CORNELL UNIVERSITY TURFGRASS TIMES

CUTT

2007 Issue 1 • Volume 18 • Number 1

Don't Fear the Weevil! Managing the Annual Bluegrass Weevil

When we went out to survey annual bluegrass weevil populations in 2004 we missed the mark. The small black insects were more anxious than we were to get their activities off the ground on the fairways where we had chosen to study their seasonal fluctuations. At one of our two sites, adults were already detected on the first survey date April 17th. And we were off the mark again in 2005, not because we had not learned our lesson and gotten to the course soon after snowmelt, but because populations were so low that they were barely detectable. Yet one fairway over, they had emerged in such serious numbers that we could almost feel the reverberations of their boring and chewing as they laid into the margins of the tee box and the fairway edge. The superintendent had never seen such severe problems in that sector of the course before.

In fact, golf course superintendents throughout NY and the Northeast were sobered by the ravages of annual bluegrass weevil in 2005. Many experienced the weevils outbreaking in areas where they had not been problematic the previous years. Others experienced such an unpredictable recolonization by overwintering adults, and such a chaotic development of the spring and summer generations, that it was dizzying to ascertain where the insect was in its life cycle. These are "where" and "when" targeting issues: predicting *in space* which areas of the golf course will have problems, and predicting *in time* the opportune moment to target susceptible life stages with controls. The unpredictability of 2005 meant damage to high visibility areas (like the edges of tees, greens and fairways), and it meant laying out control applications not once, but two or three times against the same generation, sometimes five times over the course of the summer. The upshot: stress on already tight insecticide budgets and another reason to fall short of exaggerated golfer expectations.

Why is this insect so challenging to manage and what strategies should we pursue to improve our chances of keeping it in check? In this article we summarize the problem, the challenges and the perspectives for annual bluegrass weevil management. We will also

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CUTT, "Cornell University Turfgrass Times" is published four times per year by the Turfgrass Science Program at Cornell University, Ithaca, New York 14853. Address correspondence to: Cornell University Turfgrass Times, 20 Plant Science Building, Cornell University, Ithaca, NY 14853; phone: (607) 255-1629; email: fsr3@cornell.edu.

Editor: Frank S. Rossi, Ph.D.

Design & Production: NYS Turfgrass Assn. Latham, NY

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Clippings

This year's Field Day will highlight the depth and breadth of the research and education underway at Cornell University designed to improve the environmental stewardship and profitability of green industry partners.

"Something for Everyone"

The 2007 Cornell University Turfgrass and Landscape Industry Research Field Day

Cornell University, Ithaca, NY
Tuesday June 19, 2007
9:00 to 3:30

The Cornell University Programs that conduct research and education for the turfgrass and landscape industries are pleased to invite you to the 2007 Cornell Research Field Day. The Field Day will be held at the Cornell University Turfgrass and Landscape Research and Education Center and the Cornell Plantations on the Cornell Campus in Ithaca, NY.

This year's Field Day will highlight the depth and breadth of the research and education underway at Cornell University designed to improve the environmental stewardship and profitability of green industry partners. Many exciting new projects are underway in golf and sports turf management, as well as in urban and landscape horticulture such as CU Structural Soil, the latest tree and shrub selections for the landscape, scouting practices and landscape pest management strategies, perennial plant demonstrations and research and nursery crop production. There is something for everyone involved in the green industry.

Several guided and self-guided options are available throughout the day that will include a diverse trade show of equipment and wares and our famous Cornell Chicken barbeque lunch. Industry certification credits including New York State pesticide recertification credits will be awarded for attendance.

For more information on this exciting opportunity for all members of the green industry in New York, contact Joann Gruttadaurio at 607-255-1792 or jg17@cornell.edu.

Dr. Elizabeth Lamb Named New Coordinator of the Ornamentals IPM Program

Dr. Elizabeth (Betsy) Lamb is the new coordinator of the Ornamentals IPM Program for the New York State Integrated Pest Management Program (NYS IPM). The other members of the team are Gary Couch, Eastern Educator, and Brian Eshenaur, Western Educator. The Ornamentals team provides education and demonstration of IPM for nursery and greenhouse crops, sod an Christmas trees.

Betsy comes most recently from the University of Florida (although she is holding her own with the winter weather) where she worked with greenhouse vegetable producers and taught Horticulture courses. She has some experience with cold weather as she did her PhD at the University of Minnesota, her Master's at Cornell, and is originally from Geneva, NY.

Her projects so far have centered on finding a focus for the program and the team. This has included meeting CCE Educators around the state and touring a variety of ornamentals industry sites, including DeBuck Sod, Saratoga Sod, and Lakeside Sod, to discuss primary pest problems and IPM needs with the growers.

Her office is 49B Plant Science, Cornell and her email address is eml38@cornell.edu. Any questions or concerns on IPM for ornamentals are welcome. Additional information on IPM is available at the NYS IPM website www.nysipm.cornell.edu.

Does Coring Increase Runoff?

There is increasing Concern over the runoff of nutrients, especially phosphorus (P). Fertilizer regulations are being considered in spite of the lack of data to support the contribution of turf fertilizer to increasing P concentrations in surface water. In fact, a significant amount of data exists to support the role of turf in stabilizing soil and reducing the particulate movement of P.

Core cultivation (aeration) that removes a plug of soil from the ground is known to be an important practice for high quality turf. Studies have demonstrated the short term benefits of compaction relief, increased infiltration by reducing soil layering and bringing soil to the surface to enhance overseeding operations. However, there is concern over the potential increase in soil runoff of P following core cultivation.

Researchers at Penn State University conducted an experiment on perennial ryegrass and creeping bentgrass growing on a silt loam soil. One half-inch diameter tines were used to disrupt about 15 percent of the soil surface and cores were processed on the surface leaving soil accumulation on the surface. A simulated 50-year rainfall event (six inches per hour) was applied to the plot to generate runoff.

Results indicated that soluble P from a fertilizer application made 24 hrs prior to simulated rainfall did result in significant levels of P runoff from the core cultivated turf. This effect dissipated within a week of the application. In addition, there was significantly more runoff water collected from the perennial ryegrass turf as compared to the bentgrass.

There was no evidence to indicate that core cultivation alone increased the amount of soluble or particulate P, especially where soil tests indicate low soil P values. Disturbing the soil surface seemed to increase infiltration and reduce overland water flow thereby reducing the risk of runoff. However this was not absolute and anytime the turf surface is disturbed there is increaded potential for soil P loss, especially when conducted in conjunction with a fertilizer application.

From: Kauffman, G. L. , III, and T. Watschke. 2007. Phosphorus and sediment in runoff after core cultivation of creeping bentgrass and perennial ryegrass turfs. Agron. J. 99(1):p. 141-147.

Source of N Effects Putting Surface Performance

The importance of a putting surface to the game of golf cannot be overstated. Although it comprises less than two percent of the entire maintained area of a golf course it consumes a disproportional amount of inputs, especially precise fertilization.

Professor Max Scholssberg at Penn State University investigated the effect of N rate and N source on the performance of a mixed stand of annual bluegrass and Penn A-4 creeping bentgrass. He applied from 1.4 to 8.2 lbs of actual N per 1000 square feet with various ratios of nitrate-N to ammoniacal-N in frequent applications of 0.1 to 0.2 lbs of N per 1000 square feet.

As one would expect there was a strong effect of N rate on color, growth and nutrient uptake. However, N source had little effect on overall turfgrass quality and uptake of most nutrients unless N rates exceeded five pounds of actual N per 1000 square feet.

Some key findings did indicate that ammonium sources of N enhanced uptake of P, Mg and Mn. The uptake of Mn could enhance bentgrass resistance to take-all patch often associated with restricted Mn uptake. This was thought to be related to the acidifying effect of the ammonium N sources that allows for increased solubility of theses complex ions.

While no clear results emerged regarding source of N, the lack of response at more usual N rates, i.e., three pounds of N per 1000 square feet per year, was surprising. This was not consistent with previous studies that demonstrated a benefit of ammonium to nitrate ratios in the 50 percent range. This might be related to differential response of high shoot density bentgrass cultivars and more annual types of annual bluegrass. In the end, under neutral soil pH conditions the evidence supports the use of acidifying fertilizers for maximum putting green performance.

From: Schlossberg, M. J., and J. P. Schmidt. 2007. Influence of nitrogen rate and form on quality of putting greens cohabitated by creeping bentgrass and annual bluegrass. Agron. J. 99(1):p. 99-106.

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Scanning the Journals

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His passion for protecting the environment and providing safe and beautiful sports fields for athletes and fans has gained him recognition as a leader in integrated pest management. It is his personal mission to share his knowledge, experience and research with others through presentations, articles and community outreach.

Trotta Named the 2006 Environmental Communicator of the Year

There is nothing I love more than using this page to recognize someone in our industry who is working to benefit each of you reading this column. Today that person is Turfgrass IPM Specialist Kevin Trotta, who, collected the 2006 Turf and Ornamental Communicator's Association (TOCA) Environmental Communicator of the Year Distinction at the association's annual meeting in Napa, Calif. The award is given each year to an active green industry member for outstanding efforts in communicating the benefits of environmental stewardship to a particular audience within the turf and ornamental industry. He is the eighth recipient of the award.

Trotta is an educator, speaker and writer about Integrated Pest Management (IPM) and is an expert in the practical application of those sustainable and environmentally friendly practices in turfgrass management. Trotta began his career in the green industry as a lawn and landscape contractor. He also served as an assistant golf course superintendent before becoming head groundskeeper for the North Rockland Central School District in Garnerville, N.Y., in 1988. Trotta holds a B.S. degree in landscape horticulture from the State University of New York and a M.A. degree in environmental studies from City College of New York.

Kim Heck, CEO of the Sports Turf Managers Association, nominated Trotta for the award because he is an ambassador for environmental stewardship in the green industry. "His passion for protecting the environment and providing safe and beautiful sports fields for athletes and fans has gained him recognition as a leader in integrated pest management. It is his personal mission to share his knowledge, experience and research with others through presentations, articles and community outreach."

Upon accepting the award, Trotta encouraged all of us to be ambassadors for this industry.

"In its early years, the turf industry adopted some pretty heavy-handed strategies and methods. We're guilty of plowing through the latter half of the last century like proverbial bulls in a china shop. We helped create our own image problem," Trotta said.

"But today there's a new breed of green industry professional on the scene: armed with new tools and techniques and aware that if we want to be perceived as stewards of the environment, we must be stewards of the environment.

"Our critics need to meet the modern sports turf manager or golf course superintendent. The public needs to know who we are, what we do and why we do it. Each one of us is a potential representative and ambassador with an opportunity to correct misconceptions and reshape our collective image. We must reach out to our colleagues and impress upon them these responsibilities at this critical juncture," he said.

"We have an opportunity in the coming years to demonstrate that the green industry is not an environmental problem; we're part of the solution."

New York State Turfgrass Association

Calendar of Events

June 19	**Cornell University Field Day**
July 9	**METGCSA Poa Annual Golf Tournament**
August 15	**Sullivan County Challenge**
August 27	**CNYGCSA Poa Annual Golf Tournament**
September 11	**NEGCSA Poa Annual Golf Tournament**
October	**Winning Fields Seminar**
November 13-15	**Empire State Green Industry Show**

For more information on any of these events (518) 783-1229 or go to www.nysta.org.

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Your Weekly Link to Turfgrass Information!

Crane Fly found on LI and be precise with dandelion control.

Week Six at a Glance — **Week 6 May 8, 2006**

ForeCast
Cool conditions through Wed then warm up, but will remain dry. The ideal time for spring dandelion control with 2,4-D has crept into Hudson Valley and some pockets of New England and Buffalo.

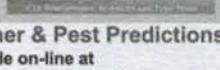
Crane Fly Alert!
Early this week, the invasive crane fly Tipula oleracea was positively reported from Nassau Co. by a home owner who reported the adults as a nuisance.

Gazing in the Grass
Dandelion control best in fall but in spring avoid ester formulations when air temp exceeds 80 to avoid injuring adjacent ornamentals

Program Note: This TUESDAY!
LIVE FROM CORNELL TO YOU!
Turfgrass Management ShortCUTT's:
Tuesday May 9 6:30-8:30pm

Topics include:

Irrigation issues, Spring Pest Update, Dandelion Control and Prepping for Summer Stress



Weather & Pest Predictions

Available on-line at

http://www.nrcc.cornell.edu/grass/

Temperature: Below normal temps except western NY (2 above)
Base 50 GDD: South to DC 60 for the week and 300 to date; NYC/NJ/SEPA 40 for the week and 175 to date; HudVal/LI 30 for the week and 120 to date; Northern 15 for the week and 70 to date. About 3 days ahead of last year and about the same for the 30 yr average.
ET: 1" region-wide. Moisture deficits of 1" widespread now.
Precip: Except for coastal New England and eastern LI that rec'd more than 1" last week most areas were well below 0.5".
2" Soil Temps: Low to Mid 50's and low to mid 60's north to south
Weather Forecast: Dry weather pattern continues through Wednesday with cooler than normal temps expected to be 3 below normal. Highs in the 50-60's and lo's in the 30-50's. Later week should see a warm up into the high 60's but still dry.
Dandelion Forecast: The ideal time for dandelion control with ester and amine formulations has crept well into NY metro/NJ area as well as Hudson Valley and spots in New Eng and Buffalo.

Regional Observations

Western NY (Monroe): Lots of reports of Crane Fly adults.

Central NY: CORRECTION Yellow underwing damaged at 10-12/1000 square ft. cause damage not per sq ft.
Capital: Lingering grub damage, some seeding underway, Cool season brown patch sample.
ADK: Cold and dry still no dandelions in bloom
Westchester: Establishment questions regarding Zeysiagrass, nights still cool and tent caterpillar reports.

Cornell SportsTurf Report
Joann Gruttadaurio

Dandelion Control in Sports Fields: For spring control of dandelions apply herbicides when the weeds are in full bloom and best if in the puff ball stage (see FORECAST website for ideal timing). Do not mow before applying the herbicide so you can maximize foliage area and for more effective control wait 3 days before mowing so the herbicide will translocate and do a more thorough job. It would be best to make a herbicide application when the soils are not too dry and weeds under stress. As far as herbicide selection the amine formulations offer less chance of drift to non-target plants.

Crane Fly Update
Dan Peck, Ph.D., Soil Insect Ecologist
Cornell University

Long Island in on the Crane Fly Map: Early this week, the invasive crane fly *Tipula oleracea* was positively reported from Nassau Co. by a home owner who reported the adults as a nuisance. This confirms

the idea that these new invasive pests occur farther afield than the Erie Canal corridor in west and central NY.
Scouting and detection: Once again, this is the time to scout for T. oleracea. Adult emergences have been reported this week from Lockport, Spencerport, Rochester, Canandaigua and Seneca Falls. This period is expected to last 2-3 weeks at any one site. You will see the pupae sticking up from low-mown turf like little twigs. They will be in the rough and fairway as well, but they are easiest to spot on the low-mown tees and greens. You may also see adults halfway emerged from these pupae, or notice the adults flying about low over the grass. The activity of birds feeding on them may also signal populations. Finally, we have seen some limited damage on greens related to grazing of larvae around holes where they have established to pupate. Some of this appears to be damage that was made over winter when larvae may have been up feeding under warmer conditions in January. In other cases it appears to be fresher damage made over the last week or two of larval feeding before pupation.

Management considerations: Once you detect crane flies and have sent samples off to me for confirmation, you will need to consider their management. If they are present on greens where tolerance will be very low, you should consider a preventive application on that subset of greens and approaches where they have been detected. Roughs and fairways will be able to support much higher populations. My recommendation is to not make a preventive application, rather to wait until June and combine their control with that of white grubs.

ABW Update: The window for preventive applications against adult ABW is upon us (Forsythia half gold/half green is a useful plant phenological indicator). Adults may have arrived a little ahead of schedule. In Ithaca, for instance, first, second and third instars have already been detected on the roughs bordering fairways. The oldest of these would have been laid as eggs in early April, maybe from the first overwintering adults to emerge and make their way toward the fairway. So it may behoove superintendents that are contemplating preventive applications to make them a little earlier rather than a little later this year.

Rutgers Diagnostic Lab Update
Richard J. Buckley

Turf: Golf turf samples with very active infections of Rhizoctonia cerealis, the cause of yellow patch. This disease is also known in some circle as cool season brown patch. It is not uncommon to find active yellow patch as late as June in our area during any cool and rainy period. The same goes for pink snow mold (aka: fusarium patch). Be aware this fungus tracks easily with mowers, so the symptoms often manifest as irregular streaks of bronze or thinning turf. A sample with overwintering populations of anthracnose basal crown rot was diagnosed. Infected plants that managed to survive the winter were beginning to decline under the slightest stress. In fact, every yellow plant in the plug had some degree of fungal activity at the crown. To check your own, take a pair of tweezers and tug the yellow plants. Infected plants break off at the crown to reveal a black fungal stroma.
Ornamentals: Several assorted conifers – Leyland Cypress, various spruces and pines, yew, and lots of junipers – have been diagnosed with winter injury this week. Some of these samples also have various diseases including: juniper tip blight on the juniper and chamaecypris and a huge population of pine oyster shell scale on black pines (check between the needles in the fascicle to find them) and lots of spruce spider mite eggs on these samples. Botryosphaeria canker was identified on pear. Lastly, our buddies the two species of the fungus *Volutella*, *Volutella buxi* and *Volutella pachysandrae* are still coming into the laboratory on their respective hosts, boxwood and pachysandra. The most recent pachysandra sample also had quite a few euonymus scales.

Nuisance Wildlife Management
Paul Curtis, Ph.D.
Cornell University

Geese: Research has shown that Canada Geese maintain strong site fidelity, i.e., they will always return to where they were born and raised. However, if birds can be moved in the first year at least 50 miles, studies have shown they do not return to their birth place. Dogs and evening laser lights remain the most effective deterrents, limited success with chemical deterrents.

Moles/Voles: Trapping remains the most effective strategy for the eastern mole downstate and the hairy and star nosed mole upstate. The hairy and star nosed mole traps must be placed deeper as they are deeper burrowers than the eastern moles. There is little to no data on Talpirid (gummy worm baits) for mole control.

Gazing in the Grass
Frank. S Rossi, Ph.D.

Dandelion Control: Each we are reminded that fall is the ideal time for broadleaf weed control as herbicides are easily translocated to underground storage organs such as tap roots or rhizomes. Still there is need for spring broadleaf control especially for dandelions when in bloom. Research at several midwestern universities through the 1990's found that for a single spring application of 2,4-D plus 2,4 DP ester provided acceptable control (>80%) when the base 50 degree day accumulation exceeded 145. The amine formulation was best after GDD was 180. The ester formulation will have a strong odor and should NOT be used when air temps exceed 80 as the risk of volatility increases and vapor drift can injure adjacent ornamentals.
Seedhead Suppression Follow up: Most areas north of NYC should be able to get by with a single well timed application of a PGR for seedhead suppression. However, if you are interested in a second application keep in mind it is best to wait 3 to 6 weeks and be sure you are on a Primo program. More than two applications of Proxy, especially without Primo, has led to scalping as false crowning problems elevates the crown tissue into the mower path.

Feature Story

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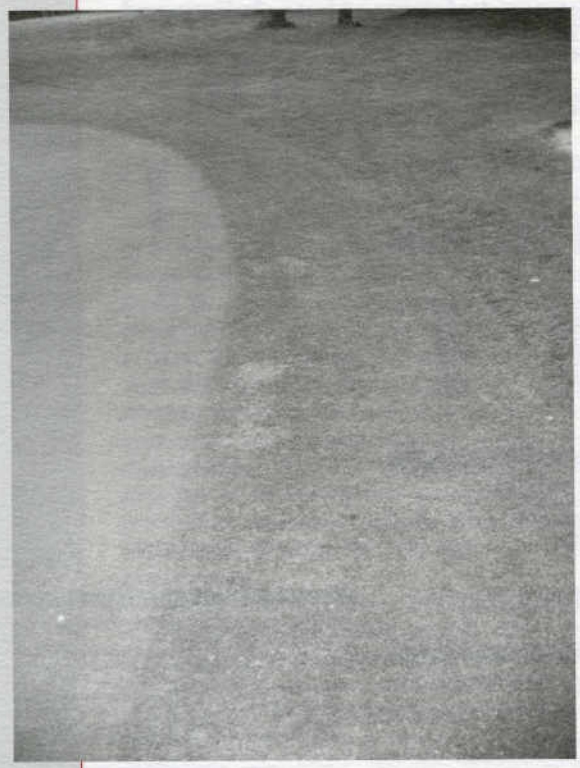
outline our ecological approach to address this issue, and the implications we expect our results to have for improved management of annual bluegrass weevil in *Poa annua*.



Annual bluegrass weevil damage obvious in collar and other perimeter areas where annual bluegrasses may be under stress.

The Problem

The annual bluegrass weevil is an increasing pest problem, in a high value and risk-adverse commodity, whose management relies completely on chemical insecticides. Many superintendents still refer to it as the "Hyperodes" weevil, a name that conjures up the "metropolitan nightmare" that haunted Downstate superintendents in its heyday. The insect is most precisely known as *Listronotus maculicollis*, or the annual bluegrass weevil (ABW). The name "Hyperodes" refers to its former taxonomic classification, and since that classification has changed, we should discourage referring to it by that name.

ABW is a native insect, born and raised in the U.S., and reportedly occurs in some 40 states. It was first linked to turfgrass injury in Connecticut 75 years ago (1931). Since then its area of impact has broadened immensely. In the past 10-15 years, ABW has burgeoned to become one of the most problematic pests of high-maintenance turf throughout the Northeast. Mid-Atlantic states like Maryland and New Jersey have recently joined NY, PA, New England, Ontario and Quebec in hosting damaging outbreaks.

Annual bluegrass is often considered a weed, especially when it encroaches on bentgrass stands. Given its competitiveness, *P. annua* almost inexorably invades to dominate fairways, greens and tees. Because it can provide an acceptable playing surface, more and more golf course superintendents resort to managing it rather than combating it. And as those managed *P. annua* habitats expand, so do possibilities for problems with ABW.

Every spring, superintendents contend with adult movement from off-course overwintering sites to the greens, tees and fairways, resulting in heavy damage to *P. annua* in the collars and surrounding areas as the insect completes 2-3 generations. Females insert eggs between the leaf sheaths. Younger larvae feed within the stem whereas older larvae drop down to feed on the crown from crude burrows in the surface, killing up to 20 stems over the course of development. Feeding adults will notch grass blades but causes little or no damage as it is cut away in the next pass of the mower. Feeding injury due to larvae is expressed as growing areas of yellow and brown spots, usually first noticed around the collar and perimeter of the greens, tees or fairways. High populations will cause substantial areas of dead turf that severely impact the visual and functional quality of golf course turf.

The Challenge

ABW is a problem of growing concern because its principal host, *P. annua*, is increasingly accommodated rather than fought, and because there are no real control options other than pyrethroid insecticides, which may be applied 2-5 times a season. Under this scenario, there is an urgent need to develop other control alternatives; insecticide options will undoubtedly be more limited in the future due to new regulations and the likelihood of pesticide resistance development. We also need to better understand the association between ABW and the golf course landscape; in addition to better targeting control applications, a stronger basic foundation will uncover entirely new ways to intercept and suppress populations.

The overall challenge taken on by our research group at Cornell University is to strengthen our understanding of ABW's association with turfgrass habitats. By doing this, we hope to uncover new control opportunities and to develop novel management approaches that will reduce reliance on chemical insecticides. We therefore seek to (1) curb the increasing impact of ABW, (2) reduce our dependence on pyrethroids by developing new control alternatives, and (3) fill knowledge gaps to better understand the association between ABW and golf course landscape.

While our current best management practices are relatively straight forward, there are serious limitations to this approach. The overall traditional strategy has been to target

adults with insecticides. To do this, adults must be targeted in the early spring after they have recolonized the fairway, greens and tees from their overwintering sites in off-play areas like tall grass and the litter along tree lines. The phenological window for this period is between the full bloom of Forsythia and flowering dogwood (or when Forsythia is half gold/half green). This is our best guess at the window when adults have recolonized and when they have started to lay eggs that will lead to the spring generation. Choose a relatively insoluble insecticide so it stays in thatch where adults are active. Synthetic pyrethroids (Bifenthrin, Cyfluthrin, lambda-Cyhalothrin, Deltamethrin) are the best options. Periphery sprays along low-mown turf, the areas most susceptible to damage, are usually sufficient. As required, the second generation of adults should be targeted around July 4.

A major limitation to this approach is reliance on one class of insecticides and the potential for resistance development. Indeed, preliminary data from the University of Connecticut support the idea that some ABW populations may harbor extremely high levels of resistance to pyrethroids. If this is the case, it is one factor that may have contributed to control failures in 2005. Another limitation is that there are no products with a proven track record against larvae. Nevertheless, the only established thresholds are based on numbers of larvae, not adults. If scouting shows a preponderance of larvae or pupae, then insecticide treatments should be withheld until they have matured into adults. Besides pyrethroids, no other alternative compounds or tactics can be recommended (other than removing *P. annua*). Under this scenario, success depends on timing. A best-case scenario is one well-timed perimeter spray; a more common scenario is 2-5 applications, sometimes with widespread fairway applications.

The Perspectives

Research advances have led us to identify three broad activity areas that will lead to more effective ABW control and promote reduced insecticide alternatives: (1) biology, ecology and behavior, (2) management alternatives, and (3) integrated pest management (IPM) tools.

First, we need to fill critical knowledge gaps in our basic understanding of ABW biology, behavior and ecology. Despite advances over the last ten years, certain critical gaps remain, especially in the face of our changing control environment. Our goal should be to fill bioecological information gaps to establish the foundation necessary to uncover and exploit new or enhanced control opportunities. Some priorities would be to (a) establish current geographical distribution in Northeastern and Mid-Atlantic states to monitor spread in impact, (b) describe the overwintering biology, (c) establish patterns of adult dispersal, population fluctuation and phenology, (d) describe and quantify reproductive biology, and (e) more firmly establish host plant associations such as adult oviposition and larval feeding preferences.

Annual bluegrass weevil adults preparing to lay eggs in stems of annual bluegrass.

Second, we need to pursue other management alternatives with the goal of identifying, developing and promoting new cultural, biological, chemical and genetic control options. Some priorities would be to determine the effect and role of (a) cultural practices such as mowing height, fertility and barrier strips of non-preferred grasses, (b) biologically-based approaches such as entomopathogenic nematodes, spinosad and Bt, (c) new chemical control products or new uses for current products, and (d) host plant resistance.

Third, we need to develop improved IPM decision tools with the goal of refining the targeting of control tactics, maximizing efficacy of controls, and reducing inputs of traditional chemical insecticides. Some priorities would be to (a) refine and validate a robust degree-day model for predicting ABW phenology, (b) refine action thresholds, (c) develop more efficient techniques for laboratory rearing and field

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To really interpret the association between ABW and the golf course, we need to conduct highly detailed studies on how populations of the different life stages and generations develop in space and time, how the insect chooses overwintering sites, and how adults move between overwintering and developmental sites.

Answering these questions will strengthen our understanding of the association between ABW and the turfgrass habitat. It will lead to new insights for management programs such as more robust forecasting to improve the targeting of control tactics and reduce insecticide use.

sampling, and (d) conduct outreach to promote the most effective and least pesticide-intensive control tactics in the context of our best understanding of *P. annua* management.

Our Approach

As far as we are aware, no field studies have addressed this pest in Upstate NY. Studies conducted Downstate suggest specific phenological windows for targeting adults as they recolonize in the spring. Nevertheless, we have no measure of how applicable these generalizations are across other areas of the insect's range. Moreover, the resolution of previous population studies has not afforded a detailed look at when the life stages occur and how the generations develop over the course of the season. To really interpret the association between ABW and the golf course, we need to conduct highly detailed studies on how populations of the different life stages and generations develop in space and time, how the insect chooses overwintering sites, and how adults move between overwintering and developmental sites.

In response, we have launched a series of studies designed to interpret the association between ABW and the golf course landscape. Our expectation is to exploit this understanding to improve IPM. Our objectives are to (a) describe the patterns of variation in seasonal fluctuations and phenology, i.e. what goes on during the growing season at the developmental sites on low-mown turf?, (b) determine the factors that affect overwintering site selection and success, i.e. what goes on during the off season at the protective overwintering sites off the low-mown turf?, and (c) document the relationship between overwintering sites and developmental sites, i.e. how does the insect navigate between sites where it overwinters and sites where it feeds, reproduces and develops?

These studies are the subject of a Masters Thesis in Entomology conducted by Maria Derval Diaz at Cornell University. Over the last two years, her activities have involved (a) weekly population surveys through soap flushes and soil core sampling at two fairways in Upstate NY, (b) extracting and classifying all captured life stages to reconstruct the development of spring, summer and fall generations through space and time, (c) monitoring the directional movement of adults through captures in linear pitfall traps, (d) conducting distribution surveys to establish overwintering sites with respect to distance from the fairway and type of litter substrate, and (e) teasing out differences among overwintering substrates in terms of preference and survivability by forcing adults to overwinter under "choice" and "no-choice" experimental scenarios. Details of the results of her research will follow in a companion article slated for a future issue of CUTT.

Implications

Overall, we expect Diaz's research to provide new understanding of where the insect overwinters, how and when it recolonizes the golf course, and how population development proceeds over the course of the season. This specifically includes factors that influence in the selection of overwintering sites, number of generations a year, timing of the life stages, and fluctuations in abundance.

In our lab's broader research agenda, we are working to answer a series of questions related to three areas. First, regarding the patterns of variation in seasonal fluctuations and phenology: How do populations and generations develop in space and time? How much does abundance and phenology vary from site to site and year to year? Can this information help us identify patterns, new control opportunities, or better ways to target pesticides? Second, regarding factors that affect overwintering site selection and success: Can adults overwinter on greens? Is white pine litter a preferred substrate in which to overwinter? Could ABW be controlled at overwintering sites? And third, regarding the relationship between overwintering sites and developmental sites: How far will adults disperse? Are there times of the year when flight is important, or do they mostly move by walking? How is adult movement guided? How might adults be intercepted as they move in from overwintering sites or as they leave to overwintering sites?

Answering these questions will strengthen our understanding of the association between ABW and the turfgrass habitat. It will lead to new insights for management programs such as more robust forecasting to improve the targeting of control tactics and reduce insecticide use. And beyond golf courses and turf, it will contribute to our overall understanding of how landscapes might be interpreted and manipulated in managed ecosystems to improve pest management strategies.

Daniel C. Peck, Ph.D. and
Maria Derval Diaz

Letter to the editor:

Dear Frank,

I have read your recent/current article, Good News, Bad News regarding golf courses and golf play.

I do agree with some of your thoughts but as a long time professional and sometime Golf Superintendent I do not think one has to be P.C. and adopt the "organic label". I suspect most of the Supers today support that approach and strive to achieve that end.

The superintendent today has far more mechanical tools and equipment and advances in the biological controls than I did graduating from Cornell in 1961 and going directly to a course as a Superintendent. The label wouldn't make it work, the management skills of the Super will, all the technical information is out there, but the leadership skills are much harder to come by.

I do not play as much golf as I would like for a couple of reasons. I do not like to play where a golf car is required because of the long walks from greens to the next tee or because the course wants to increase revenues, and usually the 3rd reason is to speed up play. I prefer to walk, observe the course, enjoy the facility, etc. I will observe the golf rules and let the faster players through but they will be missing the best part of the game.

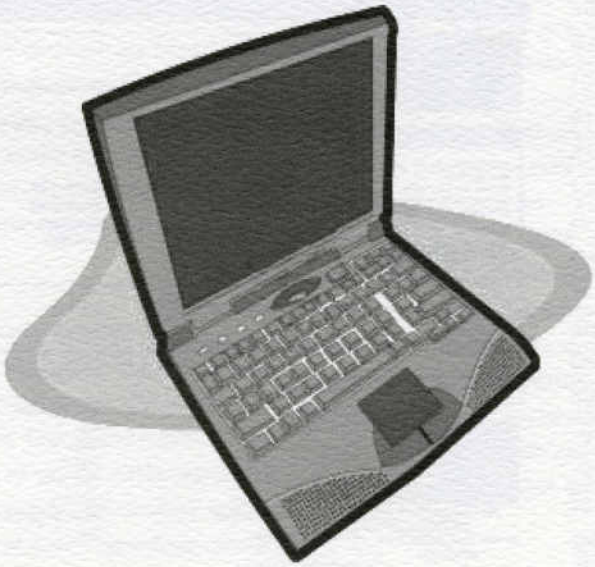
Let me give you an example. A few years ago my wife and I were playing late in the day at a very well known course and we were moving along slowly. There were a couple of foursomes ahead of us moving slow. The Ranger came charging up in his white golf car and said we would have to leave as we were holding up the foursome behind us. I looked back and yes there was a foursome in a Cushman Truckster and they were the last group on the course. At the next tee I had time to talk to this last "foursome" and confirmed what I thought – they were course employees playing a few holes and were not in a rush!

You see Frank, there is a bunch of us retired folks out here that the industry is missing just because of some of my above comments.

Perhaps the time issue should be considered temporary while one has a young family, as they are more important than golf. On the other hand when they are young let them start in youth league so it can be a family event.

I still do some consulting work in the Green Industry and I usually find the problems involve management skills and approaches rather than the technical aspects.

Sincerely,
John C. Sundholm, Lt. Col. USAF (Ret.)
Cornell Class of 1961
Iona College MBA 1974 in Organizational Behavior
Past President of NYSTA
40 Solid Years in the Green Industry



The superintendent today has far more mechanical tools and equipment and advances in the biological controls than I did graduating from Cornell in 1961 and going directly to a course as a Superintendent. The "organic" label wouldn't make it work, the management skills of the Super will, all the technical information is out there, but the leadership skills are much harder to come by.

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Healthy Ecosystem

Additional cancer and other health risk information is included in EPA risk management documents that are available for some but not all of the active ingredients in the database. The Bibliography provides a complete listing of the risk management documents currently available.

Healthy Ecosystem

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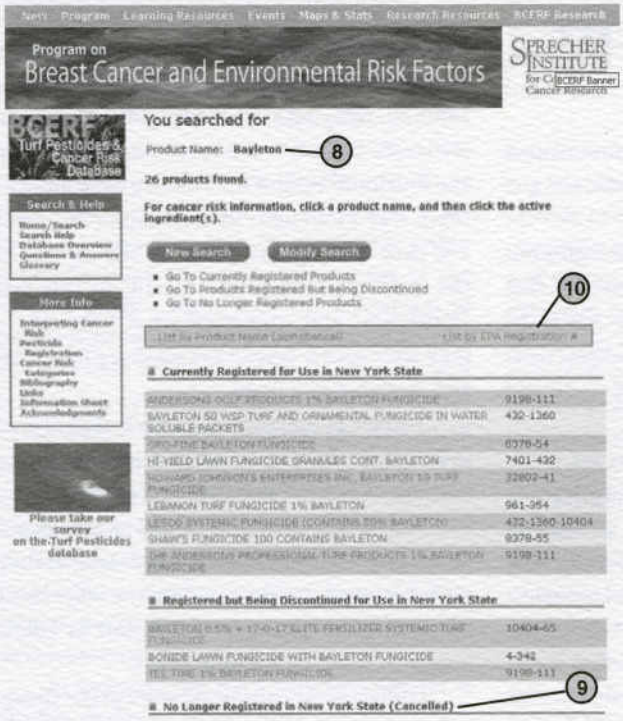


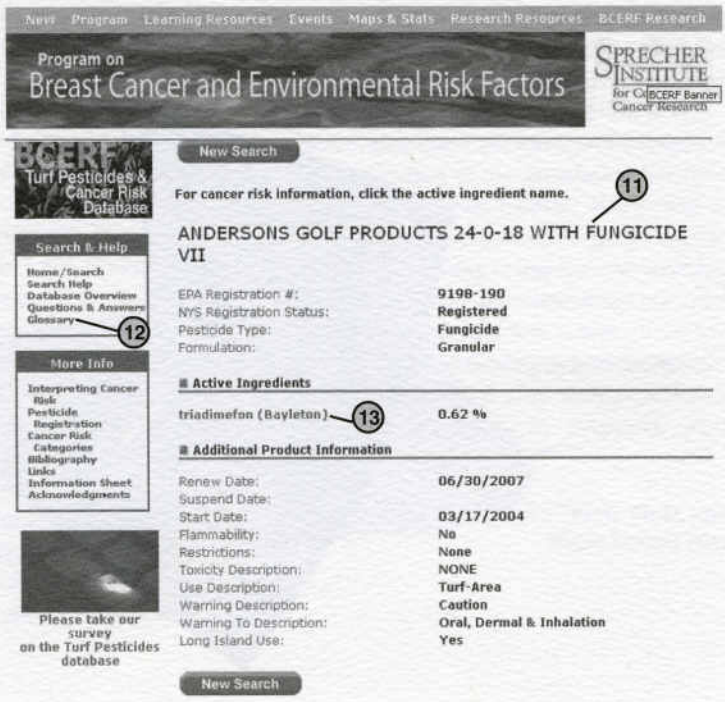
Cancer Risk Categories link in the More Info box on the left side of the page **(4)**.

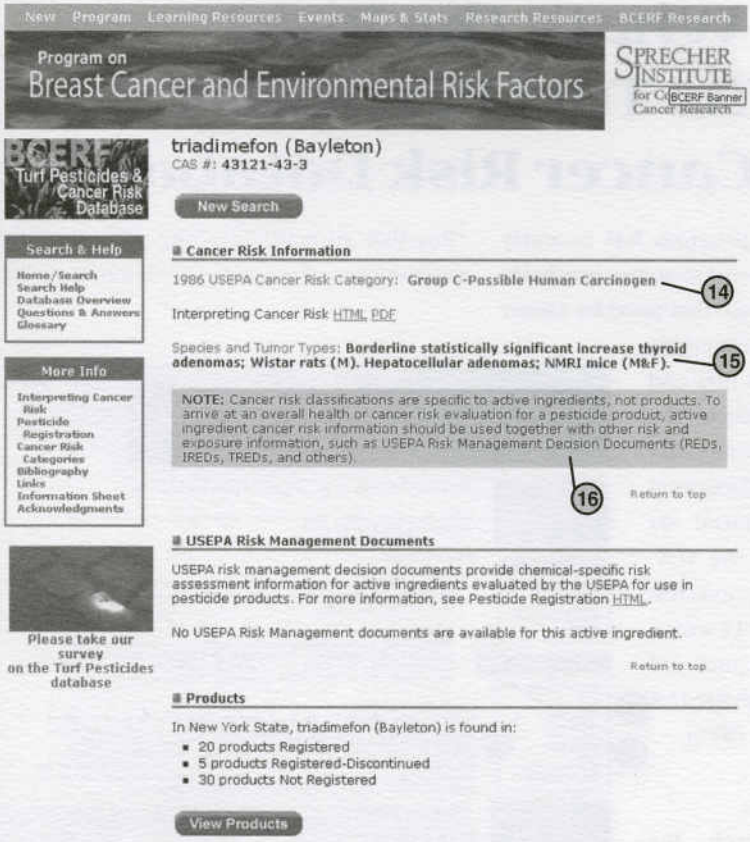
Additional cancer and other health risk information is included in EPA risk management documents that are available for some but not all of the active ingredients in the database. The Bibliography **(5)** provides a complete listing of the risk management documents currently available. These documents are also provided on the Results page for each active ingredient search where available. Risk management documents, known as Re-registration Eligibility Decisions, or RED documents, are documents provided by EPA as part of the pesticide re-registration process. For each chemical being re-registered for use in a pesticide product, the documents provide details on how the EPA evaluated the chemical and its associated human and environmental health risks and determined what levels and types of use would be acceptable.

Additional detailed information about pesticide registration and re-registration is available in the More Info box **(6)**. Information on interpreting cancer risk is also available to view or print **(7)**.

Find pesticide products:

Since the full names of pesticide products are often long and complicated, a search using one or more keywords **(8)** enables quick and easy access to corresponding products. Products in the database are limited to those that have ever been registered for turf and lawn use in NYS, and then only those that include active ingredients evaluated for cancer risk by EPA. Cancelled products **(9)** are included because BCERF focus groups with turf pesticide applicators revealed that many applicators are





information is available, including the cancer risk category **(14)** and the species of laboratory animal tested and tumor types found **(15)**. An important note on this page informs users that cancer risk classifications are specific to active ingredients, not products, and that a variety of risk information found in EPA risk management documents should be used to estimate the actual cancer risk associated with use of a particular pesticide product **(16)**. Links to Interpreting Cancer Risk, EPA risk management documents, and turf and lawn care products that include the active ingredient are included on this page.

At this time, the *Turf Pesticides and Cancer Risk Database* does not include all active ingredients and associated turf and lawn care products registered in New York State. Cancer risk has not been fully evaluated for many active ingredients. Cancer risk information is not available for all chemicals because federal pesticide registration laws have, until recently, only required full evaluations of cancer risk for chemicals that will be used in pesticides that also have food-crop uses. Federal legislation effective October 1, 2006, now requires that, over time, all chemicals proposed for pesticide registration or re-registration are evaluated for a variety of health risks, including cancer. The process of accumulating new cancer risk information on these chemicals will take many years. The *Turf Pesticides and Cancer Risk Database* will be updated as this information becomes available.

Heather Clark, Ph.D.

interested in the risks of products that they may have used in the distant past but no longer use. Product results can be sorted by name alphabetically or by EPA registration number **(10)**.

Get product details:

Clicking on a product takes you to the Product Details page **(11)** where product-specific information can be found. Terms on this page and elsewhere in the database are hyperlinked to their definitions in the Glossary **(12)**, which is always a click away on every page in the Search & Help box on the left side of the page. Clicking on a product's active ingredient **(13)** takes you to the Active Ingredient page for that particular chemical.

Get active ingredient details:

You can get to the Active Ingredient page from the Product Details page, the Browse All button or the Active Ingredient menu on the Home/Search page, or via the active ingredient list produced from a cancer risk category search. Once here, a variety of active-ingredient-specific

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At this time, the Turf Pesticides and Cancer Risk Database does not include all active ingredients and associated turf and lawn care products registered in New York State. Cancer risk has not been fully evaluated for many active ingredients.

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The Turf Pesticides and Cancer Risk Database integrates information on chemicals evaluated for carcinogenicity by the U.S. Environmental Protection Agency (EPA) with 111 active ingredients found in turf and lawn care pesticides registered for use in New York State (NYS).

What's the Risk? The Turf Pesticides and Cancer Risk Database

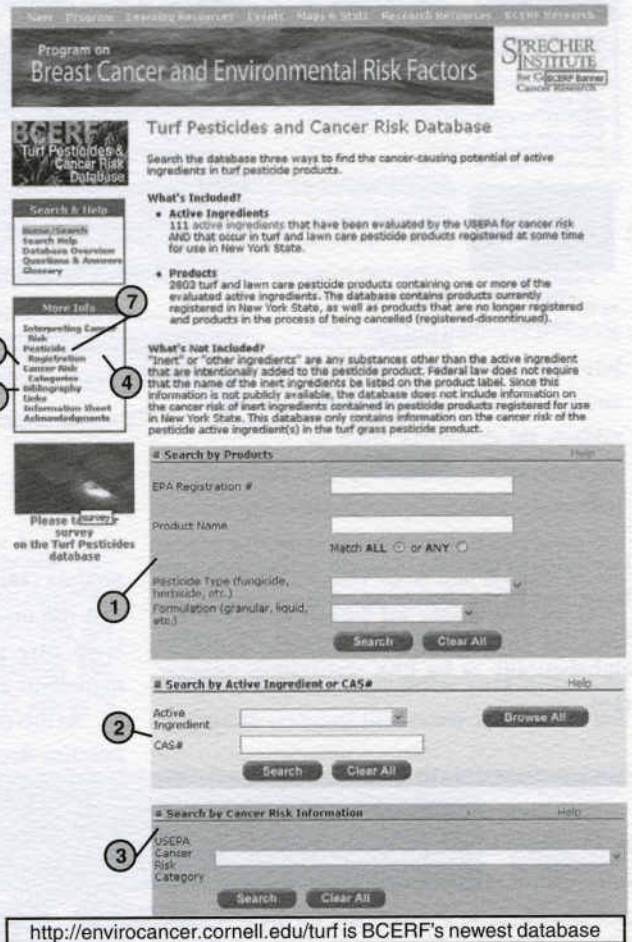
The BCERF program has recently launched an easy-to-access, searchable online database that provides cancer risk information for chemicals found in over 2,800 turf and lawn care pesticide products. The *Turf Pesticides and Cancer Risk Database* integrates information on chemicals evaluated for carcinogenicity by the U.S. Environmental Protection Agency (EPA) with 111 active ingredients found in turf and lawn care pesticides registered for use in New York State (NYS).

Search several ways:

Users can search for information several ways: by product **(1)** or active ingredient **(2)**, or by cancer risk category **(3).**

Find cancer risk information:

Cancer risk information in the database is available in several forms. Users can look up or search by the EPA cancer risk category assigned to a particular chemical active ingredient, such as "Carcinogenic to Humans" or "Possible Human Carcinogen." Detailed descriptions are provided by clicking on the



http://envirocancer.cornell.edu/turf is BCERF's newest database

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