results when such pesticides are used in combination with biological agents. Second, our results clearly show that a number of pesticides used in combination with inoculants can dramatically affect their suppressive qualities toward various diseases. This is best illustrated by the impact of Bayleton and Proxol on the suppression of *P. graminicola* by *E. cloacae*. Finally, our results have shown that some suppression of brown patch can be detected in a number of commercially-available microbial inoculants.

Future Directions

It is clear that commonly-used pesticides will have impacts on biological control organisms. Even though the inoculant may tolerate the pesticide, changes in biological control activity are going to occur. However, it is unlikely that any potentially negative responses will be observed when biological inoculants are used in combination with chemical pesticides. It is also apparent that, in a golf course setting, there will be little control over the types of materials that are applied. Thus, emphasis should be redirected to other aspects of product development that may have a more direct influence on the suppressive activities of introduced inoculants.

Since it is apparent that some of the inoculants have potential suppressive activity, future work should focus on ways of maximizing their activities in golf turf settings. One of the more obvious areas for improvement is in application frequency and timing as well as application volumes. It was clear from work with many of these inoculants that 2 gallons of water per 1000 ft^2 is insufficient for maintaining maximum activity. Inoculants that failed in this current trial performed well in other trials where the gallonage of water was substantially increased. Furthermore, in other trials with some of the same inoculants, increasing the application frequency and timing significantly improved their performance. Therefore, future work should emphasize these aspects of product development.

Also essential to this work are the capabilities to accurately follow populations of introduced organisms. Without this capability, many subsequent experiments will also be difficult to interpret. If treatments fail, we need to know whether it was a problem with the persistence and development of the introduced organism(s). Equally important will be studies directed toward defining cell density effects on suppression of various diseases and the relationships of cell densities of the introduced inoculant to that of the target pathogen. It is most likely that many of these inoculants will have maximum activity (at a given cell density) when disease pressure is low and will tend to fail under conditions of high disease pressure. We expect to follow this line of investigation in the coming years.

Eric B. Nelson and Cheryl M. Craft
Cornell University Turfgrass Team

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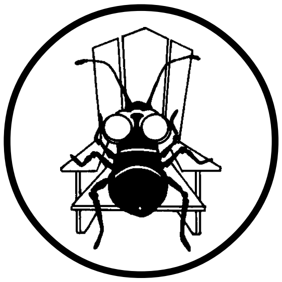
The experimental inoculant RD-107 showed a significant suppressive effect toward brown patch on the 7/30 date. Additionally, Bac Pac, Daconil Ultrex, EcoSoil B-1b, Roots 1 and 3, and Super Bio showed significant reductions in symptoms over the untreated control.

Our results clearly show that a number of pesticides used in combination with inoculants can dramatically affect their suppressive qualities toward various diseases.

Do Bio-Controls and Pesticides Mix?



Pest Watch

Our studies were designed to first determine the in vitro toxicity of various herbicides, insecticides, and fungicides to selected turfgrass pathogens so that laboratory and field results could be properly interpreted.

Experiments were conducted in 1998 to examine the impact of pesticide applica tions on the efficacy of commercial microbial inoculants used to suppress turfgrass diseases. Our goal in this research was to document any positive or potentially negative combinations of biological disease control products with commonly-used fungicides, insecticides, and herbicides. Our studies were designed to first determine the in vitro toxicity of various herbicides, insecticides, and fungicides to selected turfgrass pathogens so that laboratory and field results could be properly interpreted. Next,. we examined in laboratory studies, the impacts of high label rates of selected chemical pesticides on the efficacy of inoculants for control of *Pythium graminicola, Sclerotinia homoeocarpa,* and *Rhizoctonia solani* on creeping bentgrass.

Procedures and Results

Objective 1: Determine the direct toxicity of selected herbicides, insecticides and fungicides to various turfgrass pathogens so that laboratory and field results may be properly interpreted.

The following pesticides were studied:

Fungicides
chlorothalonil (Daconil)
triadimefon (Bayleton)
etridiazole (Koban)
propamocarb (Banol)
iprodione (Chipco 26019)
mefanoxam (Subdue Maxx)

Insecticides
imidacloprid (Merit)
chlorpyriphos (Dursban)
trichlorfon (Proxol)

Herbicides
prodiamine (Barricade)
mecoprop (Weedstroy)
dicamba (Banvel)
fenoxaprop (Acclaim)

Pesticides were incorporated into corn meal agar or potato dextrose agar for *Pythium graminicola* isolate PRR-11 or *Sclerotinia homoeocarpa* isolate shgu and *Rhizoctonia solani* isolate R6, respectively. Data were subjected to probit analysis to calculate LD_{50} values for each of the selected pesticides against each of the three pathogen isolates. The smaller the LD_{50} value, the more toxic the pesticide.

Each of the three pathogens differed greatly in their sensitivities to the various pesticides. In general, the herbicides and insecticides were the least toxic to *P. graminicola.* The insecticide Merit was the least toxic whereas the fungicides Banol and Daconil were the most toxic to the organisms. Interestingly, Daconil is not typically believed to have significant toxicity to *Pythium* species. *Sclerotinia homoeocarpa*, on the other hand, was considerably more sensitive to nearly all of the pesticides tested and was highly insensitive only to the herbicide Banvel. For example, *S. homoeocarpa* was extremely sensitive the fungicides Daconil and Banner

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