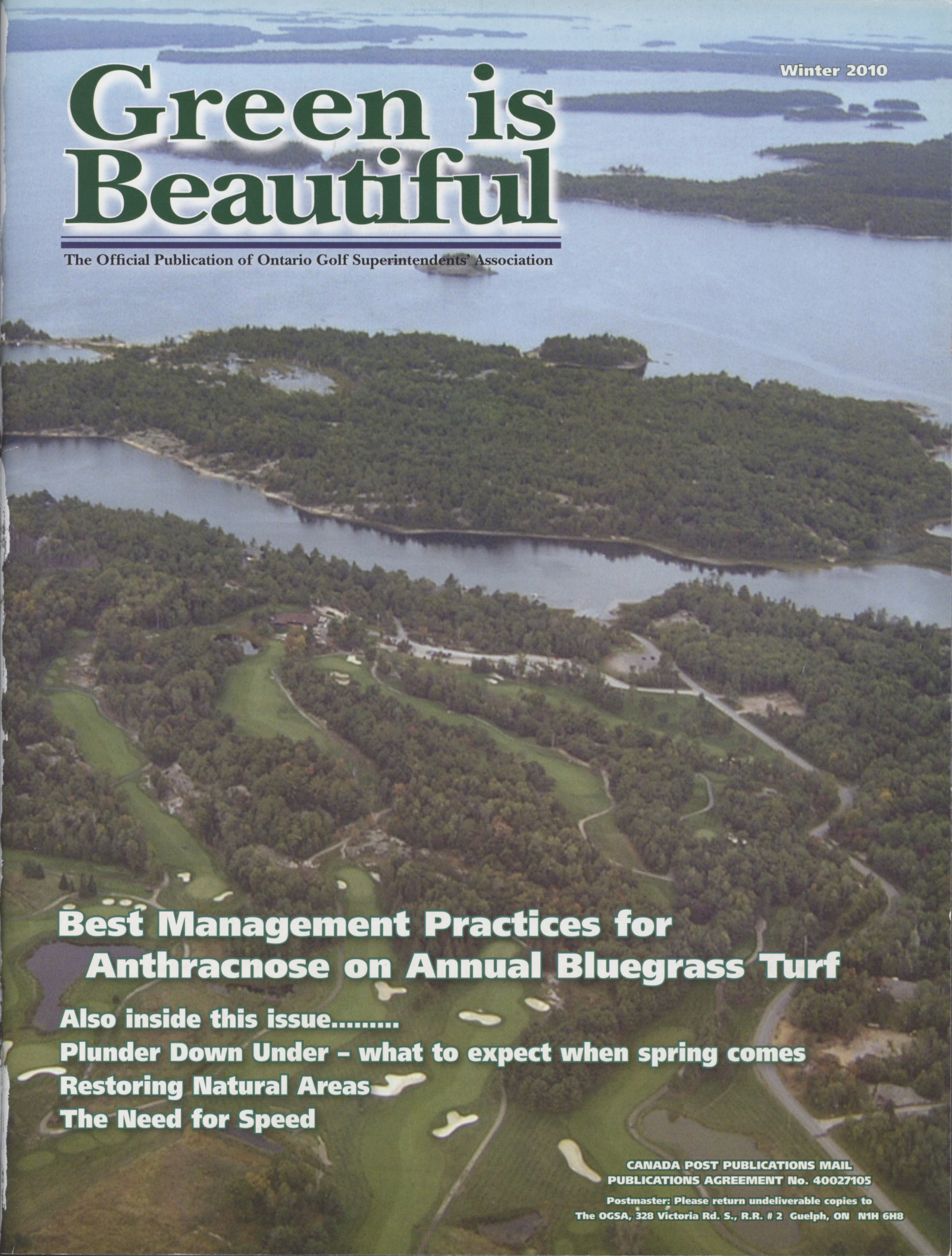


Winter 2010

Green is Beautiful

The Official Publication of Ontario Golf Superintendents' Association

Best Management Practices for Anthracnose on Annual Bluegrass Turf

Also inside this issue.....

Plunder Down Under – what to expect when spring comes

Restoring Natural Areas

The Need for Speed

CANADA POST PUBLICATIONS MAIL
PUBLICATIONS AGREEMENT No. 40027105

Postmaster: Please return undeliverable copies to
The OGSA, 328 Victoria Rd. S., R.R. # 2 Guelph, ON N1H 6H8

GRUB PROTECTION THAT LASTS, AND LASTS, AND LASTS.

Introducing **NEW** Arena insecticide, the preventative and curative grub control with maximum application timing flexibility. Apply anytime from May to September for superior white grub control and control over a broad spectrum of pests for improved turf quality.

Arena™
50 WDG INSECTICIDE

VALENT® | www.valent.ca | 519-822-7043
Read and follow the label instructions before using.

ENGAGE AGRO
1-866-613-3336

President's message

by Jeff Alexander
Parry Sound Golf & Country Club

As I write my first President's message, it's hard not to reflect on the last eight years that I have been involved with the OGSA. I remember Jim Flett calling me and asking if I would like to be nominated to run for the Board of Directors. At the time I was very busy with the Georgian Bay Golf Superintendents Association, but Jim took the time to discuss the importance of the OGSA and being engaged with your provincial association. Jim was a big influence in helping me make the decision to become a director and I'm so glad I did. Along the way you work with so many great individuals who volunteer their time to make our profession better. I would like to take this opportunity to thank each president who I served under; Jim Flett, Mark Piccolo, Rob Ackermann, Paul Scenna, Robert Burrows, Sean Desilva, Jeff Stauffer and Randy Booker. Thanks so much for your support, leadership and friendship over the years.

Speaking of past presidents, the OGSA held it's 2nd Past Presidents' Luncheon at Credit Valley Golf and Country Club on January 14th. The afternoon was filled with some great camaraderie, stories of the past and a good discussion on the association's direction into this new decade. Thanks to all the past presidents that attended and a special thank you to our host Jeff Stauffer for organizing the day.

I had the opportunity to attend the Golf Association of Ontario Awards Ceremony and Annual General Meeting at Maple Downs Golf & Country Club on January 30th. The Golf Association of Ontario (GAO) has built their new home at Wooden Sticks Golf Club and has signed a new lease agreement for the next 15 years. Although membership numbers where slightly down the association financially ran a surplus. One great thing is that our player development program is really in great shape, having our province win 6 of the national championships in 2009. In other news the GAO was able to hire their provincial coach for this year to continue to run programs and work with our golfers. The GAO donated funds to the Ontario Turfgrass Research Foundation. OTRF President David Kuypers was on hand to accept the cheque and graciously spoke of our profession and why we need continued research in our industry. A special presentation was given by the Royal Canadian Golf Association on their new branding named "Golf Canada". Over the last year they have built some strong relations to help them market and sell their branding and will be working with all provinces to unveil and promote it. Look for the new Golf Canada Cards that any provincial member can purchase for special privileges.

Continuing education is an important part of being a golf course superintendent. I hope you had a chance to participate in the 2010 Canadian International Turfgrass Conference and Trade Show. By attending this show you have shown that you are committed to improving your profession, career and facility. Socializing with colleagues and building new relationships are part of the process, providing a learning opportunity as we get ready for another golf season. The Awards Luncheon showcases our scholarship winners. in the past year. Congratulations to our recipients Michael Herbert Newton, Alex Barratt, Tyler Windfeld and Michael Trainor. The 2010 show is a joint effort between the CGSA and the OGSA. I would like to thank Ken Cousineau and his staff at the CGSA for all the hard work they have done to make this show a success. Thank you to the Conference Co-Chairmen, Jarrod Barakett and Chris Andrejicka and their committee on a job well done!

The golf industry in Ontario looks strong with associations being governed by individuals that truly care about the future of the game of golf. The growth and viability of the game is everyone's responsibility. Make sure you check *Calendar of Events* on our website for association updates. Sign up for some events this year and take advantage of what your association has to offer.

I am very honoured and humbled to be the 55th President of the Ontario Golf Superintendents' Association. At anytime, please feel free to contact me with concerns, comments or suggestions. All the best for a successful 2010 golf season!

"Green is Beautiful" is Printed on Recycled Paper

ONTARIO GOLF SUPERINTENDENTS' ASSOCIATION
Guelph Turfgrass Institute
328 Victoria Road South
Guelph, ON N1H 6H8

Ph: 519-767-3341
Toll Free: 877-824-6472
Fax: 519-766-1704
Email: ogsa@gti.uoguelph.ca
Website: www.golfsupers.on.ca

Contents

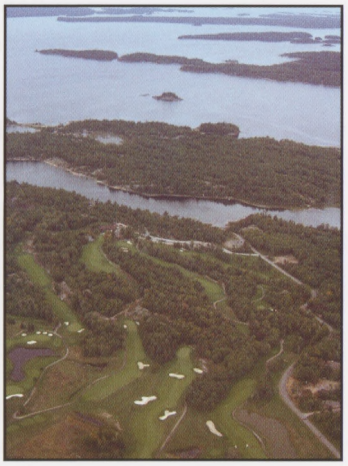
BEST MANAGEMENT PRACTICES FOR ANTHRACNOSE ON ANNUAL BLUEGRASS TURF 22
2nd Annual Gardening Seminar 20
Above the hole 36
Editorial message 5
From roots to shoots 8
Golf course highlight - Mill Run Golf Club 21
Health & safety 11
Looking back 41
Off the fairway 38
On the REEL side of things 34
President's message 3
Second to one 35
The need for speed 12
Turf or consequences 42
What's new 6

Advertisers

Agrium Advanced Technology - Acelepryn 43
Agrium Advanced Technology - Sales 20
Almack Agronomic Services Inc. 40
Aquatrols 35
Bartlett Tree Experts - Canada 39
Bayer Enviromental Science - Triton 18
Braemar Building Systems 19
Burnside Golf Services 39
DCS Agronomic Services 11
Douglas Wood Large Tree Services 19
Engage Agro Corporation - Arena 2
Enviro Sol - Looking for Calcium 13
Evirol Sol - Solu-Cal & Solu-Cal S 15
Fast Forest 40
GC Duke Equipment 16
Green Horizons Group of Farms 16
H & M Turf Ltd. 3
Maple Turf Supply 39
Master's Turf Supply Ltd. 40
Ontario Seed Company 7
Plant Products - The Thinking Super's Solution 37
Robert Kains Golf Course Design Ltd. 40
Turf Care Products Canada - Irrigation Div. 14
Turf Care Products Canada 44
United Agri Products Inc. - Respond 3 19
United Agri Products Inc. - Rhapsody 16
Vanden Bussche Irrigation 20
Zander Sod Co. Limited 7

Green is Beautiful

The Official Publication of Ontario Golf Superintendents' Association



COVER PICTURE

Aerial view of Parry Sound G&CC, looking west out towards the beautiful 30 thousand Islands of Georgian Bay

photo by Ken Webb, Senior Forestry Technician of Westwind Forest Stewardship and Greens Director and proud member of Parry Sound G& CC.

OGSA is committed to serving its members, advancing their profession, and enriching the quality of golf and its environment.

Layout, Design & Printing provided by

G·R·A·P·H·I·C SERVICES PRINTERS & LITHOGRAPHERS

Tel: 519.763.5745 • Fax: 519.763.9532

32–34 Essex Street • Guelph, Ontario • N1H 3K8

e-mail: info@graphicservices.ca

www.graphicservices.ca

Editorial message

by Dorothy Hills

Perhaps one of the most important concept developed by man is the sense of time. We all live in the field of time...past, present and future. There's no time like the present - time on your hands (don't you wish) - time is of the essence - time marches on – time waits for no man.

I hope you have time before the busy spring golf season arrives to relax and read some of the interesting articles presented in this issue. Together with our regular contributors, members, professors and researchers have given their time to provide you with up-to-date information and perspectives on many various aspects of the golf industry.

Take a look at the photo on page 40 to see if you can identify the Past Presidents who met to participate in the luncheon, recently held at the Credit Valley Golf & Country Club. A great time was had by all.

Due to the timing of the CGSA/OGSA Joint Conference, we are unable to publish the usual conference summary, photos and articles in the Winter issue, as the publication should be on your door step by the time the dust settles from the 2010 conference and trade show. However, stay tuned in, as we will endeavour to put some of the photographs of our award winners on the web site, and provide the link in *Clippings* for our member's viewing pleasure.

Check out the calendar for upcoming golf tournaments and take the time to have some fun and network with your colleagues in a relaxed environment. Also, note the IPM exam preparation courses presently being offered at various locations throughout Ontario.

Once again it's time to thank our Above the hole author, April Grabell for her contributions about our industry from the perspective of a 2nd year diploma student and intern. Congratulations April on a job well done, and best wishes in your future endeavours! If you are interested in becoming the next student writer for *Above the hole*, please read the following information and make a submission. If you know of anyone who qualifies, please pass along the information.

OGSA's Green is Beautiful "Above the Hole Writing Contest!

How would you like to be part of Ontario's leading Golf Course Management Magazine? The Ontario Golf Superintendents' Association's official publication, *Green is Beautiful* is pleased to present an opportunity to all turfgrass student interns. The column "Above the Hole", authored by University of Guelph Turfgrass intern April Grabell is open to a new intern as of April 2010. The magazine's Editorial committee will be reviewing submissions from Ontario based Turfgrass interns in April. The basic requirements include;

1. You are in the first year of your education of Turfgrass Management.
2. You have a desire to excel in the Golf Course Management Business.
3. You have an aptitude for writing.

How do I apply?

We ask that each applicant submit an article entry. The article will be based on your growth and experiences as a student/intern. Each entry should be approximately 500 words in length and electronically submitted to the OGSA office by March 31, 2010 - at ogsa@gti.uoguelph.ca please email in using the subject line **Above the hole**, together with your contact information.

The successful applicant will receive one year paid student membership to the association as well as a writing opportunity in *Green is Beautiful,* commencing with the Spring Issue. This is a great mechanism to express yourself within the industry of your future and differentiate yourself from other interns. *Green is Beautiful* looks forward to having you on board.

What's new

TURFGRASS DIPLOMA SCHOLARSHIP

Congratulations to Michael Herbert Newton, who is enrolled in the second year Turfgrass Diploma Course at the University of Guelph and is our 2009 scholarship winner. Michael says in his application, "The three superintendents who I have had the privilege to work for have encouraged me and supported me in my pursuit of an education in turfgrass. I wish to model myself after these young professionals and hopefully someday support and guide individuals to educate themselves in turfgrass because it's fun, challenging and an exciting field to work in, especially in Canada."

INTEGRATED PEST MANAGEMENT SEMINAR COURSES & EXAM

The legislation states that a golf course using class 9 pesticides must be registered on or before April 22, 2010. It also states that courses can only be registered once they have submitted the name and IPM Agent certification # of the IPM Agent responsible for the golf course.

To assist those who have not yet certified as an IPM Agent the Guelph Turfgrass Institute and the OGSA are working together to offer IPM Exam Preparation courses with Exam, at six different locations throughout Ontario.

At this time we have the following tentative dates and locations. These will be confirmed in the very near future when all details have been confirmed. Full details for these courses will be made available through our weekly email bulletin Clippings and on our website at www.golfsupers.on.ca.

Niagara - March 9
Sudbury - March 18
London - March 30
Toronto - April 1
Kingston - April 6
Barrie - April 6

In the meantime, please be advised that you are responsible for obtaining your own study material to prepare for the IPM examination. The recommended study material can be ordered on line at www.ontarioipm.com. Note that material should be studied in advance of the seminar to maximize the effectiveness of the course. There is a downloadable PDF IPM Accreditation Exam Study Guide (Item 3) available on the IPM web site that directs you to specific areas in the study material to focus on.

2010 OGSA TOURNAMENT SCHEDULE

Event	*Date*	*Golf Course*	*Host Supt.*
OGSA Curling Day	March Day TBA	Club at North Halton	Dean Baker
CAN/AM Challenge	May 11th	Grosse Ile G&CC (MI)	Daniel Dingman
Pro/Super Challenge	June 3rd	Otter Creek Golf Club	Randy Booker
Presidents' Day	July 12th	Brampton Golf & CC	Martin Kopp
Assistants Tournament	TBA	TBA	
Alex McClumpha	October 4th	Black Bear Ridge GC	Bill Fach
*OTRF Fundraiser	Sept. 20th	Bayview G&CC	Thom Charters

Details of the above OGSA events will appear on our website under both "Events" and "Calendar of Events," as they are confirmed and further details are available. All events will be announced in our e-bulletin *Clippings* when registration is open. For your convenience, on line registration will be available again this year.

*Note The OTRF tournament is not an OGSA event. Details, when available, can be accessed on their website at www.otrf.ca.

Welcome!

OGSA Welcomes our newest members

Bradley Carey Class C
King's Forest Golf Course
Blair Elson Class C
Eagles Nest Golf Club
Jeff Eyers Class C
Port Carling Golf & CC
Sterling Gibbons Class A
Port Hope Golf & CC
Derek Glass Class D
Buttonville Fairways
Ben Ingram Class Supt
Caledon Woods GC
Todd Joel Class S
Seneca College
Kip Keith Class C
Diamond Back Golf Club
Mark Magee Class A
Coral Creek Golf Course
David Mahoney Class D
New Zealand
Mark Marusic Class C
Oakville Executive GC
Robert Mulville Class C
Cataraqui Golf & CC
Steve Oxley Class F
Taboo Resort, Golf & Spa
Gib Piché Class C
Port Carling Golf & CC
John Sadak Class F
Lionhead Golf & CC
Biser Stavrev Class F
Lionhead Golf & CC
Jasmine Steinke Class C
Toronto Golf Club
Sean Walker Class Supt
Harmony Creek Golf Centre
Jennifer Young Class C
Devil's Pulpit Golf Assn

Complete Turf Equipment Ltd.
Thom McLean Class E
Doug Hubble
D. Wyllie & Sons Ltd. Class E
David A Wyllie
Forest Fence & Deck Co.
Paul Loader Class E

From roots to shoots

by Pam Charbonneau
OMAF Turfgrass Specialist

The plunder down under – what to expect when spring comes

What condition will my greens be in when spring comes? That is probably the biggest question on most golf superintendent's minds at the moment. Depending on where your golf course is located, you may have had a solid sheet of ice on greens starting from as early as the first week in December or at the latest, from Christmas Eve on. The spring thaw in late January helped to melt some of the ice, but if your greens are in a low lying area where the snow melt and the rain accumulated, you are back to having ice on your greens after the most recent deep freeze. The weather gurus had predicted a warmer than average winter. They have been right so far. The overall temperatures have been warmer than usual, but the presence of the ice layer is worrisome.

From the winter weather and the conditions so far, my best guess is that the types of winter injury that you are most likely to see is anoxia. There is a lot in the area of turfgrass winter injury that we know about and a lot we don't know. Luckily for us in Canada, there are two very good research teams (Laval University/Agriculture and Agri-food Canada, Quebec and Olds College, Alberta) that have added immensely to our knowledge of winter injury, especially in the area of anoxia caused by ice encasement. Let's review what we know about it.

Anoxia

Anoxia is a condition that can occur under an ice cover or under a winter protective cover that can kill turf. Anoxia means lack of oxygen. Under covers the turf plants use up oxygen and other toxic gases such as carbon dioxide (CO) can build up. During the winter, under snow, ice or covers, turfgrass plants respire. In this process sugars within the plant are mobilized in the presence of oxygen to provide energy for the plant so that it can stay alive during the winter. The equation for respiration is as:

$C_6H_{12}O_6$ (hexose sugar) + $6O_2$ (oxygen) ——> $6CO_2$ (carbon dioxide) + $6H_2O$ (water) + energy

In a closed system, where there is no gas exchange, under anoxic conditions (lack of oxygen), this process or reaction can not occur. If this is the case the plant will run out of energy and eventually die. The other aspect of respiration in a closed system is that as the oxygen is depleted, carbon dioxide builds up and it may have deleterious effects. Usually anoxia can be detected by the foul smell that eminates from a green when it is uncovered in the spring. The smell is thought to be a result of the build up of gases under the cover and there is usually turf injury accompanying it.

In addition to respiration from turfgrass plants under covers, there are also soil bacteria that are respiring in the very same way as the turfgrass plants. This further contributes to the oxygen depletion and the carbon dioxide buildup. Factors that affect the rate of respiration of plants and soil bacteria are temperature, soil water content, degree of plant dormancy and soil organic matter content.

Factors Affecting Anoxia

Research at Olds College, Alberta has also shown that ice covers and ice encasement lower turfgrass winter hardiness levels. Tompkins et al., 2004 conducted research to determine whether or not it is beneficial to remove an ice sheet from a putting green. To determine this they looked at cold hardiness levels of annual bluegrass and creeping bentgrass under ice cover or ice encasement for various lengths of time in a laboratory and a field study.

In the laboratory study, plants in the ice cover treatment were covered with a 2.5 cm thick layer of ice which was formed gradually by spraying the surface of the turf with a mist bottle in a freezer. Ice encasement was accomplished by completely saturating the soil of a plug of turfgrass and then adding the 2.5 cm layer of ice as described above for the ice cover treatment. The control treatments had a thick layer of snow cover maintained throughout the experiment.

Snow covered treatments maintained cold hardiness for the longest period of time and ice encasement produced the most rapid loss of cold hardiness. The differences were greater for annual bluegrass than creeping bentgrass. At 90 days after treatment, snow covered annual bluegrass had cold hardiness levels of -18ºC, while the ice covered plants had cold hardiness levels of -4ºC and ice encased annual bluegrass plants were dead.

Ice covered annual bluegrass had a rapid loss of hardiness between 75-90 days after treatment and ice encased annual bluegrass rapidly lost hardiness between 45-60 days after ice encasement. By contrast creeping bentgrass began to lose hardiness at 90 days after treatment in both ice treatments but retained moderate hardiness levels for 150 days. In the field study, annual bluegrass had a more rapid loss of hardiness than in the lab. Annual bluegrass plants subjected to ice encasement lost cold hardiness between day 45 and day 60.

In addition to the potential for development of anoxia under ice cover, there is also a loss of cold hardiness and they may, in fact, be related to one another. High respiration rates under the ice covers may use up the plants stored energy leaving it more susceptible to the cold and the high respiration rates also could contribute to the build up toxic gases that injure the plants.

In the Quebec City area there have been many golf courses that have been using the winter protective covers consisting of a permeable cover, straw and an impermeable cover. There were some greens which recurrently had come out of the winter with dead turf, in spite of being covered. The death of the turf under the covers could not be attributed to freezing stress, excess water or snow mould. Rochette et al. (2006) set up an experiment with greens that recurrently had damage under covers and those which overwintered successfully with covers. They measured temperature and the O_2 and CO_2 levels under the covers throughout the winter. What

they found was that the greens that had recurrent damage had anoxic conditions by day 90, where the greens that traditionally had overwintered successfully had sufficient O_2 levels up to the end of the winter (day 130). The greens with recurrent damage also had high levels of CO_2 by day 90 and the other set of greens that overwintered well had adequate amounts of O_2 and low CO_2. The greens that suffered recurrent damage under cover had a 69% higher respiration rate on average than the greens that overwintered successfully. These two sets of greens were all annual bluegrass greens, so the differences in respiration could not be attributed to the turfgrass species. The differences in respiration and hence oxygen depletion were due to the soil biological activity. The greens with recurrent damage had significantly higher total nitrogen and total organic carbon. To verify these results they tested the respiration rates of soil based greens vs. USGA specification greens and found that the soil based greens consistently had higher respiration rates than the USGA specification greens.

New Findings on Anoxia

Castonguay et al., (2009) conducted a controlled environment experiment to determine what it is about anoxic conditions that kills grass plants. They were interested in whether it was the low O_2 or the high CO_2 or a combination of both. They also wanted to know what effect temperature had on the presence of these two gases under ice or covers. They exposed annual bluegrass and creeping bentgrass to: low O_2, low CO_2 (LL): low O_2, high CO_2 (LH); high O_2, low CO_2 (HL); high O_2, high CO_2 (HH) and a control (21% O_2 and 0.04% CO_2. These turf plants were with the different gas levels were maintained at two temperatures: 1ºC and -2ºC. Plants were removed from the cold treatments every two weeks from Nov. 24, 2000 to April 2, 2001. Some of the plants were used to evaluate regrowth/winter damage and the others were used for biochemical analysis

What they determined is that it is a lack of oxygen that contributes to damage of the turf in anaerobic conditions not high CO_2 or the combination of low O_2 and high CO_2. They also found that annual bluegrass is more susceptible than creeping bentgrass to anoxia and if the temperature is lowered to -2ºC , the damage from anoxia is much less.

Chantigny et al., (2002) looked at cool wet soils during the winter in Quebec and showed there was a shift toward the production of volatile fatty acids when anaerobic conditions existed. Castonguay et. al., (2009) also wanted to look at the effect of different volatile fatty acids in the presence of anoxia on turfgrass damage. They exposed turf to three volatile fatty acids (acetate, butyrate and proprionate). Their research determined that there is a relationship between the presence of VFA and damage to turfgrass plants under anoxic conditions. This also verifies that the odour that is present when greens covers are removed in the spring is due to a build up of these volatile fatty acids.

The same set of experiments also looked at sugar content of the turfgrass plants under the different oxygen and carbon dioxide combinations. Sucrose is a sugar made during photosynthesis in plants. Plants can bind sugars together to form fructans. Both sucrose and fructans are found in the tissues of cold acclimated annual bluegrass and creeping bentgrass and are thought to influence cold tolerance.

At 1ºC, sucrose declined in all of the low oxygen treatments. Sucrose was significantly higher in the HH and control treatments. Annual bluegrass sucrose level declined to nearly 0 in the low O_2 treatments. Creeping bentgrass sucrose declined in the LH only. Overall at -2ºC, sucrose levels were higher in both species with more of a decline in sucrose in the annual bluegrass in the low O_2 treatments. Under anoxic conditions (LH) sucrose concentrations were very low by the end of the experiment, regardless of species.

Fructans responded a bit differently. Fructans levels declined at both temperatures with higher levels of fructans in creeping bentgrass and a more rapid decline in creeping bentgrass. In annual bluegrass the lowest fructans levels where in the high CO_2, regardless of the O_2 levels. It appears that low O_2 is responsible for depletion of sucrose and high CO_2 is responsible for depletion of fructans.

Dionne et al. (2001) suggested a link between fructans and cold tolerance in annual bluegrass. If high CO_2 levels exist either under ice or under winter protective covers then fructans levels can decline making annual bluegrass more susceptible to low temperature injury as spring approaches.

More recent work on anoxia and covers

More recently more field experiments were conducted at Olds College, Alberta on soil based annual bluegrass greens during the winter of 2007-2008 and 2008-2009. The objective of this trial was to evaluate various covering systems that would increase oxygen levels and, in turn, prevent damage associated with anoxia. Impermeable winter covers, some with an insulating air layer and some without, were compared against ice cover and snow cover only treatments. Additional treatments to examine air replenishment under the covers were also evaluated. The treatments were as follows:

1. No ice, snow cover only
2. Ice, snow cover only
3. Ice, impermeable cover, no air
4. Ice, impermeable cover, bubble wrap (approximately 2 cm in thickness)
5. Ice, impermeable cover, bubble wrap, air replenishment
6. Ice, impermeable cover, Enkamat (approximately 1 cm in thickness)
7. Ice, impermeable cover, Enkamat, air replenishment

Gases were sampled every two weeks beginning at 30 days after ice cover. At the end of the experiment samples were collected to test for relative cold hardiness and plots were evaluated for winter survival and turf quality.

Oxygen content under the various treatments remained constant for the first 75 days of the trial. However by day 90, there was a significant reduction in oxygen levels. On day 90, the highest CO_2 levels were recorded for the ice, snow cover only and ice, impermeable cover, no air layer treatments. Ice without any air layer had lowest O_2 and highest CO_2.

Soil temperatures for the first 75 days of the trial ranged from -2 to -8ºC. The ice, snow cover only had lost winterhardiness and were dead. Air replenished at 30 and 60 days didn't keep the O_2 from depleting or the CO_2 from rising. All the plots that had covers with air survived well.

continued on page 10...

continued from page 9...

Anoxia Prevention

In the case of annual bluegrass putting greens with ice encasement, the annual bluegrass plants in the study conducted by Tompkins et. al., 2004, showed that all the plants were dead by 45 days after ice encasement. It would be advisable that attempts be made to remove ice before the 45 day mark to prevent anoxic conditions from killing the turfgrass plants. This can be accomplished in the winter by running an aerator over the greens to break through the ice and allow gas exchange. Later in the winter and towards early spring it can also be accomplished by applying dark coloured topdressing materials that absorb heat on top of the ice. These can range from natural organic fertilizers to coloured topdressing sands, inorganic amendments, etc.. The dark colour absorbs heat from the sun and can help melt the ice layer. This technique works best on thin ice layers. These products honeycomb the ice layer allowing for gaseous exchange.

In the case of soil based greens with high organic matter under straw and impermeable covers, it is recommended that these greens be vented using perforated drain pipe under the impermeable covers. These pipes must vent to the outside of the greens covers without letting water in under the covers. The optimum spacing of these pipes is not known and many superintendents are experimenting on venting methods and venting spacing. With each passing winter, more information on specific recommendations should be available to superintendents.

What does all this mean?

If you are trying to determine what the chances of injury to your golf greens is due to anoxia under an ice layer the following factors need to be considered. If your greens are composed mainly of annual bluegrass then the chances of damage occurring increase greatly. As we know from various experiments, annual bluegrass that is encased in ice lost winter hardiness at 45 days and death occurred at 75 days. Thompkins et al. (2004) recommend removal or disruption of the ice cover of annual bluegrass greens before the 45 day mark. You can do the math based on your course to get a feel for your chance of anoxia injury due to the ice cover. A cautionary note however, many of the studies to determine this information about anoxia were conducted in a lab or a controlled environment where temperatures were held at one temperature for the duration of the study. In the real world the temperature is fluctuating and we do not always know how temperature will interact with ice covers.

If your greens are mainly push up greens composed of annual bluegrass and are constructed with soil, especially if there is high organic matter present in the soil or if there is a thick thatch layer, the chances of anoxia increase based on the research findings to date and even more. In this case there is even more reason to attempt to mechanically disrupt the ice cover.

Temperature plays a big role in the damage caused to turfgrass plants under anoxic conditions. At 1ºC damage due to anoxia was much worse than at -2ºC based on controlled environment experiments. Temperatures at the soil level under the ice cover will be influenced by the ambient air temperature and by the amount of snow cover. If there is ample snow over the ice, it might make conditions worse by holding the temperature at soil level around the freezing mark. As we know, snow is a great insulator and keeps temperatures moderated. Lack of snow will generally mean that the soil temperatures are lower on average and this will slow down respiration and slow down the onset of anoxic conditions. Thompkins et al. (2009) showed ice and snow covered annual bluegrass greens were dead by day 75.

Lastly, anoxia lowered the O_2 and raised the CO_2. Each of these conditions lowers the plant sugars. Low O_2 lowered sucrose levels and high CO_2 lowered fructans levels. Both of these are partly responsible for cold hardiness levels. With low levels of these sugars going into the spring the turfgrass plants are more likely to be prone to low temperature injury.

It would make a very interesting project to conduct a survey this spring of the actions that were taken on greens with ice covers and document the success of the actions by measuring the winter survival of the greens. I would love to hear from some of you in the spring to see if the suggestions in this article were successful.

References

Beard, J.B. 1970. An ecological study of annual bluegrass. USGA Green Section Record March:13-18.

Charbonneau, P. 2009. The Wrath that is a Canadian Winter. GreenMaster

Dionne, J. 2000. Winter protection of annual bluegrass (*Poa annua* L.) golf greens. USGA Green Secton Record 38:11-13.

Dionne, J., Y. Desjardins, P. Nadeau, and Y. Castonquay. 2001. Freezing tolerance and carbohydrate changes during cold acclimation of green type annual bluegrass *(Poa annua* L.) ecotypes. Crop Sci. 41:443-451.

Rossi, F.S. 1996. Physiology of turfgrass freezing stress. Turfgrass Trends 5:1-12.

Tompkins, D.K., J.B. Ross, and D.L. Moroz. 2000. Dehardening of annual bluegrass and creeping bentgrass during late winter and early spring. Agron. J. 92:5-9.

Tompkins, D.K., J.B. Ross, and D.L. Moroz. 2004. Effects of ice cover on annual bluegrass and creeping bentgrass putting greens. Crop Sci. 44:2175-2179.

Tompkins, D.K., P. Rochette J.B. Ross. 2009. Mitigation of anoxia under ice covers on annual bluegrass putting greens. http://ptrc.oldscollege.ca/documents/MitAnoxiaIceCoversBGPuttingGreens.pdf

Ross, J.B. 1999. Evaluation of winter covers for prevention of freezing injury on putting greens. http://ptrc.oldscollege.ca/199_ar/covers399-00.html

by Doug Johnson
SAFETAID and Health and Safety Consulting
First Aid and Safety Supplies and WHMIS Training

Upgrading Your Safety Program

I expect that by now anyone reading these safety articles will have started to put a Health and Safety Program into place in their workplace.

Over the last few years I have written about many aspects of occupational health and safety. In these articles I have discussed the responsibilities of various people in the workplace. In general I have called these folks the workplace participants. Anyone working in your workplace is generally referred to as a workplace participant.

One thing I and others in the health and safety field have been noticing over the last few years is a shift in the types of charges that have been occurring after an injury has occurred in a workplace. As a case in point I have copied information from the Ontario Ministry of Labour (MOL) website for your information. This is a quick overview of one injury that happened in London, Ontario.

"A heavy equipment dealer was fined $75,000 on November 16, 2009, for a violation under the Occupational Health and Safety Act (the Act) after a worker was critically injured.

On April 8, 2008, at the London, Ontario dealership, a technician was working on a piece of heavy equipment that had come in for maintenance. The machinery had arrived missing part of the guard over its engine fan. While doing maintenance, the worker passed a hand over the opening in the guard. The worker's hand was pulled into the engine fan and amputated.

A Ministry of Labour investigation found that although the worker had received safety training, the dealer had no procedure in place to assess hazards during maintenance work.

The company pleaded guilty under the Act to failing, as an employer, to take the reasonable precaution of implementing a safe work procedure relating to hazard assessment before or during maintenance.

The fine was imposed by Justice of the Peace Sonia Aleong. In addition to the fine, the court also imposed a 25% victim fine surcharge, as required by the Provincial Offences Act. "[1]

This seems to be a new position from the Ontario MOL. It appears as if the Ontario MOL is starting to take a look at the quality of a safety program in addition to the content. There has been a great deal of discussion recently in the health and safety field about the quality of training and the quality of the follow up in the workplace by the employer, managers and supervisors.

I believe it is important to discuss the issue of procedures relating to hazard assessment. This is often an area where employers, managers and supervisors fail in their safety communication message. Generally, employers arrange to have safety training provided and then fail to follow up with procedures and protocols to ensure that the training was effective. They also fail to ensure that there is a comprehensive method that the workplace participants can use to assess hazards before they become injuries or losses.

This court case indicates that the MOL will be looking for clearly defined procedures in the future.

I am working with a company right now who is dealing with an order to comply that requires the company to have an emergency plan in place that is comprehensive, effective, and communicated to all affected workplace participants.

When you are reviewing your health and safety procedures it is a good idea to look at them carefully to ensure that you have procedures that are functioning and controlled in your workplace. If you cannot deal with this on your own it would be a good idea to get in contact with someone who can assist you and make sure that your workplace complies and is a safe place to work.

Enjoy the rest of winter!

[1] http://www.labour.gov.on.ca/english/hs/

THE NEED FOR SPEED

Article & photos by Cameron Fraser,
Assistant Superintendent
Rosedale Golf Club

Looking at the backdrop behind the 15th green. 6th green is seen to the far left

Green speed is an area of golf course management that continues to attract a lot of attention. It seems that not many courses these days, can escape the controversy that surrounds the topic. There are a few different apparatus used to measure the speed of a green. Most common is the Stimpmeter. This tool was developed over 90 years ago by Edward Stimpson, a skilled amateur golfer from Massachusetts. Mr. Stimpson's concern at the time he created the device, was not the speed of the greens, it was the consistency. Green consistency should be the goal of every golf course manager no matter how "fast" or "slow" you consider your greens. Within any given day you can have a golfer approach you to tell you that they think the greens are too fast, hours later have another tell you that they are putting slow, and fifteen minutes after that you hear they are perfect! Who is right? Keeping your greens a consistent speed throughout the season is a more realistic goal then to try and please each individual golfer's speed expectations. When I am asked: "How fast are the greens today?" I usually respond, "the uphill putts are slow and the down hill ones are fast".

As the assistant superintendent at Rosedale Golf Club I have the privilege of attending Greens Committee meetings on a monthly basis throughout the golf season. At the first meeting of the 2008 season the Committee decided to set a target green speed for the year. This allowed us to manage our greens to a known objective. They wanted to have a report done on the speed of the greens for each meeting. This meant I would record the speed of our six flattest greens, including the putting green, each day and create an average for the course.

There are a variety of different methods and recommendations to obtaining a green speed value. We decided to use the Stimpmeter to take the measurement in the same place, on each green, in four directions. For the first couple of months I was recording greens speeds in the morning and afternoon. I found there was not a great difference between the A.M. and P.M. speeds and it was decided that the committee would be satisfied with only one daily recording. I tried to take readings around the same time each day but this proved to be difficult considering the variety of responsibilities that require my attention throughout the day. This year I have delegated the task to one of our key staff who is able to record the speed at the same time (12 P.M.) every day.

The device you decide to use to obtain green speed values is not as important as what you do with the information provided by the tool. The information collected from the Stimpmeter gave us the ability to individually manage each green based on their speed. Some greens always rolled a little faster and some a little slower depending on there locations. We found that a particular green that was located in a good growing environment always seemed to stimp a little slower. The environment allowed the plants to really thrive resulting in a healthy, dense stand of turf. I concluded that a dense stand slowed the ball down a little as there are more blades of grass creating friction against the ball. Thus, a leaner, thinner stand of turf might roll slightly faster. Another green that is located in a lower part of the golf course, tends to be wetter than other sites and also rolled slower. I attributed the higher humidity and softer surface as a contributing factor. I also believed that the higher annual

bluegrass to bentgrass ratio played a part considering annual bluegrass is generally denser than bentgrass. Reversely, we have a green that has more bentgrass then annual bluegrass and it putts very smooth and fast.

Once you have differentiated the fast greens from the slow you should ask yourself "How can I get them consistently the same speed?". If they were within a half a foot of each other the committee were satisfied. We felt we could double cut the slow greens on days we felt they needed a little more speed. We did not put them on a schedule; rather, I monitored them daily and made a decision based on the Stimpmeter reading from that day. Once you understand the factors that affect the speed of the ball you can reasonably predict the speed for any particular day. I found rainfall contributed the most to decreasing the speed, affecting the two slowest greens the most. As an example, if we had a lot of rain the night before I would have the staff double cut the slowest greens knowing they were going to need more speed even before I stimped them. The double cut would give them approximately 4-5 inches more speed.

The Stimpmeter allowed me to provide the Green Committee with documentation that proved the greens were consistent throughout the golf course and at our target speed. The report contained the speed of the individual six greens I stimped, a course average, and a list of factors that I felt were affecting the green speed. The list of criteria proved to be very helpful aiding in the explanation of our greens performance.

At each meeting I would provide a report including:

- Temperature – The higher temperatures allow the grass to grow at a faster rate slowing down the ball roll.
- Humidity – With higher humidity the moisture in the air and on the leaf blade slows down the ball roll.
- Wind – There is no obvious relationship between green speed and wind. It can be assumed that on windy days with low humidity the greens would dry out making them a little firmer and quicker.
- Frost – Stunts the growth of the plant. We experience frost during the spring and fall months. Days with frost slightly increases the speed.
- Rain – softens the greens and slows down ball roll. The more rain the slower the greens become.
- Irrigation – similar to rain.
- Mowing – keeps the height of the putting surface consistent and reduces resistance to the ball roll.
- Height of Cut – lowering the height increases the speed to a certain point. We have been as low as 0.100 of and inch but found we can keep the greens at a desirable speed while mowing them at 0.115. Raising the height to 0.115 during the majority of the summer takes some stress off the grass plant.
- Speed Rolling – Increases the speed of the greens by half a foot on average.

continued on page 15...

2011 ONTARIO GOLF COURSE MANAGEMENT CONFERENCE & TRADE SHOW

Windsor, ON | January 12–14, 2011

continued from page 13...

- Double Cut – Cutting the green twice in two different directions.

- Grooming – vertically mows the grass thinning it out. Removing grass from the green creates less resistance to the ball roll. This is usually done before topdressing allowing the sand to work its way into the green.

- Topdressing – fills in the ball marks and any other imperfections on the green. This helps to produce a smoother surface. Until the sand is worked into the green it can create friction slowing the ball roll.

- Growth Regulator – Slows down the growth of the plant. Smaller amounts of clipping are produced allowing for a better cut from the mowers. The grass grows less during the course of the day keeping the greens at a more consistent speed throughout the day.

- Fertilizer – Can stick to the ball taking it off line. It can also create friction slowing down the ball roll. Might cause a surge in growth also slowing the speed down.

The daily record keeping has become an extremely valuable tool allowing us to use quantifiable data to explain the performance of our greens. We will continue to work towards our goal of understanding that the environment, weather and our cultural practices will govern the speed of any particular green. It is our responsibility to use this information to make educated decisions towards achieving our goals. We can proudly say that when they are putting "slow" they are consistently slow. As every golf course has their own unique characteristics it's important to use trial and error in order to determine which method and test are best suited to your needs. I hope this sheds some light on the variables to consider, common practices and potential solutions to create the best conditions possible to serve your membership and customers.

Taken from 1st tee looking down the 1st hole.

THANK YOU SPONSORS !

We appreciate your support in co-sponsoring the OGSA Social at Fionn MacCool's

BAYER ENVIRONMENTAL SCIENCE

BURNSIDE GOLF SERVICES

DCS AGRONOMIC SERVICES

G.C. DUKE EQUIPMENT LTD.

MAXIUM GOLF LEASING

BASF CANADA

PLANT SCIENCE INC.

TURF CANADA INC.

ENVIRO • SOL and ALLTURF LTD.

NUTRITE and ONTARIO SEED COMPANY

chipco® TRITON™

Chipco Triton SC™ with StressGard™ formulation technology offers excellent disease control against anthracnose, dollar spot, brown patch, pink and grey snow mould while providing unprecedented turf quality and unbeatable protection against the stress your turf faces.

Take advantage of the most complete line of turf fungicides in the golf industry. Chipco Triton SC, Rovral Green GT, Compass 50WP and Aliette Signature.

Backed By Bayer – As always, you're Backed by Bayer. And that means our team of professionals is your team of professionals. All of our research and support is to ensure you have the most effective products available. Superior products and superior support – only from Bayer.

Chipco Triton SC **Rovral Green GT** **Compass 50WP** **Aliette Signature**

INTRODUCING
Chipco Triton SC™ fungicide

For more information on Triton SC and the complete line of Bayer products, contact Bayer Environmental Science
www.bayeres.ca **1-888-283-6847**

Bayer Environmental Science

BACKED by BAYER™

2nd Annual Gardening Seminar

by Paul Grotier, Assistant Superintendent
Donalda Club

On February 2nd, 2010, for the second year in a row, Donalda Club was the host of what is hoped to be an annual event. Golf course gardeners from the GTA and beyond were invited to a full day seminar which included breakfast, lunch, and four interesting speakers who touched on an assortment of issues affecting today's golf course gardener. Fortunately, the weather was more co-operative this year than last and all 23 participants were able to attend without any delays.

Brenda Noble, Head Gardener at the Donalda Club, and Kyra Zeldon, Head Horticulturist at Cedar Brae Golf and Country Club, put in a lot of time and effort in planning this event and were able to put together an interesting mix of presenters. Dave Zeldon started the day off with an enthusiastic and entertaining demonstration of how to build your own vermicomposting system. He also shared a collection of tips and ideas for implementing sustainable gardening practices. Victor Lewicki, long time gardener at Thornhill Golf and Country Club, shared his experiences with a variety of ornamental grasses as well as an amazing collection of photos from his many projects. After a short break Marjorie Mason got everyone's stomachs growling with an inspiring presentation on creating a beautiful and edible potager garden. Following a satisfying lunch, Brenda Noble shared an array of ideas for designing planters for every season.

According to feedback, an enjoyable and educational day was had by all. As is almost always the case, the camaraderie that is fostered through such educational events is always an invaluable by-product. Clearly, this event has gained momentum and has helped fill the void within the landscape industry to provide educational and networking opportunities which are specific to golf course horticulturists. In order to ensure the continuation of this event a new host and additional help organizing is needed. If anyone is interested in planning next year's event, please contact Brenda Noble at Donalda Club.

Photo by Jeff Alexander.

Golf course highlight

Mill Run Golf Club
269 Durham Road 8
Uxbridge ON L9P 1R1
Phone: 905 852-6212
Fax: 905 852-9272
Website: www.golfmillrun.com
Golf Course Superintendent:
Rod Speake
Email: rspeake@golfmillrun.com

Photo by Rod Speake

COURSE PROFILE

What region is your club located in?
Uxbridge Township

What is the classification of your club?
Member owned, Semi-Private

Size of membership and number of rounds?
450 members
42,000 rounds on Championship Course
22,000 rounds on Highland Course

Typical opening and closing dates?
April 15 opening until November 7

Name of Superintendent
Rod Speake

How long have you been a superintendent?
9 years

List other accomplishments
Working on Audubon Certification

How long have you been an OGSA member?
13 years

How many year round staff?
4

How many seasonal staff?
26

How many mechanics and assistants?
Assistant: Steve Saunders
Mechanic: Frank Pagneillo

How many gardening staff?
1 - Beryl Jean Fordham

COURSE STATISTICS

How many holes?
27 hole Championship Length Course
18 hole Executive Course

What is the yardage from back & forward tees?
Championship: 6690 back tees, 5187 forward
Highland: 3500 back, 3128 forward

What is the size of driving range and range tee?
10 acres of range and 1.5 acres of tee deck

How many bunkers?
Championship: 74 Highland: 12

How many ponds, and/or how many times does water come into play?
Championship: 7 times

Who was the original architect?
Rene Muylaert original course
Jason Miller new nine

What was the year of original construction?
1984 original, 2007 new nine

What major tournaments held?
GAO Public Players Championship

What type of irrigation system?
Existing course is Toro Hydraulic and new nine is Toro Electric - all with the OSMAC SitePro Central Control Package

What is the size of your maintenance shop?
8,000 ft^2 (half heated, half cold storage)

What is the size of the greens, tees & fairways?
Championship Course:
Greens: 4.5 acres
Tees: 4 acres
Fairways: 32 acres
Highland Course:
Greens: 2.2 acres
Tees: 2 acres
Fairways: 9 acres

What is your predominant grass?
Poa Bent on greens and tees, Poa Bent Bluegrass on fairways

How many USGA greens and loam greens?
10 USGA Greens
35 Loam Greens

What is the predominant soil type?
Sandy

What equipment do you have in inventory?
4 Toro 3150 Triplex Greens
3 Toro 3150 Triplex Tees
2 Toro Walker Greens
2 Toro Walker Tees
3 Toro 5410 Fairway Units
3 Toro Sidewinder 3500
Toro Multi Pro 5700 sprayer
Toro 4000 rough unit
Proflex rough unit
TyCrop topdresser - pull behind
2 Toro Sandpros
1 John Deere Sandpro with push blade
Toro Sandpro spiker attachment
Toro 880 aerifier
Toro Procore 648 aerifier
VertiDrain aerifier
Buffalo Turbine blower
Speed Roller
2 Kubota tractors
John Deere tractor
Kubota backhoe attachment
Kubota front pallet forks
2 Kubota loader attachment
2 Pronovost trailer
Chevy Silverado truck
Experss dual bedknife grinder
Experss dual reel grinder

COURSE PROJECTS & PLANS

What projects have you recently completed?
Cart path extensions and tee deck enlargements on par 3's

What long range plans for renovation do you have in the next five years?
Continue with tee deck and bunker improvements, also a realignment of a golf hole.

Are there any particular challenges you face with your property?
Very sandy property so managing our water is a very difficult challenge in a dry year.

Do you have any success stories?
Transforming staff and equipment in the turf department from an 18-hole operation to a 27-hole operation on the Championship Course in my first year.

Best management practices for anthracnose on annual bluegrass turf

Although our understanding of anthracnose disease on *Poa annua* greens is incomplete, several cultural and management practices can reduce its occurrence and its severity.

Anthracnose (caused by *Colletotrichum cereale*) is a destructive fungal disease of weakened turf that occurs throughout the U.S., Canada and Western Europe (15) and is particularly severe on annual bluegrass (*Poa annua*). The frequency and severity of anthracnose epiphytotics on golf course greens has increased over the past decade (13,14) and is thought to be associated with some of the management practices used by superintendents to improve playability and ball-roll distance. Combinations of management factors may be enhancing the severity of this disease.

Scientists within the NE-1025 multistate turf research project are studying the biology, ecology and management of anthracnose of annual bluegrass turf on golf courses. They are examining the biology of the pathogen, assessing fungicidal control and fungicide resistance development, evaluating the effect of cultural practices on anthracnose severity and developing annual bluegrass and bentgrass selections for resistance to this disease. Completed and ongoing field trials within this five-year project (2005-2010) have evaluated registered and experimental fungicides, fungicide programs and annual bluegrass management practices, including nitrogen fertility, chemical growth regulation, mowing, rolling, topdressing, verticutting and irrigation as well as the potential interaction among practices. Ultimately, results from these experiments will be used to devise a comprehensive set of best management practices for the control of anthracnose disease on golf courses.

Host susceptibility

Anthracnose can be found on cool- and warm-season turf in roughs, fairways and tees, but often the disease is most destructive on annual bluegrass maintained at a putting green height of cut. Outbreaks are also increasingly common on creeping bentgrass (*Agrostis stolonifera*) and may develop on other cool-season turf species including ryegrasses (*Lolium* species), fescues (*Festuca* species), Kentucky bluegrass (*Poa pratensis)* and velvet bentgrass (*A. canina*).

Although the disease is often most severe during warm weather, outbreaks may occur throughout the year, causing either a foliar blight or a basal rot of leaf sheaths, crowns and stolons (15).

Anthracnose is often present on turf mowed at a higher height without producing severe damage, which suggests that plant health (vigor and stress) is a major factor that determines disease severity. The disease can cause extensive injury on turf maintained at low fertility, very low mowing heights or turf grown under suboptimal conditions (drought stress, excess shade, high humidity).

The greater susceptibility of annual bluegrass to anthracnose is probably related to a number of factors including the weak perennial nature of this grass species. Annual bluegrass is well known for its prolific seedhead (flowering) expression that occurs predominantly in the spring (April through early June). Seedhead development requires considerable metabolic energy, which reallocates photosynthate away from roots and shoots toward seedheads just before the most stressful time of

James Murphy, Ph.D.
Frank Wong, Ph.D.
Lane Tredway, Ph.D.
Jo Anne Crouch, Ph.D.
John Inguagiato
Bruce Clarke, Ph.D.
Tom Hsiang, Ph.D.
Frank Rossi, Ph.D.

the growing season. Summer stress tolerance has been associated with increased root depth and number; thus, the reallocation of photosynthate away from roots and crowns probably weakens annual bluegrass and increases its susceptibility to anthracnose. Breeding for improved tolerance to anthracnose disease is one objective of the annual bluegrass breeding program in Pennsylvania and the bentgrass breeding program in New Jersey.

The true causal agent of anthracnose on cool-season turf

For more than 90 years, the pathogen responsible for turfgrass anthracnose was known by the same name as the fungus that causes anthracnose disease in corn, *Colletotrichum graminicola* G.W. Wils., because the pathogens so closely resemble one another. Recent DNA fingerprinting studies, however, indicate that the pathogen responsible for anthracnose in cool-season turf, while closely related to the corn pathogen, is a distinct fungal species, *C. cereale* Manns (5). This same fungus has been found across North America colonizing numerous cool-season grasses in field crops, prairies, residential lawns, ornamental grasses and other environments (4,5). Outside of the golf course environment, it appears that *C. cereale* rarely induces disease because the fungus can colonize other host plants without causing visible damage.

Annual bluegrass putting green turf shows initial symptoms of anthracnose. **Photo courtesy of B. Clarke**

Even though *C. cereale* can be found on many cool-season grasses, DNA fingerprints of individual isolates collected from North America, Japan, Australia and Europe indicate that this fungus is subdivided into groups of host-specific populations (4,5). With few exceptions, turfgrass pathogens are members of different populations of *C. cereale* than those found on other grass hosts. In addition, the populations of *C. cereale* infecting annual bluegrass are distinct from the populations that infect creeping bentgrass. Such host-specificity is illustrated on golf courses by the appearance of the disease on one grass species at a time in mixed swards of annual bluegrass and creeping bentgrass (15). Although anthracnose can be found on many plants, the host specificity of *Colletotrichum* species indicates that stands of non-turfgrass hosts are not likely to harbor strains that could cause anthracnose on turfgrasses.

Research with DNA fingerprinting indicates that *C. cereale* does not inhabit warm-season grasses (4). Anthracnose outbreaks on warm-season turfgrass, caused by other species of *Colletotrichum*, are rare and typically cause little damage.

Biology and epidemiology

Because the anthracnose pathogens on turf and certain field crops were thought to be the same organism throughout most of the 20th century, much of the ecology, epidemiology and pathogenic process of *Colletotrichum cereale* are inferred from research on corn and sorghum. There appear to be environmental and host factors that promote both anthracnose foliar blight and basal rot in cool-season turfgrasses, but these are poorly understood. In addition, the increase in anthracnose disease on turf during the past decade has given rise to speculation that more virulent strains of *C. cereale* may have emerged; however, no research data supporting this hypothesis have been reported. Although annual bluegrass has been successfully inoculated with *C. cereale* in the field, detailed studies of the biology of this pathogen have been hindered, in part, because a reliable method for infecting turf under controlled conditions in the greenhouse and growth chamber is lacking. Such studies are currently being conducted by NE-1025 scientists, but definitive results have yet to be published.

Symptomology and the disease cycle

On annual bluegrass, symptoms first appear as orange to yellow-colored spots that range from 0.25 to 0.5 inch (0.64-1.3 centimeters) in diameter. As the disease spreads, spots may coalesce into large, irregularly shaped areas of infected turf on greens, tees and fairways. Older or senescing

leaves are often colonized first, resulting in yellow leaf lesions. In close-cut turf, the lower stems may become affected, resulting in water-soaked, blackened tissue that is easily pulled from infected crowns.

Infested foliar or stem tissue are often covered with numerous *acervuli* (reproductive structures) with distinctive black spines (*setae*) that are used as diagnostic features for disease identification. From these acervuli, the pathogen produces masses of reproductive spores called *conidia* that can be spread by water or mechanically (foot traffic, mowing, etc.) to healthy plants. Once in contact with a susceptible plant, spores germinate to produce hyphae and a specialized structure known as an *appressorium* that adheres to the host tissue, allowing the fungus to penetrate into the plant (12). Based on studies of corn and sorghum, *C. cereale* is thought to overwinter in turf as dormant resting structures called *sclerotia* or as fungal mycelium in infected plant debris.

Colletotrichum cereale colonizes older senescing leaves of annual bluegrass. **Photo courtesy of J. Inguagiato**

Temperature required for infection

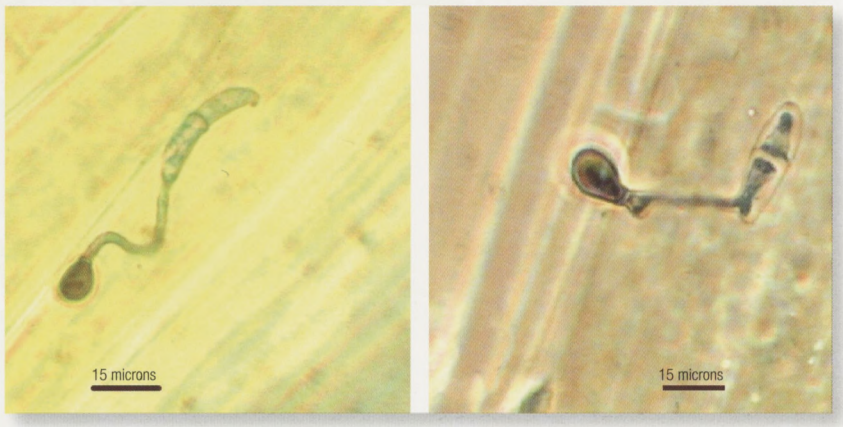
Anthracnose foliar blight is generally favored by higher temperatures (85 F-95 F [29.4 C-35 C]) in the summer and autumn. However, basal rot symptoms can be observed year-round, often occurring simultaneously with foliar blight symptoms during periods of heat stress. Laboratory studies indicate that some isolates of *C. cereale* grow best between 70 F and 88 F (21.1 C-31.1 C) and are able to cause foliar infection between 81 F and 91 F (27.2 C-32.7 C) (7). These observations correlate with summer outbreaks of foliar blight and basal rot, but do not explain the development of anthracnose basal rot symptoms under cool conditions (winter or spring). Additional research is needed to ascertain the optimal temperatures required for infection by cool-weather strains of this pathogen.

Acervuli with setae on leaf sheath. **Photos courtesy of T. Hsiang**

Anthracnose management: chemical control

Research and experience indicate that preventive fungicide applications are far more effective than curative applications for the control of anthracnose on putting greens. However, because we lack knowledge regarding the disease cycle and epidemiology of anthracnose, the best timing for preventive applications remains unknown. Generally, it is recommended that superintendents initiate a preventive fungicide program at least one month before the normal onset of anthracnose in their area.

Fungicides belonging to eight chemical classes are currently available for anthracnose control:



Germinating anthracnose conidium produces an appressorium on plant tissue.

the benzimidazoles, dicarboximides (specifically, iprodione), DMIs (demethylation inhibitors), nitriles, phenylpyrroles, phosphonates, polyoxins and QoIs (strobilurins) (Table 1).

These products can be separated into two groups: multisite inhibitors and single-site inhibitors. As the name implies, multisite inhibitors inhibit several to many biochemical processes in the fungal cell. In contrast, single-site inhibitors suppress only one biochemical process. This is an important distinction because it determines the risk of a given product for fungicide resistance; single-inhibitors have a moderate or high risk for resistance development, whereas multisite inhibitors generally have a low resistance risk.

Preventive versus curative

In addition to being more effective, preventive applications also expand the number of products available for use. Of the eight chemical classes available for anthracnose control, only the benzimidazole, DMI and QoI classes have significant curative activity. The nitrile, phenylpyrrole, phosphonate and polyoxin fungicides have little to no curative activity against anthracnose, but are very effective in tank-mixes or when applied on a preventive basis (6,17). Moreover, in New Jersey trials, using tank-mixtures and alternating among the eight chemical groups have generally been more efficacious than using a single product sequentially.

Although the benzimidazole, DMI and QoI chemistries have curative activity, superintendents should not rely solely on curative applications for anthracnose control. These chemistries are also at risk for fungicide resistance, as discussed later in this article, and curative applications may encourage resistance development in

Fungicides for anthracnose control

Chemical class	Common name	Topical mode of action	Utility	Resistance risk	Trade name, manufacturer
Benzimidazole	thiophanate-methyl	acropetal penetrant	preventive/curative	high	Cleary's 3336, Cleary Chemical Fungo, The Scotts Co. SysTec, Regal Chemical T-Storm, Lesco
Dicarboximides	iprodione	localized penetrant	preventive	moderate	Chipco 26GT, Bayer Iprodione Pro, BASF
DMI	fenarimol	acropetal penetrant	preventive/curative	moderate	Rubigan, Gowan Co.
	metconazole	acropetal penetrant	preventive/curative	moderate	Tourney, Valent
	myclobutanil	acropetal penetrant	preventive/curative	moderate	Eagle, Dow AgroSciences
	propiconazole	acropetal penetrant	preventive/curative	moderate	Banner Maxx, Syngenta Propiconazole Pro, Micro Flo Co. Savvi, Regal Chemical Spectator, Lesco
	triadimefon	acropetal penetrant	preventive/curative	moderate	Bayleton, Bayer
	triticonazole	acropetal penetrant	preventive/curative	moderate	Trinity, BASF Triton, Bayer
Nitrile	chlorothalonil	contact	preventive	low	Daconil, Syngenta ChloroStar, Regal Chemical Concorde, Griffin LLC Echo, Sipcam Agro USA Manicure, Lesco
Phenylpyrrole	fludioxonil	contact	preventive	low	Medallion, Syngenta
Phosphonates	fosetyl-Al	true systemic	preventive	low	Chipco Signature, Bayer Prodigy, Lesco
	phosphite salt	true systemic	preventive	low	Alude, Cleary Chemical Magellan, Nufarm Americas Resyst, Regal Chemical Vital, Phoenix Environmental Care
Polyoxins	polyoxin D	localized penetrant	preventive	moderate	Endorse, Cleary and Arysta LifeScience
QoI	azoxystrobin	acropetal penetrant	preventive/curative	high	Heritage, Syngenta
	fluoxastrobin	acropetal penetrant	preventive/curative	high	Disarm, Arysta LifeScience
	pyraclostrobin	acropetal penetrant	preventive/curative	high	Insignia, BASF
	trifloxystrobin	acropetal penetrant	preventive/curative	high	Compass, Bayer

Note. This list of products and manufacturers is not intended to be complete. Other turf fungicide products containing the same active ingredients may be available.

Table 1. Currently available fungicides for anthracnose control.

anthracnose populations.

Phosphonates

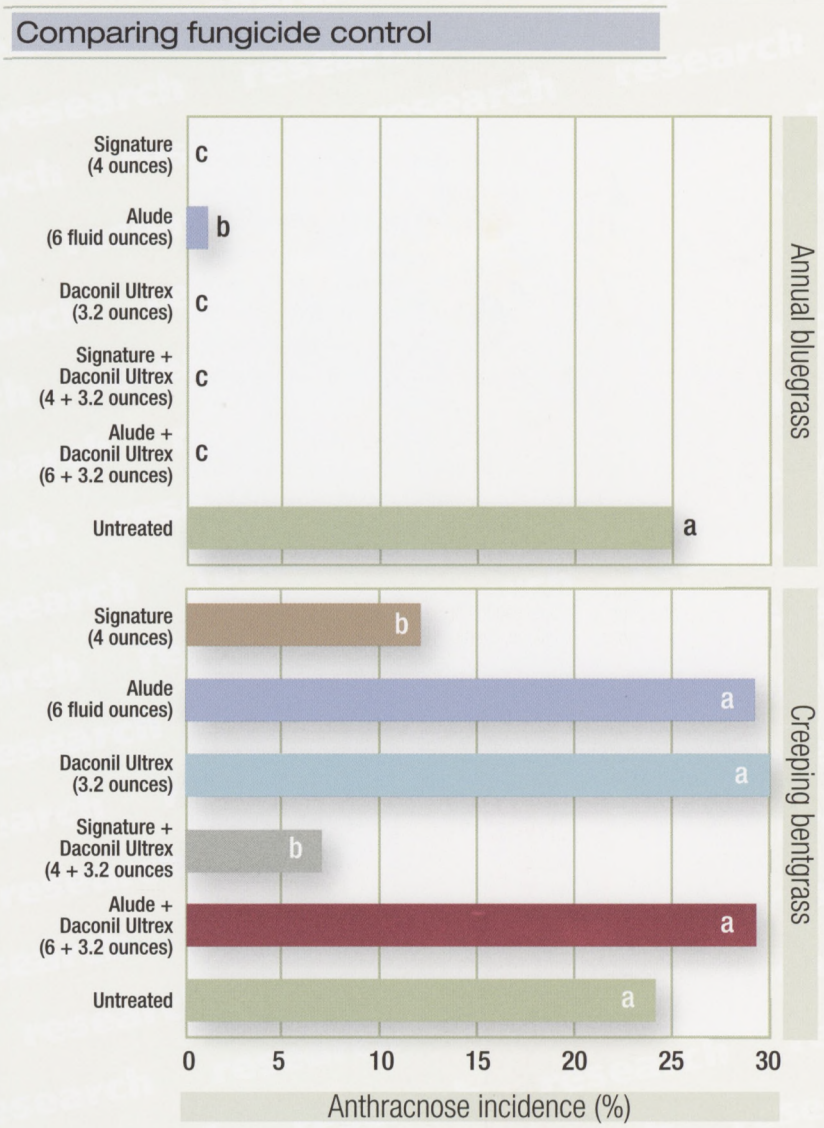
Although primarily used to control *Pythium* diseases, the phosphonates have recently been shown to be very effective against anthracnose when used preventively. Fosetyl-Al, released in the early 1980s, was the first phosphonate fungicide labeled for use on turf. Originally marketed as Aliette and now sold as Chipco Signature or Prodigy, fosetyl-Al is a complex molecule that is broken down to release the phosphite ion PO_3^- in the plant after application.

Since 2000, a new generation of phosphonates has been released into the turf market: the phosphite salts. These products contain phosphite (PO_3^-) in the form of a sodium (Na^+), potassium (K^+) and/or ammonium (NH_4^+) salt. Phosphonates have direct fungicidal properties and are also thought to reduce anthracnose by improving overall turf health and stimulating host defense responses. The risk of fungicide resistance for phosphonates is considered low to moderate because of these potential multiple modes of action. Certain formulations of fosetyl-Al also contain a copper phthalocyanine pigment, which imparts a green or blue-green color to the turf after application. Copper phthalocyanines are large macrocyclic molecules that absorb and refract light, conduct electricity and have a variety of other biological properties. These pigments are known to increase the overall quality of putting green turf after several successive applications.

Research in North Carolina and Pennsylvania has focused on evaluating fosetyl-Al and phosphite salts for anthracnose management. When applied on a preventive basis, fosetyl-Al has provided excellent control on both creeping bentgrass and annual bluegrass. Although the phosphite salts have been very effective on annual bluegrass, these products have only provided moderate anthracnose control on creeping bentgrass over three years of testing in North Carolina (Figure 1).

Application techniques

Proper application techniques are essential to a successful fungicide program for the control of anthracnose. Research in Pennsylvania indicates that fungicides should be applied in 2 gallons of water/1,000 square feet (81.5 milliliters/square meter) using nozzles that produce medium to coarse droplet sizes. Applications in lower water volumes or using extremely coarse droplet sizes can significantly reduce fungicide performance.



Fungicide resistance

Fungicide resistance has complicated anthracnose management. Resistance has not been an issue for multisite fungicides like chlorothalonil, but it is a concern for those with a site-specific mode of action. Resistance has developed in anthracnose to site-specific fungicide classes including the QoIs, benzimidazoles and DMI fungicides (21).

How resistance develops

Resistance typically results from repeated use of fungicides from a single fungicide class and can result in immunity or tolerance to that fungicide class. Resistance to each fungicide class develops independently (for example, a QoI-resistant fun-

Figure 1. Comparison of phosphonate fungicides for preventive control of anthracnose on annual bluegrass (**top**) and creeping bentgrass (**bottom**) greens. All fungicides were applied on a 14-day interval in 2 gallons water/1,000 square feet with a carbon dioxide-powered sprayer at 40 pounds/square inch (275.8 kilopascals) using TeeJet 8004 nozzles. Applications to annual bluegrass were initiated May 23, 2005, and data were collected on Aug. 15, 2005. Applications to creeping bentgrass were initiated June 29, 2006, and data were collected Aug. 6, 2006.

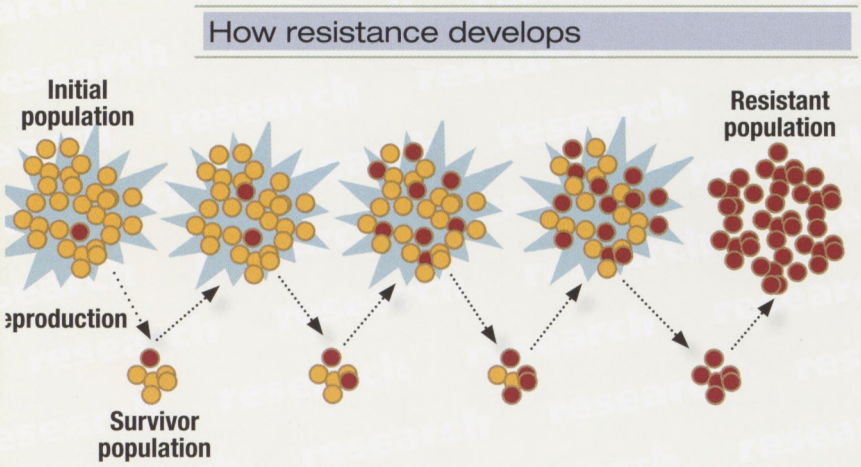


Figure 2. This is a simplified model of a multiple-step process over time, where repeated applications of a single-site mode of action fungicide select for naturally resistant individuals from a population. As more fungicide applications are made, the frequency of resistant survivors increases. In anthracnose populations, eventually, a high frequency of resistance can be selected for.

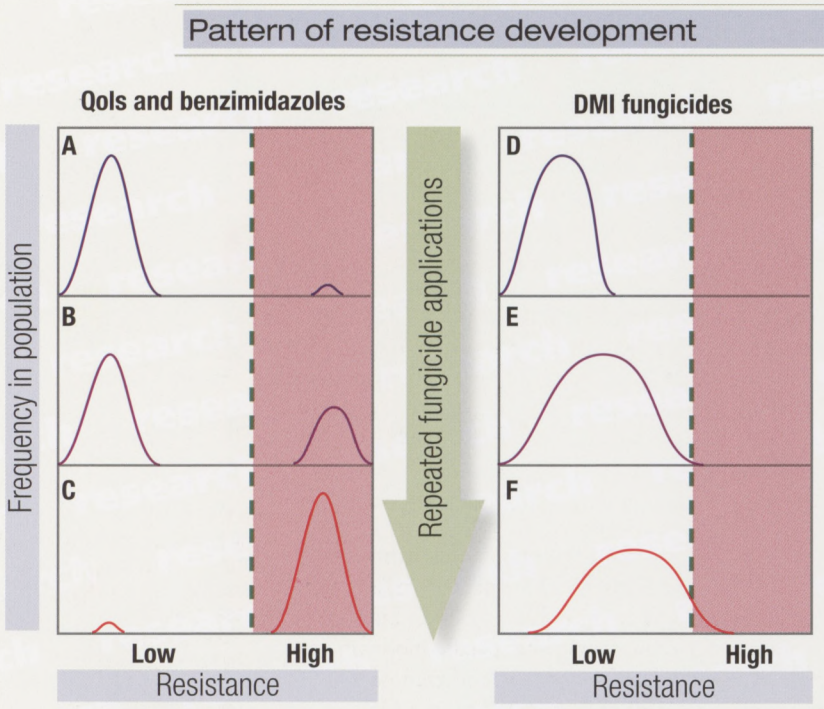


Figure 3. Patterns of resistance development to QoI, benzimidazole and DMI fungicides. Sensitive populations (**A, D**) change in response to repeated fungicide applications over time (**B, E**). For QoIs and benzimidazoles, a fungicide-immune population develops that cannot be controlled at all by fungicide applications, and it completely dominates the population (**C**). For DMIs, the population becomes more fungicide-tolerant, but most DMI-tolerant individuals can still be controlled with high-rate applications (**F**). For each fungicide group, the green line represents the highest labeled rate of fungicide; the proportion of the population that is sensitive to the fungicide and can be controlled is shown in the white boxes to the left, and the proportion of the population that is no longer sensitive to the fungicide and cannot be controlled is shown in the red areas to the right. **Adapted from Professor Wolfram Koeller, Cornell University**

gal population may be sensitive to benzimidazoles and vice versa). Repeated applications of the same fungicide or fungicides from the same fungicide class over time can quickly select for a higher frequency of resistant individuals (Figures 2,3). Unfortunately, once resistance to a chemical class develops, it does not go away as long as the resistant isolates persist in the population, even if fungicides from that chemical class are not used or are used sparingly in the future. Resistant isolates are as "fit" as sensitive ones with the added bonus of being able to survive certain fungicide applications.

Delaying resistance

The development of resistance can be delayed by limiting the number of applications from one fungicide class. Repeated sequential applications, late curative applications and low-label-rate applications tend to encourage the development of resistance. The use of multisite, contact fungicides is an important strategy for reducing the overall potential for resistance development because it can reduce the total amount and number of high-risk, single-site fungicide applications. Tank-mixing fungicides (especially with multisite fungicides) may not stop resistance development, but it can prevent total control failure from a fungicide application; for example, a tank-mix of chlorothalonil with a QoI fungicide still selects for QoI resistance, but the chlorothalonil will contribute to disease control of individuals that are both resistant and sensitive to QoIs.

QoI fungicides

The QoI fungicide azoxystrobin (Heritage) was commercially released for use on turf in 1997. Resistance of *Colletotrichum cereale* to the QoI fungicides (Heritage, Compass, Disarm and Insignia) developed quickly (1) and was fairly widespread in the U.S. by 2004. QoI-resistant individuals of *C. cereale* are immune and cross-resistant to all fungicides in this chemical class, even when the fungicides are applied at 10 times standard rates or higher.

Thus, the use of QoI fungicides for anthracnose control should be discontinued for locations with a history of poor QoI performance and/or resistance confirmed by laboratory testing. There is no evidence that QoI resistance in fungal populations will decrease over time; resistance is likely to be permanent. However, for any given location, resistance may be localized to one or only a few greens. Subsequently, QoIs may still be effective on other greens where resistance has not developed. QoI fungicides can also still be used for the control of other diseases (for example, *Rhizoctonia*

diseases and summer patch) where the anthracnose pathogen has developed resistance to the QoI fungicides.

Benzimidazoles

Benzimidazole fungicides have been used on turf since the 1960s, and currently only thiophanate-methyl is labeled for use on cultivated grasses. Resistant isolates of *Colletotrichum cereale* were found as early as 1989 in Michigan (10) and more recently in a number of other locations throughout the U.S. (21). Like QoI-resistance, resistance to the benzimidazoles results in complete immunity for individuals and is permanent in established populations of anthracnose. Benzimidazole use for anthracnose control should be discontinued at locations with a history of poor benzimidazole performance and/or resistance confirmed by laboratory testing.

DMI fungicides

DMIs have been used on turfgrasses since the 1980s, and several DMIs are currently available for use on cultivated grasses. Whereas *Colletotrichum cereale* can quickly develop resistance to QoI and benzimidazole fungicides, it gradually develops a tolerance to DMI fungicides, which means that good control may be achieved with high labeled rates or shorter application intervals. In California, isolates that are two to 10 times more tolerant to propiconazole (for example, Banner MAXX, Syngenta) than sensitive isolates have been found on greens, but these isolates could still be controlled with the high label rate (2 fluid ounces [59.1 milliliters]) of Banner MAXX when applied at 14-day intervals (21). This suggests that pathogens that have developed tolerance to DMIs are still manageable with high rates of DMIs. To both maintain the utility of these fungicides and minimize non-target effects of excessive use (potential plant growth regulation), it is prudent to alternate the DMIs with other fungicide chemistries.

Additionally, there is a clear difference in the intrinsic activity of the different DMI fungicides (22). On average, propiconazole was roughly five times more toxic to *C. cereale* than myclobutanil (Eagle, Dow AgroSciences) and 40 times more toxic than triadimefon (Bayleton, Bayer) in laboratory studies. In New Jersey fieldwork, season-long applications resulted in anthracnose severity of 7.5% (Banner Maxx), 33% (Eagle) and 79% (Bayleton) (17). The intrinsic activities of new DMIs such as triticonazole (Trinity, BASF; Chipco Triton, Bayer) and metconazole (Tourney, Valent) are being examined at this time.

The potential for resistance development to the DMIs can be reduced by alternating fungicide chemical classes, using the most intrinsically active DMI (propiconazole) and applying a higher labeled rate during cooler temperatures (phytotoxicity or thinning can occur at high label rates when some DMIs are applied during high temperatures) to obtain the maximum disease control with this fungicide class.

Multisite fungicides

Since multisite fungicides have a low risk for resistance, these are important tools in an anthracnose management program. Chlorothalonil used alone or in a tank-mixture can be very efficacious, especially when used preventively. As mentioned above, tank-mixes can also provide better disease control if QoI, benzimidazole or DMI applications are made to resistant populations or populations with reduced sensitivity. Since 2001, seasonal limits have been imposed for the use of chlorothalonil on golf courses, so it is important to conserve its use for difficult-to-control diseases such as anthracnose.

Other fungicides

So far, no cases of resistance have been reported for the other classes of site-specific fungicides used to control anthracnose including the polyoxins, phenylpyrroles and phosphonates. Of these, the polyoxins and phenylpyrroles are more likely to have future resistance problems because of their mode of action, so these should be used judiciously.

Anthracnose management: cultural practices

Nitrogen fertility

Minimizing nitrogen fertility is one approach used by superintendents to increase ball-roll distance (green speed) on putting green turf. However, management trials on annual bluegrass greens in

Anthracnose and nitrogen, 2004

Nitrogen interval†	% turf area infested‡				
	June 11	June 20	July 19	Aug. 17	Aug. 30
Every 28 days	9.0 a	14.6 a	34.3 a	40.0 a	56.0 a
Every 7 days	3.6 b	9.2 b	16.4 b	27.2 b	41.8 b

†Nitrogen was applied as an NH_4NO_3 solution containing 0.1 pound nitrogen/1,000 square feet (0.49 gram/square meter) from May 7 to Oct. 9, 2004.
‡Means followed by different letters are significantly different from one another.

Table 2. Anthracnose disease response to nitrogen fertilization of annual bluegrass turf mowed at 0.125 inch (3.2 millimeters) in North Brunswick, N.J., during 2004.

New Jersey indicate that soluble nitrogen applied every seven days at a low rate of 0.1 pound/1,000 square feet (0.49 gram/square meter) from late spring through summer can reduce anthracnose severity 5% to 24% compared to the same rate of nitrogen applied every 28 days (11) (Table 2). Additionally, fungicide efficacy for the control of anthracnose was increased in plots that received an additional 0.125 pound of nitrogen/1,000 square feet (0.61 gram/square meter) every 14 days from May through August (6). Specific mechanisms associated with reduced anthracnose severity in plants with greater nitrogen fertility are currently unknown, although increased plant vigor has been proposed (20).

Superintendents have frequently asked about the potential role, if any, of late- and early-season granular fertilization and are seeking guidance on the relevance of this practice to controlling anthracnose on annual bluegrass turf. Work on anthracnose foliar blight of fairway turf indicated that annual nitrogen fertilization should be moderate (3 pounds nitrogen/1,000 square feet [14.6 grams/square meter]), and a greater proportion of the annual nitrogen fertilizer should be applied in autumn rather than spring to reduce disease severity (8). These effects may be explained by a depletion of carbohydrate reserves induced by aggressive spring nitrogen fertilization and exacerbated by low net photosynthesis during summer stresses.

Annual nitrogen rate and season of fertilization need to be evaluated for anthracnose basal rot under putting green conditions as well as the possibility of an interaction between summer applications of soluble nitrogen and granular nitrogen fertilization programs. Research trials addressing these objectives will be initiated in late summer 2008 in New Jersey.

Anthracnose response, 2004 and 2005

Nitrogen interval (days)†	Embark (mefluidide)‡	Primo (trinexapac-ethyl)§	Aug. 30, 2004	July 30, 2005
	Fluid ounce/1,000 square feet		% turf area infested	
28	0	0	65.0	84.9
28	0	0.125	51.3	86.5
28	0.69	0	57.4	82.0
28	0.69	0.125	50.3	85.3
7	0	0	48.9	66.6
7	0	0.125	43.0	67.6
7	0.69	0	50.0	69.0
7	0.69	0.125	25.1	45.9
LSD#			6.77	9.45

†Nitrogen was applied as an NH_4NO_3 solution containing 0.1 pound nitrogen/1,000 square feet from May 7 to Oct. 9, 2004, and May 21 to Aug. 3, 2005.

‡Mefluidide (Embark 0.2L) was applied as a split application of 0.69 fluid ounce/1,000 square feet (0.22 milliliter/square meter) on April 7 and 21, 2004, and April 6 and 20, 2005.

§Primo MAXX 1ME was applied at 0.125 fluid ounce/1,000 square feet (0.04 milliliter/square meter) every 14 days from April 7 to Sept. 22, 2004, and April 6 to Aug. 10, 2005. Initial Primo application was delayed on turf previously treated with Embark until April 21 in 2004 and April 20 in 2005.

#LSD (least significant difference). The difference between two means (that are within the same level as the other two factors) must be equal to or greater than the LSD value to be considered statistically different.

Table 3. Anthracnose disease response to nitrogen fertilization, Embark and Primo application on annual bluegrass turf mowed at 0.125 inch (3.2 millimeters) in North Brunswick, N.J., during 2004 and 2005.

Plant growth regulators

Plant growth regulators (PGRs) are widely used to reduce shoot growth between mowing, improve shoot density, increase stress tolerance and enhance playability of putting green surfaces. Primo (trinexapac-ethyl, Syngenta) applied to annual bluegrass greens at 0.125 fluid ounce/1,000 square feet (0.039 milliliter/square meter) every 14 days from May through August reduced disease from late June to late July (6). Other research in New Jersey from 2003 through 2007 indicated that Primo or Embark (mefluidide, PBI Gordon) used alone had infrequent and inconsistent effects on anthracnose, but did not greatly aggravate disease severity. Additionally, in plots where Embark and Primo were used in combination, anthracnose severity was reduced 6% to 14% compared to plots that received only one of these plant growth regulators during the last two years of a 3-year trial (11). At advanced stages of disease (end of the season), the combination of weekly nitrogen fertilization with Embark and Primo application provided the greatest reduction in disease severity (Table 3).

Many superintendents were using chemical growth regulation strategies not addressed in previous research; thus, further assessment was conducted from 2005 to 2007. Treatment effects evaluated included rate (0.1, 0.125 and 0.2 fluid ounce/1,000 square feet [0.03, 0.04 and 0.06 millimeter/square meter]) and frequency (seven versus 14 days) of Primo application, and combinations of Primo with Embark or Proxy (ethephon, Bayer), which are commonly used to regulate seedhead development of annual bluegrass. Data

from this trial have not been completely analyzed, but it is clear that use of these growth regulators alone or in combination are not increasing anthracnose severity.

Verticutting

Verticutting is another common management practice used on greens to minimize puffiness associated with thatch accumulation and to improve surface playability. Verticutting has been reputed to enhance wounding of host plant tissue and thereby increase anthracnose severity (9,13,15). Contrary to this perception, verticutting to a shallow depth (0.1 inch [3.0 millimeters]) did not have a substantial effect on anthracnose severity in New Jersey (11). Infection studies with *Colletotrichum* in annual bluegrass and corn have demonstrated that wounds are not required for host penetration (3,16,19). However, other researchers (18) have reported that verticutting to a 0.2-inch (5-millimeter) depth increased anthracnose in annual bluegrass. Thus, verticutting to a depth that cuts crowns and stolons (severe wounding) and removes thatch may enhance plant stress and increase anthracnose severity, whereas verticutting to groom (light vertical mowing) the leaf canopy appears to have little effect on disease severity.

Mowing and rolling practices

It is well known that a lower cutting height will increase ball-roll distance (green speed) on a putting green. Lower cutting height has also been associated with increased anthracnose severity (2). More frequent mowing (double- or triple-cutting) is used to increase green speed and is thought to intensify wounding of leaf tissue. Moreover, lightweight rolling is used to smooth the turf canopy and improve ball-roll distance. Frequent use of these practices either alone or in combination was thought to increase stress and susceptibility to anthracnose on putting greens.

As expected, research in New Jersey during 2004 and 2005 found that a 0.015-inch (0.38-millimeter) increase in mowing height (0.110 to 0.125 inch, or 0.125 to 0.141 inch [2.8 to 3.2 millimeters, or 3.2 to 3.6 millimeters]) was sufficient to reduce anthracnose severity (Table 4). Contrary to expectations, increasing mowing frequency from a single daily mowing to double-cutting daily did not increase anthracnose severity, and lightweight vibratory rolling every other day either had no effect or slightly reduced anthracnose severity (Table 5).

Additional analysis of this data is under way; but it appears that the practices of double-cutting and rolling (rather than lowering the cutting height) should be used to improve ball roll without intensifying anthracnose severity.

Research in New York is currently evaluating the possibility that mower setup including walk-behind mower design, bedknife position and frequency of clip may affect basal rot anthracnose. Moreover, traffic stress from maneuvering mowing and rolling equipment on the edge of greens has been suggested as a potential cause of enhanced anthracnose on greens. A trial has been initiated in New Jersey to determine whether routine mowing and rolling operations can affect anthracnose, depending on the location of the equipment traffic on a putting green, that is, perimeter (edge) or center.

Topdressing practices

Topdressing used to smooth putting surfaces and manage thatch accumulation has been sug-

Anthracnose and mowing height, 2004

Mowing height		% turf area infested†			
inches	millimeters	Aug. 2	Aug. 11	Aug. 23	Sept. 15
0.110	2.8	4.2 a	36.8 a	51.7 a	61.8 a
0.125	3.2	2.6 ab	32.2 a	48.0 ab	53.6 b
0.140	3.6	1.1 b	28.8 a	40.5 b	44.5 c

†Means followed by different letters are significantly different from one another.

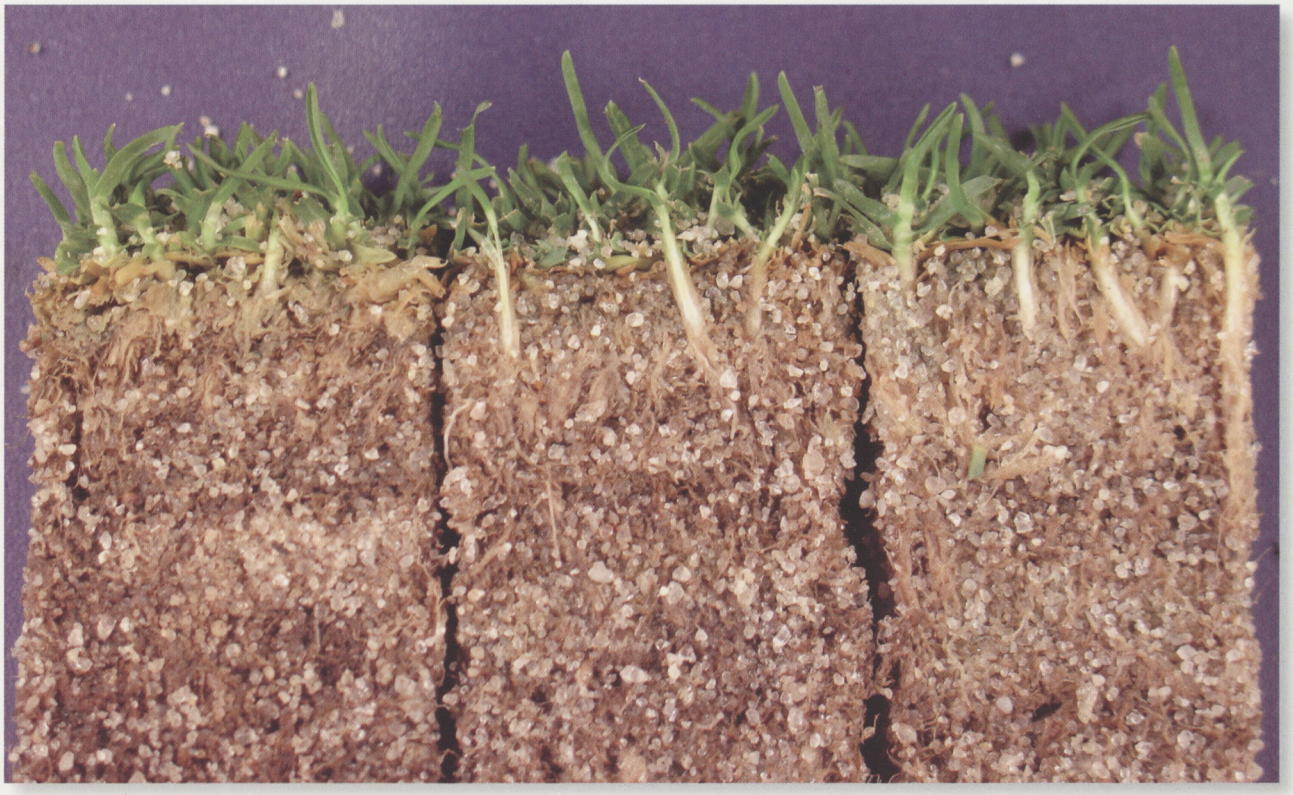
Table 4. Anthracnose disease response to mowing height on annual bluegrass putting green turf in North Brunswick, N.J., during 2004.

Anthracnose and rolling, 2004

	% turf area infested†			
Lightweight rolling	Aug. 2	Aug. 11	Aug. 23	Sept. 15
None	3.0 a	34.2 a	49.0 a	56.2 a
Every other day	2.3 b	31.0 a	44.4 b	50.4 b

†Means followed by different letters are significantly from one another.

Table 5. Anthracnose disease response to lightweight rolling on annual bluegrass putting green turf in North Brunswick, N.J., during 2004.



Light, frequent sand topdressing buries and protects crowns and leaf sheaths. Note the depth of crowns in the **middle** (1 cubic foot/1,000 square feet/week [0.0003 cubic meter/square meter]) and **right** (2 cubic feet/1,000 square feet/week [0.0006 cubic meter/square meter]) profile samples are greater than the profile sample on the **left** (no topdressing). **Photo courtesy of J. Inguagiato**

gested as contributing to anthracnose epidemics. Trials were initiated in New Jersey to determine whether rate and frequency of sand topdressing influenced disease development. Initial data analyses indicate that sand topdressing may slightly increase anthracnose at early stages of the disease but later reduces disease severity. Light, frequent applications (topdressing every seven or 14 days at 1 or 2 cubic feet/1,000 square feet [304.8 or 609.6 cubic centimeters/square meter]) provided the most rapid and substantial reduction of anthracnose. Sand topdressing every 21 or 42 days at a higher rate (4 cubic feet/1,000 square feet [1,219.2 cubic centimeters/square meter]) also reduced disease by August in 2006 and 2007.

A companion study in 2005 and 2007 assessed whether methods of sand incorporation and sand particle shape (that is, round versus subangular) affect disease severity. The incorporation methods evaluated in this study (that is, stiff-bristled brush, soft-bristled brush, vibratory rolling or none) had no effect on anthracnose. Moreover, both sand types at first enhanced disease in July, but continued topdressing reduced disease severity later in the season (August and September) each year compared to turf that was not topdressed.

Irrigation management

Proper irrigation management is critical to maintaining plant health and the playability of putting green turf. A trial was established in New Jersey to determine whether irrigation regime (that is, 100%, 80%, 60% and 40% of reference evapotranspiration, ET_o) influences anthracnose disease. This trial is being continued in 2008, but initial data indicate that anthracnose severity was increased in plots irrigated with 40% or 60% ET_o compared to turf receiving 80% or 100% ET_o. Further data collection and analysis is needed to determine the veracity of these results.

Summary

Currently, best management practices for the control of anthracnose disease on annual bluegrass putting green turf include implementing a frequent low-nitrogen-rate fertility program initiated in late spring and continuing through summer. Soluble nitrogen applied every seven days at 0.1 pound/1,000 square feet (0.49 gram/square meter) from late spring through summer has been effective at reducing disease severity. However, the annual nitrogen rate and seasonal aspect of fertilization need to be further studied as well as the possibility of an interaction between summer applications of soluble nitrogen and granular nitrogen fertilization programs.

Chemical growth regulation strategies including the use of Embark, Proxy and Primo do not

intensify disease severity and, on occasion, may reduce severity. Relatively large reductions in disease severity have also occasionally been observed where frequent low-nitrogen-rate fertilization is combined with the use of seedhead suppressants (Embark or Proxy) in the spring and sequential applications of the vegetative growth regulator Primo throughout the growing season.

If it is feasible, superintendents should use double-cutting and lightweight rolling instead of lowering mowing heights to achieve greater ball-roll distance (green speed). Increasing mowing height as little as 0.015 inch (0.38 millimeter) can decrease anthracnose severity, whereas daily double-cutting and lightweight rolling increase ball-roll distance and do not intensify disease. In fact, rolling may slightly reduce disease severity.

Preventive fungicide applications (generally one month before the normal onset of symptoms) are far more effective than curative applications. The benzimidazole, DMI, dicarboximide (iprodione), nitrile, phenylpyrrole, phosphonate, polyoxin and QoI fungicide chemistries can effectively control anthracnose, but resistance has been a problem with several of these groups. Repeated sequential applications of single-site (benzimidazole, DMI and QoI) fungicides, late curative applications and low-label-rate applications tend to encourage the development of resistance and, therefore, should be avoided. The use of multisite contact fungicides is an important strategy for reducing or delaying the overall potential for resistance development. Tank-mixtures and alternation of these chemical groups are often more efficacious than single product applications and should be used to reduce the potential for fungicide resistance. Recent research suggests that fungicides should be applied in 2 gallons of water/1,000 square feet (81.5 milliliters/square meter) using nozzles that produce medium to coarse droplet sizes.

Conclusions

Although much has been learned about the biology and management of anthracnose through this project, many questions remain unanswered. We must continue to gain a more comprehensive understanding of the anthracnose system on annual bluegrass and bentgrass that will enable us to develop more specific and better targeted management programs. Very little is known about the life history of *Colletotrichum cereale* and the epidemiology of anthracnose, including where and how the pathogen survives and the weather conditions that drive infection and symptom expression. Such information would aid in the development of a useful predictive model for basal rot anthracnose. Moreover, this knowledge would enable superintendents to more effectively target fungicide applications or other management practices to key points in the disease cycle. For example, if the timing of initial infections was known, then superintendents could apply preventive fungicide applications at the most effective time(s), thereby potentially providing more effective control with the most efficient (reduced) chemical inputs.

Fungicide resistance remains a problem for anthracnose control, and is a continuing risk for new site-specific fungicides. Scientists are actively investigating how pathogen populations respond to fungicide applications, how resistance develops over time and which resistance management strategies are most effective. Continuing cultural management research will clarify the effect of top-dressing, irrigation and traffic on anthracnose disease severity, from which best management practices can be enhanced. And, continuing work on selecting and breeding annual bluegrass may lead to new varieties of annual bluegrass with improved tolerance to anthracnose disease.

Disclaimer

Use pesticides only according to the directions on the label. No endorsement is intended for products mentioned, nor is criticism meant for products not mentioned. Trade names are used only to give specific information; this publication does not recommend one product instead of another that might be similar.

Funding

The authors thank USDA Hatch Regional Hatch Project NE-1025, GCSAA, USGA, GCSA of New Jersey, U.S. Environmental Protection Agency, The Land Institute, Tri-State Turf Research Foundation, and Rutgers Center for Turfgrass Science for supporting this work. A portion of the research described in this paper has been funded by the U.S. EPA under the Science to Achieve Results (STAR) Graduate Fellowship Program. EPA has not officially endorsed this publication, and the views expressed herein may not reflect the views of the EPA.

Acknowledgments

Graduate student Joseph Roberts, technician T.J. Lawson and numerous student assistants contributed greatly to this research. We also thank the participating golf superintendents and their clubs for allowing us to do research on their courses.

Literature cited

1. Avila-Adame, C., G. Olaya and W. Köller. 2003. Characterization of *Colletotrichum graminicola* isolates resistant to strobilurin-related QoI fungicides. *Plant Disease* 87:1426-1432.
2. Backman, P., G. Stahnke and E. Miltner. 2002. Anthracnose update: Cultural practices affect spread of disease in northwest. *Turfgrass Trends* 11:T1-T2, T4.
3. Bruehl, G.W., and J.G. Dickson. 1950. Anthracnose of cere-

Contributing scientists

The Multistate Research Project NE-1025, Biology, Ecology, and Management of Emerging Pests of Annual Bluegrass on Golf Courses has many participating scientists. Other scientists involved in the anthracnose research portion of the project are:

- Stacy Bonos, Ph.D., Rutgers University
- Michelle DaCosta, Ph.D., University of Massachusetts, Amherst
- Peter Dernoeden, Ph.D., University of Maryland
- Brad Hillman, Ph.D., Rutgers University
- David Huff, Ph.D., Pennsylvania State University
- Geunhwa Jung, Ph.D., University of Massachusetts, Amherst
- John Kaminski, Ph.D., University of Connecticut
- Peter Landschoot, Ph.D., Pennsylvania State University
- Joseph Roberts, Rutgers University
- Wakar Uddin, Ph.D., Pennsylvania State University

The research says

→ Controlling anthracnose disease on annual bluegrass greens requires initiating a frequent low-nitrogen-rate fertility program in late spring and continuing it through summer. Further study is needed on annual nitrogen rate, seasonal aspects of fertilization and the possibility of an interaction between summer applications of soluble nitrogen and granular nitrogen fertilization programs.

→ Using Embark, Proxy and Primo does not intensify anthracnose disease severity and may reduce it. Frequent low-nitrogen-rate fertilization combined with the use of seedhead suppressants in spring and sequential applications of Primo throughout the growing season may reduce disease severity.

→ Increasing mowing height as little as 0.015 inch can decrease anthracnose severity; daily double-cutting and lightweight rolling increase ball-roll distance and do not intensify disease; and rolling may slightly reduce disease severity.

→ Preventive fungicide applications are more effective than curative applications. Repeated sequential applications of single-site fungicides from the same class, late curative applications and low-label-rate applications tend to encourage the development of resistance.

→ Multisite fungicides have a negligible risk of resistance and can help reduce overall selection pressure for resistance. Tank mixes can be more efficacious and reduce the impact of resistance, but resistance to the individual mixing partners must still be managed.

→ Topics for future research include clarifying the effect of topdressing, irrigation and traffic on anthracnose disease severity, and understanding where and how the anthracnose pathogen survives and the weather conditions that drive infection and symptom expression.

als and grasses. Technical Bulletin 1005. USDA, Washington, D.C.

4. Crouch, J.A. 2008. Evolution of *Colletotrichum* species inhabiting grasses in diverse ecosystems. Ph.D. dissertation, Rutgers University, New Brunswick, N.J.
5. Crouch, J.A., B.B. Clarke and B.I. Hillman. 2006. Unraveling evolutionary relationships among the divergent lineages of *Colletotrichum* causing anthracnose disease in turfgrass and corn. *Phytopathology* 96:46-60.
6. Crouch, J.A., E.N. Weibel, J.C. Inguagiato, P.R. Majumdar, et al. 2003. Suppression of anthracnose on an annual bluegrass putting green with selected fungicides, nitrogen, plant growth regulators, and herbicides. *2003 Rutgers Turfgrass Proceedings* 35:183-192.
7. Danneberger, T.K., J.M. Vargas Jr. and A.L. Jones. 1984. A model for weather-based forecasting of anthracnose on annual bluegrass. *Phytopathology* 74:448-451.
8. Danneberger, T.K., J.M. Vargas Jr., P.E. Rieke and J.R. Street. 1983. Anthracnose development on annual bluegrass in response to nitrogen carriers and fungicide application. *Agronomy Journal* 75:35-38.
9. Dernoeden, P.H. 2002. Creeping bentgrass management: summer stresses, weeds, and selected maladies. John Wiley & Sons, Hoboken, N.J.
10. Detweiler, A.R., J.M. Vargas Jr. and W.L. Brendt. 1989. Resistance of *Colletotrichum graminicola* to benomyl. Proceedings of the International Turfgrass Research Conference 6:359-362.
11. Inguagiato, J.C., J.A. Murphy and B.B. Clarke. 2008. Anthracnose severity on annual bluegrass influenced by nitrogen fertilization, growth regulators, and verticutting. *Crop Science* 48.1595-1607.
12. Khan, A., and T. Hsiang. 2003. The infection process of *Colletotrichum graminicola* and relative aggressiveness on four turfgrass species. *Canadian Journal of Microbiology* 49:433-442.
13. Landschoot, P., and B. Hoyland. 1995. Shedding some light on anthracnose basal rot. *Golf Course Management* 63(11):52-55.
14. Mann, R.L., and A.J. Newell. 2005. A survey to determine the incidence and severity of pests and diseases on golf course putting greens in England, Ireland, Scotland, and Wales. *International Turfgrass Society Research Journal* 10:224-229.
15. Smiley, R.W., P.H. Dernoeden and B.B. Clarke. 2005. Compendium of turfgrass diseases. 3rd ed. APS Press, St. Paul.
16. Smith, J.D. 1954. A disease of *Poa annua*. *Journal of the Sports Turf Research Institute* 8:344-353.
17. Towers, G., K. Green, E. Weibel, P. Majumdar and B.B. Clarke. 2003. Evaluation of fungicides for the control of anthracnose basal rot on annual bluegrass, 2002. *Fungicide and Nematicide Tests* 58:T017.
18. Uddin, W., M.D. Soika and E.L. Soika. 2006. Influence of nitrogen source and rate on severity of anthracnose basal rot in mixed annual bluegrass and creeping bentgrass greens. *Phytopathology* 93:S86.
19. Vernard, C., and L. Vaillancourt. 2007. Penetration and colonization of unwounded maize tissues by the maize anthracnose pathogen *Colletotrichum graminicola* and the related nonpathogen *C. sublineolum*. *Mycologia* 99:368-377.
20. White, D.G., R.G. Hoeft and J.T. Touchton. 1978. Effect of nitrogen and nitrapyrin on stalk rot, stalk diameter, and yield of corn. *Phytopathology* 68:811-814.
21. Wong, F.P., and S. Midland. 2004. Fungicide resistant anthracnose: bad news for greens management. *Golf Course Management* 72(6):75-80
22. Wong, F.P., and S.L. Midland. 2007. Sensitivity distributions of California populations of *Colletotrichum cereale* to four sterol demethylation inhibitor fungicides: propiconazole, myclobutanil, tebuconazole and triadimefon. *Plant Disease* 91:1547-1555.

GCM

James Murphy (murphy@aesop.rutgers.edu) and Bruce Clarke are Extension specialists at Rutgers University, New Brunswick, N.J. Frank Wong is an associate Cooperative Extension plant pathology specialist and associate plant pathologist in the department of plant pathology and microbiology, University of California, Riverside. Lane Tredway is an associate professor in the department of plant pathology, North Carolina State University, Raleigh. Jo Anne Crouch is a post-doctoral associate and John Inguagiato is a graduate student in the department of plant biology and pathology, Rutgers University, New Brunswick, N.J. Tom Hsiang is a professor in the department of environmental biology, University of Guelph, Ontario, Canada. Frank Rossi is an associate professor in the department of horticulture, Cornell University, Ithaca, N.Y.

This article has been reprinted with thanks to the Golf Course Superintendents Association, from their official publication, Golf Course Management. It was originally published in the August 2008 issue (pp. 93-104) Formatting only has been adjusted to facilitate Green is Beautiful.

On the REEL side of things

by: Warren Wybenga, Equipment Manager,
Donalda Club, Toronto
WWybenga@donaldaclub.ca (416) 447-5575 x263

Some Things I've Learned

This upcoming season marks my twenty-first year working in the turf industry, on golf courses specifically, and the nineteenth looking after equipment. Over these years I have had the opportunity to learn from some very talented and experienced individuals… some techs, some not…but each and every one had been blessed with talent and, whether they realized it or not, the occasion to share this knowledge with those who took the time to listen and observe. Don't rule out anyone as a potential source of information. You never know who or where that next wafer of wisdom may come from.

One of the first things that I learned, even before I officially started into my apprenticeship, was to realize when it was time to walk away. I'm not talking about when personalities conflict (but it certainly would apply here too), rather when you're working on a machine and no matter what you do or try, you just can't "get it". It doesn't have to be for very long or sometimes you may have to leave it for days, but it never fails to amaze me that by simply taking the time to collect your thoughts or focus on something else entirely, your perspective can be restored and what was frustrating you to no end mere moments before, now goes together seemingly without effort. The nut that you have to thread back onto a bolt, that you can't even see and is just at the end of your fingertips, will suddenly start and spin on like it couldn't wait to be reunited with its mate. Frustration is never a productive emotion so if you feel yourself starting to loose your cool, don't throw the wrench, just walk away for as long as it takes to refresh your outlook and face the task with renewed energy. Taking a well timed break will actually end up saving you time in these situations.

Sooner or later, every tire will go flat…with the exception of that middle-aged spare, right fellas? Even a tire that has not lost one pound of pressure for years will at some point come up short. It is important to the performance of every piece of turf equipment that the tires are kept at the recommended pressures at all times. After all, this is where the rubber meets the road (or turf or cart path) and every system on that machine, from the suspension and steering to brakes and implements is designed with those pieces of round rubber in mind. This is most noticeable during the changing of the seasons and whenever there is a sudden change in barometric pressure. Another culprit is newly installed cart path curbing. It takes time for operators and golfers alike to get used to taking that corner a little wider than they're used to, so it's always a good idea to check the fleet for soft tires immediately following these times. And don't rely on your eyes alone…that's why they invented pressure gauges.

I don't care whether you spin grind or relief grind or even both. Either method is capable of providing a tournament quality cut from your reels if it is done properly. To each his own and we all have our preferences, but be careful not to confuse the two disciplines. Do not back-lap if your reels have not been relief ground. It is simply a waste of time, energy and resources. Think of back-lapping as an additional tool at your disposal to be used with relief ground reels only, which by their nature have smaller contact/surface areas between reel blade and bed-knife, allowing the lapping process to return the reels nearer to their post sharpened condition. Spin grinding conversely allows for very little relief on the reel blade, as the necessary relief is provided by grinding it into the bed-knife, making it very difficult for the lapping compound to do its intended job. If a previously "spun" reel is dull, spin it again…it's a much faster way to achieve better results than by trying to combine the two disciplines. So remember, if you relief grind your reels, keep the bucket of lapping compound full and have at it. If all you do is spin grind then free up some shelf space by donating it to someone who can make use of it properly.

In closing, I want to offer my heartfelt congratulations to retired long time Turf Equipment Technician, Association Board member, volunteer, college instructor, industry advocate, and friend, Eddie Konrad, for being selected by the International Golf Course Equipment Managers Association as the 2009 recipient of the Edwin Budding Award. This award was created to recognize those in the turf equipment industry whose actions have gone above and beyond the norm to help develop our industry into what it is today. Edwin Budding was one of those individuals who helped define golf, not as a player, but as an engineer. He designed the first reel mower, which has shaped golf as we know it today. The IGCEMA created this award to recognize individuals that demonstrate the same qualities Mr. Budding did, whose influence has resulted in significant change in our industry above and beyond the normal day to day. His dedication and selfless devotion to the education of both present and future Turf Equipment Technicians helped the selection committee to distinguish Eddie from within a notable list of finalists that hail from the UK, Canada and the USA, all of whom have made significant contributions of their own. Eddie was presented with his award at the 2010 Golf Industry Show in San Diego.
Congratulations Eddie and good luck with your new "retirement" career as an industry consultant and speaker!

Second to one

by Tyler Windfeld, Assistant Superintendent
Black Diamond Golf Club
Winner of the 2009 Hugh Kirkpatrick Busary

Tyler submitted the following as part of his application for the Hugh Kirkpatrick Bursary.

Staff Management

I have spoken with a couple of assistants who are no longer in the profession and have moved on in a different direction. These assistants have given the same reason for leaving the industry and that was due to the pressure of managing staff. The most difficult thing for anyone in the business, I believe, is staff management. Moving through the ranks generally managing the staff would make or break ones ability to complete some tasks. I have found that some of the other department skills such as irrigation and spraying can come easy to someone, with practice. It is the different personalities and work habits of the staff, which change from day to day, that makes managing a team on the golf course, very challenging.

One of the most frequently asked questions I get from people is about when you get to mid season and the staff are not working as well, or they may not be as enthusiastic as they were at the beginning of the season, "How do you boost moral amongst the staff?" I found that throwing a staff party to show how much you appreciate their hard work every couple of months usually gets our staff working as a team again and also encourages them to continue doing their job to the best of their ability. Usually, if you show the employee that you believe in them and that they are capable of completing the task, the outcome will be very positive.

Above the hole

by April Grabell
Student and Intern

While superintendents and assistant superintendents all over Ontario worry about all of the ice and snow on the greens, turf students at the University Guelph are learning of ways to reduce and prevent winter injury from occurring, amongst other key turf management practises. In a year from now several of us will be in this same situation wondering, hoping, and praying the greens will survive through the winter. The thought of this is quite overwhelming, and stressful to say the least. Only a few years ago I was wondering what I wanted to do for a career, and now I am embarking on a career that I truly enjoy. I once thought that I would never fit in with a class full of men, now everyday it seems as though I become more like one of them, in fact it is quite frightening! The turf management principles are not learnt in a class, they are found among the interaction between students, staff, and turf industry professionals. That is the main reason why I enjoy the turf industry so much; it is a continuous learning process!

With that in mind, the turf students at the University of Guelph have been busy this past fall and winter hosting and attending many networking events, such as the annual "Sodding of the Cannon", several informative Turf Club speaker presentations, the 6th Annual Turfgrass Symposium, and the CGSA/OGSA conference and trade show.

The infamous sodded cannon brought to you by UoG turf students, and Green Horizons: Compact Sod! Also, complete with a bentgrass tee and green courtesy of Springfield Golf & Country Club!

The 6th Annual Symposium was held on November 27th 2009. More than 120 golf course superintendents, industry representatives, university faculty and students attended the symposium at the Cutten Club, organized by first-year University of Guelph turfgrass management students.

The symposium, named "Doing more with less: Turf in tough times" focused on how to survive and thrive in an unstable economy. The event featured a top-quality line-up of speakers, a complimentary lunch and plenty of networking opportunities for students and turf professionals alike.

"We all learned a lot, from coming up with the right speakers to finding sponsors and using communications tactics to market the event, all within tight deadlines," says student Matt Eastman.

Three speakers from different corners of the industry presented unique perspectives on how to save time and money within a rapidly changing field, while continuing to provide a high standard of service. The speakers included:

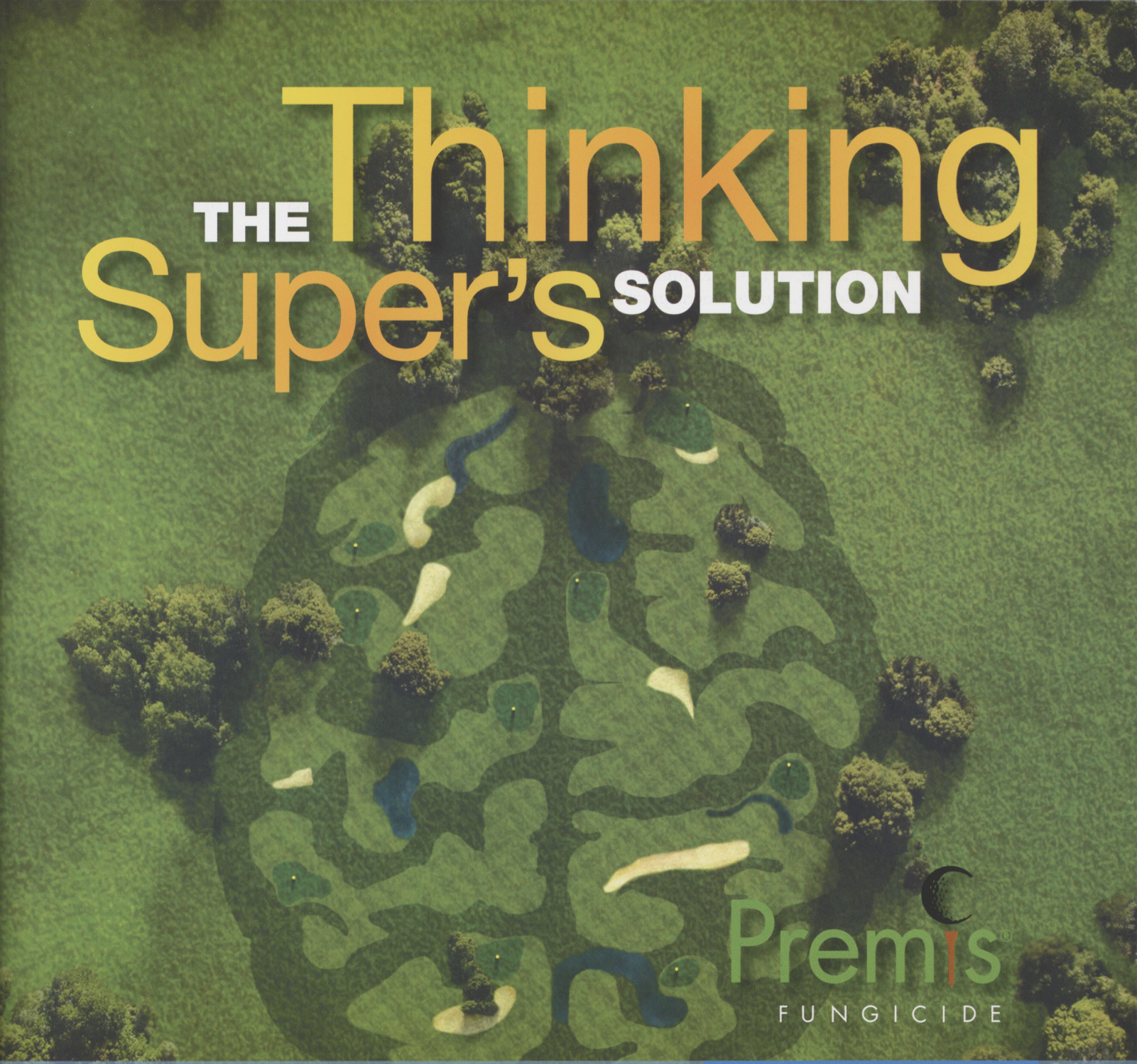
- Dr. Tom Hsiang, pathology researcher at the University of Guelph. Dr. Hsiang addressed alternative treatments for turf disease.
- Ron Schiedel, co-owner of Green Horizons Group of Farms Ltd. Mr. Schiedel is a successful entrepreneur who demonstrated how good business practices can override a bad economy.
- Keith Bartlett, superintendent of St. George's Golf and Country Club, which is hosting the 2010 Canadian Open. Mr. Bartlett discussed strategic course management.

There was also a segment to the symposium called "Beat the Clock" in which five students each spoke for two minutes highlighting various turfgrass management tips based on experience and knowledge they have gained from their program.

"This project has given the students opportunities to practice real-life communications and networking situations and learn from them," says Prof. Rob Witherspoon, program director of the turfgrass management program at the University of Guelph.

The symposium was free of charge for those who attended, thanks to key sponsors from the turf industry. Title sponsors include Syngenta, John Deere and Turf Care. Additional sponsors include Enviro-sol, Nutrite, Ontario Seed Company, GC Duke Equipment, the Guelph Turfgrass Institute, McCormick Global Communications, Frechette Lawn Care, Ontario Agricultural College and the Department of Plant Agriculture (Courtesy of Anne Douglas).

In closing, my experience at the University of Guelph has been surreal and I look forward to what lies ahead of me in the turf industry!



YES! Thinking Superintendents are clamouring to make PREMIS® 200F Fungicide part of their program this season.

As you know, dollar spot is the most costly turfgrass disease worldwide. We can also count on struggling with brown patch (*the* most common summertime issue that plagues turfgrass), and anthracnose. So, as you can understand, there's a lot on our minds.

But now, with **PREMIS®**, supers have a proven innovative solution designed to make their life dramatically easier. It's no wonder it's the "Thinking Super's Solution".

Can you afford *NOT* to play with these guys?

P.S. In addition, **PREMIS®** is part of the **BASF** BetterTurf™ offer.

BASF
The Chemical Company

For more information go to www.BetterTurf.ca

Off the fairway ...

by Daisy Moore

Restoring Natural Areas

We are becoming accustomed to the term Integrated Pest Management. IPM means that we must develop a series of means to control pests, other than targeted sprays, synthetic or otherwise. We are quickly learning that a major method is by prevention.

In ornamental gardens pesticides are rarely used because the principles of prevention are instinctively cultivated by the gardener. Avoidance being one of them. If you plant a snowball Viburnum, European Burch or Norway Maple for example, you are asking for trouble. On golf courses, preventative measures are built in to the management strategies that favour turf. There is a general understanding that if you look after something it will do better. In natural areas, how it is all working very much depends upon the level of disturbance the area has had, and whether it has been tended to since. When we conjure up an image of a natural area we see a trillium lined sugar bush or an alpine meadow. These habitats aren't disturbed at all. The plant communities are stable (self-sustaining) and we have no hand in it. We can learn from this.

Natural areas on golf courses are rarely undisturbed. Traffic, grade changes, dumping the clippings, light changes, exuberance of mulch and so on all play a role in making natural areas vulnerable to weed invasion and grief. Added to that is the removal, during construction, of the herbaceous layer of plants, leaving the area naked to the potential of restoring the indigenous species and previous diversity. The seed and source of plants are gone or diminished until they are re-introduced by us or nature. Weeds move in partially because there is nothing there to stop them. If left unchecked, disturbed areas will be taken over by the invasive weeds and create an eye-sore, plus be a source of weeds and undesirables to the cultivated areas. Given the chance, desirable plants and indigenous species can re-inhabit natural areas and form their own truce with the new locals.

In the urban environment we have learned to tolerate some weeds and even call some of them wildflowers. Buttercups, Daisies, Chicory and even Queen Anne's Lace have become an expected part of the local landscape, even though they are from overseas. We have come to expect Tansy or Blueweed or Teasel to grow on gravelly banks and don't feel threatened by them, very often. There was a case at Mad River that I remember where a year or so after construction the out of play areas were coated with a pretty blue flower that everybody was loving. Blueweed (viper's bugloss is another name for it) soon shifted to disfavor when all wayward balls had to be conceded to the bees. There is a much larger list of weeds that contribute nothing positive (as far as we know) and can lay to waste vast expanses of land. Where and how you draw the line in what is acceptable and what isn't, is part of the management question.

To improve the appearance of natural areas it boils down to knowing more about your weeds. There are worse things to do, believe me, and you might find yourself getting hooked on the fascinating tales surrounding individuals. For the sake of control measures, there are three things you need to know, assuming you know what the weed is in the first place.

The first would be to inquire about the preferred site conditions of the plant, the habitat. Weeds are adaptable to less desirable growth conditions and this can tell us something about the site. Poorly drained, compacted, contaminated and so on. You might be able to amend the conditions against the weed's favour. For example, Plantain grows in compacted soil where others can't. Creeping Charlie will take over when you add thatch to the equation. To grow something more favourable, relieve the compaction to make a habitat more suitable for desirable grasses or ground cover. The edges of cultivated areas and transitional zones are particularly prone to these conditions. Purple loosestrife is a plant indicator that there is a drainage problem. Garlic mustard means that the soil is currently being poisoned and the problem will spread.

Weeds are indictors of their habitat and we can use this to our advantage and build on it (as in adding plants not a building). Sweet rocket tells you that conditions are favourable for meadow like plants, if only someone would plant them. Garlic mustard and raspberries are signals of a woodland habitat.

In order to remove weeds you need to know about its root system. This way you can decide upon the appropriate tool, method and the timing of the weeding. Always assume that weeding is easier when the soil is moist. We know that if you break the tap root on a dandelion you will have triple the problem down the road. The same principle applies to most other tap-rooted plants, Burdock and Thistle for example. You have to get

the whole root. Re-growth from root pieces is a common way for weeds to regenerate themselves. Twitch grass and Goutweed are classic examples where surface cultivation and tilling only make matters worse.

Lastly, you need to know the growth characteristics of the weed, the biology, such as the time of flowering and its' method and pattern of spread. Early weeds tend to have perennial roots or be biennials and require some digging. Summer weeds tend to be annuals that blew in to bare patches last fall. Fall weeds tend to be sprawling and deep rooted, since they've had a lot of the season to grow. Fall is also the time where mother nature spreads seed and plant roots naturally bulk up. It is a critical time to act in the restoration process.

Principles of Restoration

Restoring natural areas is a process that could be broken down into four steps.

1. Provide/Identify Habitat
2. Remove Weeds
3. Introduce desirable and suitable plants North American natives
4. Monitor and manage

Look after it

It's a continuous effort to combat weed invasion. Your best defense is a strong offence in the form of cultivating a plant community that represents a stable collection of local plants. Management methods are not dissimilar to those used in turf management and gardening. The benefits when applying these methods to natural areas would include a tremendous boost to the restoration of habitat, diversity and the spirit.

Daisy is a professional horticulturist. She operates a garden design and consulting business from her home in Elora. Her website: www.daisymoore.com has samples of her work.

PAST PRESIDENTS LUNCHEON

Thanks to all who attended; it was a great afternoon!

**Date indicates the year of presidency*

Front L-R: Rob Ackermann n (2004) and Randy Booker (2009)
1st Row: William Hynd (1972), Robert Moote (1967), Pelino Scenna (1978), Paul White (1980), Jeff Stauffer (2008), Paul Scenna (2005), Jeff Alexander (2010)

2nd Row: Alan Beeney (1977), Jim Flett (2002), James Wyllie (1973), Paul Dermott (1975 – 1976), Simon George (1997), John Arends (1971), Bruce Burger (1994), Thom Charters (1988), Barry Endicott (1986), Chris Andrejicka (2010 Vice President) , Stu Leachman (2010 Director), Jennifer Pendrith (2010 Director), Doug Breen (2010 Director), Keith Bartlett (2000), Rhod Trainer (1992 not available for photo)

Looking back

15 Years Ago Today

by Barry Endicott

The Board of Directors of the OGSA in 1995 was: **John Taylor**, (pres.) Twenty Valley, **Alex La Belle** (vice pres. & newsletter editor) Merryhill, **Bruce Burger** (past pres.) Lakeview, **Simon George** (tres.) Oakville, **Ian Bowen** Oshawa, **Bob Heron** Beacon Hall, **Paul Dodson** Lionhead, **Doug Suter** Credit Valley, **Paul White** Mississaugua, **Ken Nelson**, **Jerry Richard** Craigowan and **Keith Bartlett** Thornhill. **Cindi Charters** was the office secretary.

New Members: **Terry Magee** (F) Mississaugua, **Richard Leadbeater** (S) Parkview, **Tracy Fowler** (F) Hamilton, **Paul Brown** (F) Islington, **Greg McLinton** (B) Carleton, **Kevin Inglehart** (S) University of Guelph, **Ken Johnson** (B) Indian Hills, **Terry Gale** (F) Indian Hills, **Gary Stairs** (F) Board of Trade, **Bill Thornton** (B) Wyldewood, **Todd Davey** (S) Cardinal, **Randy Booker** (B) Sleepy Hollow, **Kent McDonald** (E) Ontario Seed Co., **Tami Packham** (E) Ontario Seed Co., **Tim Baxter** (F) Bear Creek, **Natalie Arms** (F) Board of Trade, **Dave Svab** (F) Weston, **Michael Sammon** (F) Loyalist Golf Club, **Doug Dougherty** (E) Ray Gordon Equipment, **Daniel Passmore** (E) Frechette Lawncare, **Nicole Snider** (F) Beach Grove, **Sean Kelly** (F) Islington, **Brent Stainton** (B) Derrydale, **Gavin Kellogg** (A) Tyandaga, **Rob Allison** (F) Twenty Valley, **Ernie Amsler** (B) Angus Glen, **Mike Ettles** (F) Toronto Hunt Club, **Bruce Patterson** (F) Angus Glen, **Jim Power** (B) Pine Ridge, **Steven Ransom** (F), Twenty Valley, **Tim Schaly** (F) Muskoka Lakes, **James Scott** (S), Univ. of Guelph, **Eric Williamson** (F) Angus Glen.

On the move: **Thom Charters** moved to Bayview from Weston and **Jeff Burgess** took his place. **Jim Molenhuis** left Lionhead to work at a new golf course, Lake St. Joseph being built by Club Link. **Paul Dodson** from Aurora Highlands to Lionhead. **Peter White** from Credit Valley (assistant) went to Aurora. **Blake McMaster** moved from Brampton GC to Royal Montreal. **Jay Lavis** left Cardinal and went to Blue Mountain and was replaced at Cardinal by **Robert Sloan** from Sudbury. **Gary Morris** left North Bay GC and went to John Evelyn Golf Centre. North Bay hired **Kevin Wingerton**, assistant at Thornhill. **Mike Courneya**, assistant at Markland Wood, moved to the Loyalist Estate Golf Club near Kingston. **John Scott** is the new superintendent at Ottawa Rivermead and **Mike Coté** moved from Port Carling Golf and Country Club to Glendale. **Chris Andrejicka**, assistant at Devil's Pulpit, is the new superintendent at Essex **G&CC. Bernie Martin** from Osprey moved to Hunters Glen (formerly Huntington). The Beverley Golf and Country Club hired **Scott Dyker. John Parker** moved from Greystone to Trafalgar while **Andrew Keffer**, assistant at Emerald Hills took over at Greystone. **Derick Powers** moved from Brockville Golf to Carlton Golf andYacht Club.

A retirement reception for **Dr. Jack L. Eggens** was held on January 4th in conjunction with the Ontario Turfgrass Symposium. It was organized and directed by **Gordon Witteveen**, and the presenters were former students and friends: **Nigel Rennie, Rob Ackermann, Dean Baker, Keith Bartlett, Ian Bowen, Angie Capannelli, Paul Dermott, Bill Fach, Ron Heesen, Jerry Richard, Paul Scenna, Pelino Scenna, Mike VanBeek, Paul White, Mark Schneider, Marie Thorne, Hugh Kirkpatrick** and **Daisy Moore.**

OGSA, GTI, OMAFRA Field Day was held at the Springfield Golf Club on Aug 14th hosted by **Ray Dlugokecki** (Duke for short). Low gross scores were **Thom Charters** (70), **Jeff Staufer** (72), **Paul Scenna** (72) and **Ted Ellis** (73). **Rob Witherspoon** was appointed as new Guelph Turfgrass Institute Director.

The Superintendent Greens Chairman Day was held at the Rosedale Golf Club on July 17th hosted by **Bill Fach**. The winners were: 1st low gross - Brampton Golf Club, 2nd low gross – Bay of Quinte, and 3rd low gross – Galt Country Club.

The Pro/Superintendent Day was held at Monterra Golf Club on June 13th hosted by **Ron Heesen**. The winning gross team, **Dan Lavis** and Pro **John Davis,** was from Ingersol and the low net prize went to **Ed Farnsworth** and **Paul Kennedy** from Deerhurst.

Paul Dermott and **Dave Gourlay Jr.** were both nominated as directors of GCSAA by the OGSA. **Paul Dermott, Paul Scenna** and **Greg Williams** won the Environmental Stewart Award from the GCSAA. The GCSAA Conference and Show was held in San Francisco.

The Canadian International Turfgrass Conference and Show was held on March break in Ottawa and **Dr. Jack Eggens** was the recipient of the John B. Steel Distinguished Service Award.

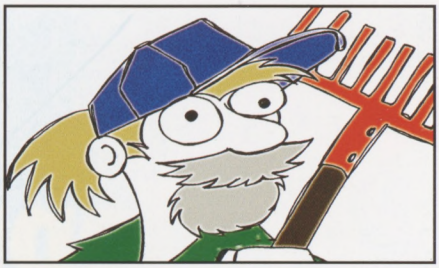
The OTRF Golf Tournament was held at Spring Lakes Golf Club hosted by **Max Frost**. **Jay Evelyn** was low gross with a 71.

Ransomes America Corporation and G.C.Duke Equipment Limited announced the new revolutionary all electric riding greensmower which operates on (8) 6 volt golf cart style batteries, offering quiet, pollution free operation.

It is the law in Ontario that signs must be posted 24 hours prior to pesticide applications on golf courses and remain in place for 48 hours after an application.

The OGSA/ Hutcheson Ski Day was held on March 8th at Osler Bluffs ski resort. The day was well attended with the following participants: **Corrie Almack** Almack and Associates, **Bruce Summers** Lakeridge, **Dean Bake**r and **Dean Cormack** Glen Abbey, **Barry, Christine** and **Jane Endicott, J D Teeter** and **Sean Fowler** Nobleton Lakes, **Doug** and **Carol Suter** Credit Valley, **Glenn** and **Heidi Burgess** Skyway Lawn, **Colin White** and **Mike Janeba** Donalda, **Gordon Witteveen** Board of Trade, **Brent, Kathy** and **Alison McCaffrey** Carrying Place, **John** and **Nancy Taylor** Twenty Valley, **Herman** and **Margaret Bruin** Downs at Cedar Creek, **Nigel Rennie** Multitine, **Tami Packham** Ontario Seed, **Craig** and **Martine Evans** Pheasant Run, **Bob Heron** Beacon Hall and **Bernd Von Cube** Cambridge. From Hutcheson Sand and Mixes there was **Bob Hutcheson**, **Angelo Capannelli**, **Kerry Carrothers, Mary Beth Kelly, Pat Spratt, Kim Hart, Sandra Power** and **Al McDonald**. We all thanked **Bob Hutcheson**, who is a charter member of Osler, for sponsoring us, offering his chalet and feeding us. Everybody had a great time.

Turf or consequences



by Doug Breen, Superintendent
Golf North Properties

Bailing Out

Every man comes to a point in his life where he bails out on whatever social trend is coming next. Something deep down inside him screams, "That's it!" and he unconsciously resolves to wear the same clothes, listen to the same music, use the same expressions, get the same haircut, and tell the same ten stories until the day he passes on to his great reward. For my dad, it was the late 50's or early 60's. He has the world's largest collection of polyester slacks – many of them plaid. He knows 50% of the lyrics to a sizable repertoire of big band and show tunes from the era, and insists that there hasn't been a decent car built since 1965. He resisted the shift from 78-rpm records to LP's until a decade after 8 Tracks were obsolete.

It has become clear to me, that somewhere in the last 15 years, I passed that "point of perpetual return" myself. I hadn't noticed that I wasn't progressing; I just noticed that new things were really starting to annoy me. That's when I came to realize that men don't just bail out on new social trends - they're actually angered by them. Take; for example, sideways hats – they enrage me. I now understand why my dad spent the 70's telling total strangers to get a haircut. I suspect that 18th century French aristocracy were flabbergasted that young people would abandon the powdered wig.

I'm uncertain what triggers this shift to curmudgeonism, but it's clearly linked to the Y chromosome. Women seem to be immune to it. Krista has an Ipod, a Facebook account, and doesn't feel the need to seek out clothing stores that will sell her the same stuff she was wearing when we graduated from school. I told her the other day that Facebook is "stupid". I don't even fully understand what it is; I've never used it, but am still absolutely convinced it's a criminal waste of time. This from a guy who used to spend entire days playing Pong; which naturally, my dad thought was a horrible waste of time too. It's got nothing to do with Facebook (or pong); it's just that it came along after the point where I'd shifted into park – culturally speaking.

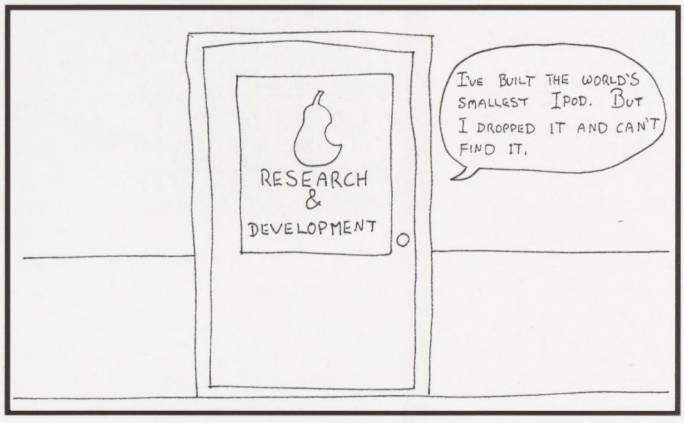
When I wake up on the couch in the middle of the night with TMZ on, and they're harassing some celebrity in an airport with a camera crew, I seldom have any idea who the celebrity is. Krista will explain to me that they're in some teenage vampire movie that I've also never heard of. Pop culture has become a puzzling mix of irrelevant and irritating to me.

One of my favourite things to do while I'm at work is to watch the golfers and try to figure out what their "best before" date was. I still see lots of guys in pastel golf shirts with popped collars, lots of hair products, and a Shooter McGavin attitude. They bailed out the day Miami Vice was cancelled, and will never shave off that Magnum PI moustache. Once a week, they tell me how much money they make, or how much they just spent on their new driver. The 80's were a very sad time to shut down.

There are lots of 50's guys who look just like my dad. Aging gentlemen, with Johnny Unitas haircuts and military tattoos. They'll never pass up an opportunity to wear a Hawaiian shirt, and could pass for extras in an Elvis movie. They prefer parkland style courses, and will beat you to death with their fifty year old clubs if the rough ever gets over two inches long.

Naturally, there's a huge contingent of Baby Boomers. They're easy to pick out, because their appearance hovers someplace between Woodstock and Studio 54. They'll also inform you that they are Boomers in pretty much every sentence, and talk about how they stopped the Viet Nam war. If you mention JFK, they'll weep. Apparently, they invented politics, critical thinking, and the environment but they also bought a lot of Monkees and Bee Gees records.

My "point of no go forward" was somewhere in the early 90's. It was also the last time I could watch the Grammy Awards without screaming at the TV. I like email, but not social networking. I like video games, but not playing them online with some 30-year-old in his mom's basement in Albuquerque. I've drawn my arbitrary line in the sand, and I'm not crossing it. I'm just doing what many of you have done before me, and if you younger folks want to waste your time and carry on with "progress", then knock yourselves out, but for Pete's sake – put your hat on straight.



Spring 2010
Acelepryn® Promotion
March 1 to June 1

When you purchase two bottles of Acelepryn Insecticide, receive an iPod® Docking Station (Approximate value $150)

Apply Acelepryn from early April to late August for preventative and early curative control of European chafer larvae and Japanese beetle larvae infesting turfgrass. Controls multiple pests with a single application.

For every two 1.89 L bottles of Acelepryn Insecticide, receive an iPod docking station (approximate value:$150). iPod docking station delivered upon paid invoice. Style may vary from that shown. iPod not included.

Agrium Advanced Technologies®

1-800-461-6471
www.turfpro.ca

TORO. **Count on it.**

To unlock the full potential of your course, you have to dig deeper.

Realize the benefits of deep-tine aeration with the new Toro® ProCore® SR Series deep-tine aerators.

Noticeably healthier turf. Vigorous root growth. Lower irrigation costs. From lightweight machines for smoother, softer greens, to heavy-duty aerators that break up even the most compacted surfaces, Toro offers high performance aerators that penetrate up to a depth of 16 inches. The Toro ProCore SR Series.

Deep-Tine Aeration – Depths up to 16"

Typical Aeration – Depths up to 4"

The right choice.

www.turfcare.ca

Turf Care Products Canada
200 PONY DRIVE, NEWMARKET, ONTARIO L3Y 7B6
PHONE 905-836-0988 • FAX 905-836-6442

London	Milton	Scarborough	Gloucester
Ph: 519-668-7664	Ph: 905-836-0988x7048	Ph: 416-298-2101	Ph: 905-836-0988x5501
Fax: 519-668-3722	Fax: 905-636-1513	Fax: 416-298-8758	Fax: 613-822-2099

TURF CARE
Helping your business grow