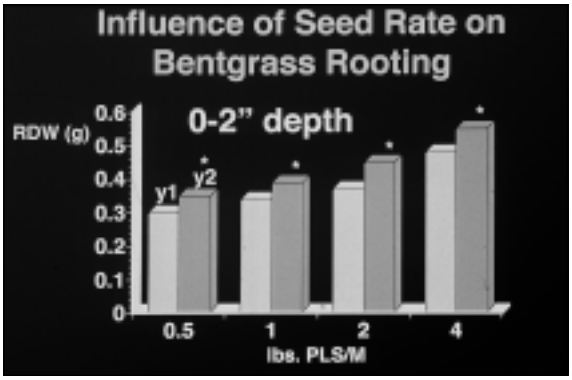
CUTT

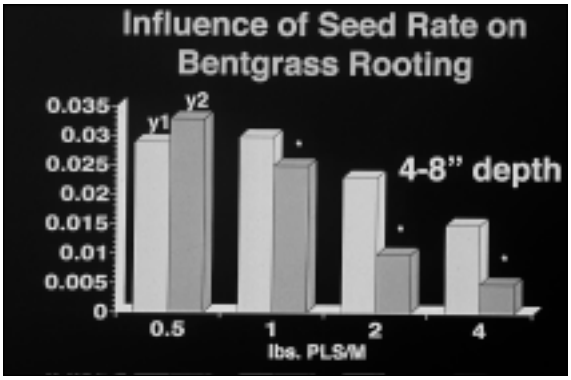
# NYSTA Research Reports

*The following reports are provided to NYSTA members as a means of keeping you informed of how your annual research grant monies are used.*

# Establishment Procedures Influences Seedling Survival, Morphology, and Rooting of Creeping Bentgrass

A study was conducted to evaluate golf putting green establishment procedures with four creeping bentgrass (*Agrostis palustris* Huds.) cultivars: Penncross, Penn A-4, L-93, and SR1119. Five seed rates were used (0.5, 1.0, 2, and 4 lb.) with five seed treatments: metalaxyl (Apron), *Pseudomonas aureofaciens*, *Azospirillum brasilience*, *Enterobacter cloacae*, and untreated seed. Seeding was undertaken twice, in June 1997 and August 1998. Seedling survival, morphology and rooting were examined.



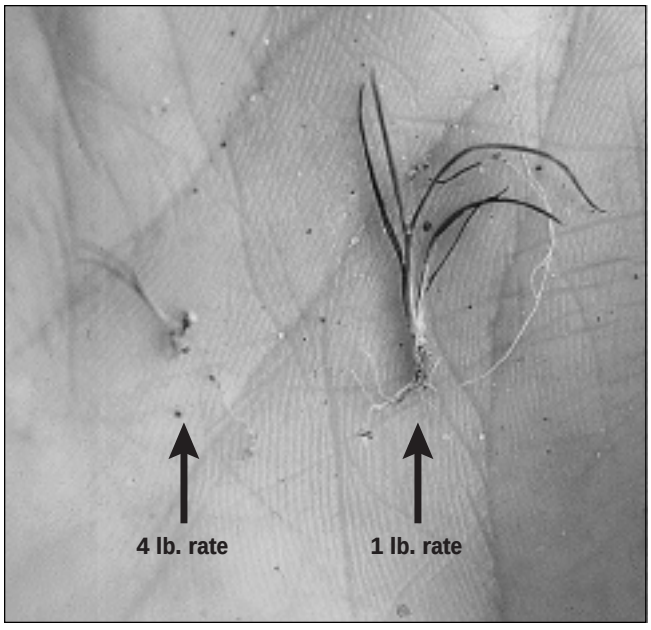

A sand (pH 7.8) putting green was constructed to "California" specifications. Data were collected in the establishment phase (up to 12 weeks after establishment) on seedling survival, visual cover and plant morphology. In addition, visual quality and root mass distribution data were collected the second season on the matured plots. Disease and drought occurrences were rated on both juvenile and mature turf.

Seed rate strongly influenced all measured parameters. Specifically, seed rate was inversely related to seedling survival and incidence of *Pythium* spp. Low seed rates produced in larger more prostrate plants All seed rates reached 90% visual cover by week 14. Overall root mass was greatest in high seed rates. However, the lower seed rates had greater root mass below four inches. High seed rates exhibited a greater degree of wilt symptoms than low rates during drought, most likely due to differences in deep root mass. Visual quality varied significantly between cultivars as management intensity increased on mature plots with Penncross consistently receiving the lowest rating.

This research provides compelling evidence in support of the importance of seed rate—independent of cultivar—for successful putting green establishment.

*Frank S. Rossi*

*The influence of seed rate on seedling development.*



# Alternative Control Tactics for Black Cutworms in Turf

Black cutworms *Agrotis ipsilon* (Hufnagel) (BCW) are economically important pests of highly maintained turfgrass—both sod production and landscape turf—throughout the United States.

We evaluated alternative control agents (entomopathogenic nematodes, inorganic sulfur, insect growth regulators, and fungal pathogens) against black cutworm larvae using test products incorporated into standard artificial diets and more natural arenas using turfgrass as the cutworm food source and application target site. A secondary objective of this project was to develop a rapid and reliable assay system that would be easily replicated and allow activity measurements for cutworm fitness (larval and pupal weights) beyond simple mortality data.

Artificial diet bioassays involved the presentation of control agents in standard BCW wheat germ diet with weekly evaluation of larval mortality and development until pupation. Three insect growth regulators, slow release inorganic sulfur, the commercially-produced entomogenous nematode Hb Oswego, the fungal pathogen commercial formulation of *Beauveria bassiana* (Botani Gard), and the fungal pathogen, *Metarhizium anisopliae* were all evaluated against mid-instar cutworms at multiple rates. Insect mortality and weight in the various treatments were evaluated seven and twenty-eight days post treatment.

Our artificial diet results suggest that insect growth regulator products that tend to be quite selective in targeting pest species, are quite active at 7 days post treatment against black cutworm larvae at the labeled or anticipated field rates. Assays indicate a reasonable dose-dependent activity with increased mortality directly correlated with higher rate of product. Cumulative cutworm mortality and pupal weights at twenty-eight days appear to follow the trends described above for the insect growth regulators and inorganic sulfur treatments.

Entomopathogenic nematode treatment (Hb) showed excellent results in our diet assay indicating that the black cutworm is highly susceptible to the nematode species even at relatively low rates. However, because these nematodes must actively search for prey in turf, and they must survive possibly harsh environmental condition in the field these results do not translate into an expectation for comparable results in the field. The commercial fungal pathogen, Botani Gard did not produce cumulative mortality nor pupal weights that were significantly different than the untreated checks. Finally, *Metarhizium* grown in rice grains and placed on top of the diet cause high levels of mortality. This fungal isolate has also proven to be active against scarab grubs in laboratory and greenhouse bioassays.

Results obtained through the addition of test compounds to artificial diet, although easily replicated and useful for comparing levels of activity within a group of products or doses of an individual compound, may not reliably mirror field activity. Through a process of trial and error requiring several rounds of test bioassays our lab developed a protocol that provided low check mortality and reasonable reproducibility if assays were conducted sequentially through time, and provided a treatment substrate (grass clippings) that are the natural target against black cutworm products. Three insect growth regulators, inorganic sulfur, Hb nematodes, and the fungal pathogen Botani Gard were tested at a single rate.

Assessing larval mortality one day post treatment appears to provide little predictability on the ultimate activity of a product. Relatively few cutworm larvae died over the first 24 hours of this bioassay. Mortality at six days was uniformly high in the insect growth regulator treatments and relatively low in the sulfur and fungal pathogen treatments. These data are similar to the mortality levels observed in the artificial diet assays. The entomopathogenic nematode treatment showed highly variable activity. It should be noted that highly variable results are often observed in field and greenhouse bioassays using entomopathogenic nematodes

The mean larval weight of black cutworms one day post treatment was lower in most treatments than in the untreated controls. Larvae were observed down in the soil of these treat-

*continued on page 15*

## NYSTA Research Reports

*We hope that you find these research summaries informative. If you would like more complete information about the research, contact the Cornell Turfgrass Program at (607) 255-3090.*

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# NYSTA Research Reports

*Our NYSTA-supported study was designed to evaluate the impacts of application scheduling on the disease control efficacy of introduced microbial inoculants.*

# Optimization of Application Timing and Frequency of Microbial Inoculants for Turfgrass Disease Control

Considerable information is now available concerning the use of microbial inoculants for the control of turfgrass diseases. However, despite positive experimental results, few microbial inoculants have been highly effective in field studies or in commercial use on golf courses.

A number of studies have shown that microbial agents perform most effectively when populations can be maintained at high levels, usually at populations exceeding $10^7$ cells/g soil. However, applications made during the daytime hours may limit population development due to UV exposure or to desiccation. The limited number of success stories of biological control on golf courses have been from sites where applications of biological control organisms were applied during the overnight hours. Our NYSTA-supported study was designed to evaluate the impacts of application scheduling on the disease control efficacy of introduced microbial inoculants.

Intuitively, daily applications made during the evening hours should greatly enhance activity of microbial inoculants over conventional weekly applications or daily daytime applications since the overnight hours should provide more suitable conditions for microbial growth and activity and reduce mortality due to UV exposure and desiccation. Furthermore, applications would be made at the times when pathogens are most active.

Our results clearly show the potential for improving upon disease control efficacy of microbial inoculants by adjusting application schedules; moving away from traditional daytime applications on a two-week schedule to nighttime applications on a daily schedule. Our results have specifically shown that daily nighttime applications of various inoculants are superior to daytime applications or weekly applications. This response was also apparently independent of population level.

Our work in 1999 also focussed on the evaluation of a number of microbial inoculants for turfgrass disease control. Last season was a particularly tough season for disease control studies since temperatures were extremely high and rainfall was well below normal. As a result, disease development was not extensive and turfgrass stress was high. We essentially saw no dollar spot on the site where the liquid formulations were evaluated and no anthracnose on the adjacent site where the solid formulations were evaluated.

Following liquid applications, anthracnose severity remained relatively constant over the course of June and July with mean disease ratings ranging from 0.67 to 1.67. One week after the first application (June 17), plots treated with Roots+Bacteria A, Roots+Bacteria B, or Serenade at 10lb/A showed significantly lower levels of anthracnose than the non-treated plots. By the 24th of June (after two applications) only plots treated with Serenade at 10lb/A had significantly lower levels of anthracnose. For the remainder of the season no treatment provided significant levels of disease control. However, some responses are worth noting. On the last two rating dates, Daconil Ultrex failed to provide a significant level of anthracnose control throughout the season. Additionally, Roots Powder+Standup provided a significantly greater level of anthracnose control than other products such as Bio-A Plus, Companion, and RD-107.

Dollar spot incidence was observed relatively early on plots to which solid formulations of biological control products were applied. Through the month of July, dollar spot incidence remained constant. Slight increases were then observed by the August 23rd rating date. Many treatments were effective in reducing dollar spot incidence. All but GC-O and HHI-4 showed consistent levels of control through the latter part of the season (up until the last rating date). HHI-2 seemed particularly suppressive to dollar spot. Daconil Ultrex a significant level of control up to the last rating date. By the last rating date, only plots treated with the GC formulation showed a significantly lower incidence of dollar spot.

*Eric B. Nelson, Michael P. Douglas, and Erica Deibert*

# Development of Alternative Weed Management Strategies in Landscape and Turf

The development of alternative weed management strategies in landscape and turf settings involves the use and implementation of novel biocontrol practices which can provide efficacious control over the course of the growing season.

Use of pathogenic organisms to control weeds has not proven particularly effective, due to problems in obtaining consistent control and difficulty in formulation of biocontrol organisms. Organically derived products, such as corn gluten meal, have also not provided consistent control, especially in commercial settings such as golf courses, parks and athletic fields where improved control is desirable.

One novel approach which shows strong potential is the selection, development and use of allelopathic or weed suppressive turfgrasses or groundcovers to naturally control annual weeds in the landscape, without the use of herbicides. Fescues, especially *Festuca rubra* spp., produce secondary products known as allelochemicals with potent ability to suppress weed seed germination and growth.

A collection of fescues was established as part of the NTEP trials at Cornell's turf farm. Quality and weed suppressive ability were evaluated in fall 1999 and spring of 2000. Of the 80 cultivars evaluated, five cultivars were identified that provided significantly greater weed suppression (>85%) when compared to other cultivars. In the laboratory, the same cultivars exhibit potent ability to suppress or kill crabgrass seedlings, even 2 weeks after fescue seeding. The chemicals produced by fescue seedlings which are responsible for growth inhibition in agar and sand cultures are currently under evaluation. Once the allelochemicals are isolated and identified, we plan to evaluate gene expression and isolate genes which are responsible for biochemical production of these inhibitors. This would be a highly valuable trait to incorporate into other less competitive turfgrasses.

In addition, an extensive literature search was conducted to select for groundcovers with known allelopathic or weed suppressive potential in the landscape. Drs. A. Senesac and Weston are currently propagating 40 different ornamental groundcovers which will be evaluated over a 3 year period for use in the landscape as far as stand establishment, aesthetic appeal and weed suppressiveness. Numerous species have been identified with strong weed suppressive potential. They will be established in both Ithaca at the Bluegrass Lane research facility and Long Island at the Riverhead research facility. A weed suppressive index will be determined for the materials under evaluation, based on growth measurements obtained. Recommendations will be developed for cultivar and species selection, seeding or planting rate and mowing heights for optimal management strategies of these ground covers and turfs to encourage maximal weed suppression.

Herbicides are also currently under evaluation for control of annual weeds in turf as well as turf growth regulation. Crabgrass control was evaluated in 1999 and 2000 using a variety of products. Due to drought in 1999, crabgrass germination was less consistent but numerous products were effective. Adjuvants were evaluated for use in control of annual broadleaf and grass weeds, to determine if organosilicon based surfactants provided improved control.

Our findings showed that under last year's difficult growing conditions, surfactants provided no additional postemergent activity of standard herbicides. Newly developed chemistry is also under evaluation for difficult to control species such as zoysia grass, and broadleaf weeds including veronica spp. and ground ivy. Zoysia grass control was not effective with early season application of ethofumesate which was reported to be effective in Georgia for zoysia suppression. Quinclorac was shown to provide effective suppression of veronica and ground ivy in mixed turf stands at all rates evaluated. Other studies with newly labeled products and products under development are underway in container ornamentals and field turf research plots.

Mugwort (*Artemisia vulgaris*) is a common perennial weed problem in turf and nursery plantings which is difficult to control, either culturally or with herbicide treatment. It propa-

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*One novel approach which shows strong potential is the selection, development and use of allelopathic or weed suppressive turfgrasses or groundcovers to naturally control annual weeds in the landscape, without the use of herbicides.*

## Clippings

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since the 1940's through the research efforts of Dr. Gambrell, Dr. Tashiro, and myself," said Villani. The Station continues to be one of a small handful of institutions working on both fundamental and applied aspects of turf entomology.

"This is a national meeting and one of the most useful ones I go to," said Robert L. Crocker, associate professor at Texas A&M. Crocker's current project taping the sounds made underground by white grubs is a potential means of monitoring their numbers. "This meeting is a chance for us all to talk about environmental concerns, pesticides and alternatives to pesticides, to exchange new information on the ecology and biology of pest species, discuss new pests of turf, and talk about the effect of government regulations," he said.

During the meeting, the group also took the opportunity to celebrate the release of the second edition of *Turfgrass Insects of the United States and Canada*. Retired Cornell professor, Haruo Tashiro, who is considered the dean of American turfgrass entomologists, is the sole author of the first edition. Drs. Vittum, Villani and Tashiro are the authors of the second edition. A dinner was held in Dr. Tashiro's honor during the conference.

Seven topics were addressed during informative panel discussions over three days. In the discussion on biocontrol, moderators Jennifer Grant (NYIPM/Cornell), Albrecht Koppenhofer (Rutgers University), and Parwinder Grewal (Ohio State University) took a look at the practical use of biological control agents for controlling turfgrass pests. The use of biological insecticides, predators, and parasitoids for insect control in turf was also discussed.

In a panel discussion on the transition of IPM from research to implementation, moderator Fred Baxendale (Univ. of Nebraska), Rich Cowles (Conn. Agric. Exp. Sta.), and Gary Couch (NYIPM/Cornell) discussed moving IPM from the classroom to the field to the end user, integrating biocontrol and traditional approaches in a realistic IPM program, and the status of action thresholds and sampling in IPM programs.

In University/Industry/Government/Professional Relationships, moderator Rick Brandenburg (North Carolina State Univ.), Dan Potter (Univ. of Kentucky), and Chris Becker (American Cyanamid) talked about how funding shapes the message, whether roles, goals and responsibilities were clear, and how these relationships affect graduate education now and in the future.

Moderators Chris Williamson (Univ. of Wisconsin), and Wendy Gelerntner (Pace Consulting, San Diego CA) talked about advances in black cutworm management, from traditional and emerging control tactics to action thresholds and laboratory bioassays.

Pheromones and their use as attractants, arrestants and repellants was the focus of the session moderated by Paul Robbins (NYSAES/Cornell), Mike Klein (USDA/ARS.), and Robert Crocker (Texas A&M).

Emerging Environmental Issues, such as the impact of FQPA on turf insect pest management, selective vs. broad spectrum insecticides, homeowner use of products and local laws were addressed in a session moderated by Amy Suggars (TruGreen Chemlawn), David Cox (Novartis), and Gwen Stahnke (Washington State Univ.).

*The Geneva Experiment Station continues to be one of a small handful of institutions working on both fundamental and applied aspects of turf entomology.*

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## Black Cutworm Control

*continued from page 7*

ments rather than feeding on the grass blades as observed in larvae feeding in untreated check replicates. Small cutworm larvae consume relatively large amounts of grass and grow rapidly during this period of their development. This weight disadvantage evaporates at the six day post treatment evaluation in the sulfur treatments (there is virtually 100% mortality in the growth regulator treatments). No weight loss was observed in the entomopathogenic nematode or fungal pathogen treatment at either evaluation.

Research conducted in this project has provided better understanding of the activity of products not currently under FQPA review against an important turfgrass pest. Additionally funding has allowed for the development of a novel and reliable screening assay that will but used to evaluate additional IPM compatible products in the future. Funding for this project was provided by the NYS Turfgrass Association and the NYS Community IPM Program.

*Michael G. Villani*