



# Hole Notes

The official publication of the MGCSA

*Issues With Ants?*



Vol. 48, No. 4 May 2014

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*Happy sister, Esme Counselman, gives new brother Cole, born May 20th, a big hug. Congratulations Shannon and Eric Counselman. Fun times ahead!*

**June 2**  
***The Scramble***  
***Fund Raiser Golf Event***  
***Dellwood Country Club***  
***Host Eric Peterson***

**June 30th**  
***South East Exposure***  
***The Bridges Golf Club***  
***Host Kyle Kleinschmidt***

**July 21**  
***The Championship***  
***Rochester Golf and Country Club***  
***Host Nick Folk***

**July 28**  
***Northern Lakes Exposure***  
***The Wilderness at Fortune Bay***  
***Host Vince Dodge CGCS***

**September 8**  
***Badgerland Exposure***  
***Lake Wissota Golf***  
***Host Kris Woppert***

**October 13**  
***The Wee One***  
***Brackett's Crossing Country Club***  
***Host Tom Prosheck***





#### EDITOR

DAVE KAZMIERCZAK, CGCS  
DAVE@PRESTWICK.COMCASTBIZ.NET

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# Presidential Perspective

by Roger Stewart, CGCS Superintendent at TPC Twin Cities

Someone who has lived in Minnesota all their life

golfers, friends or colleagues and support MGCSA Scholarships and Turf Research at the U of M.

told me that last winter was more like a Minnesota winter. So does that mean we are back into the typical Minnesota-type winter cycle? That's two of those in a row followed by two slow spring warm ups. I wouldn't mind having a bit longer winter or slow spring start if everyone else was good with it as well. Right now it just seems to make people a little less patient and a little whinier. Glad we are moving on to summer even if it didn't really happen until almost June.

Speaking of June, I hope everyone who wanted to play in the Scramble got their team together in time for the event. This is a great opportunity to play with some of your members,

This year's event at Dellwood Hills Country Club was the perfect venue for an enjoyable day of golf. Thank you to Dellwood Country Club, the clubhouse staff as well as Eric Peterson and his staff for a great day.

Don't forget about the Wee One event and another great day to give back and raise money to help our peers across the country facing critical health issues. I can think of no more noble cause than to help fellow superintendents during a crucial time in their lives and the lives of their families. Please register to play in this year's Wee One at Brackett's Crossing Country Club. Thank you so very much to the entire Brackett's Crossing Country Club



family for their generous support of this event.

Next month is a very busy month here at TPC Twin Cities as the Champions Tour comes to town once again for the 3M Championship. This is the only televised golf event that is held in the Twin Cities on an annual basis. Fortunately, the event has had tremendous support from 3M and has raised over ten million dollars for local charities here in the Twin Cities. We welcome anyone to come out and volunteer to help us during tournament week. Like the tournament, we depend on a staff of volunteers to help us provide the best playing conditions and shine a light on golf course management here in the Twin Cities. The fact that we try to have some fun and provide some great fellowship is just a plus for those who can help us. Hope to see you there!

In August, don't forget that the U of M Field Day is returning at the TROE Center. The date is August 7th and there will be some interesting things to see there including some of the results of the MGCSA member driven research that was started last year.

I hope you enjoy this month's issue of Hole Notes. Some great articles including one on ants and their control by Vera Krishek, and an interesting article about the fate of long term nitrogen applications.

Some good reads no doubt, as well as all the latest information on products from our Affiliate members and the companies they represent. Support those that support your association, it's a good thing to do!

It's Giddyup time!





**Hazeltine National Golf Club**  
Photo by Jeffrey Hartman

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# In Bounds

by Jack MacKenzie, CGCS

Alluring  
eyes watched  
me closely,  
two red and

puffy combs meant to entice even the most discerning of hens. Step by step, around my campsite, he pursued me stealthily with intimate dreams, mistaking my form for a female spruce grouse. This was one of several unexpected events I encountered upon my five day spring solo trip into the Boundary Waters Canoe Area.

My first day and ten miles in, I also encountered another surprise, one that changed my adventure dramatically. Ice, and lots of it, barred my way for the second leg of a 45-mile journey. After much thought, I had to create a plan “B” if I were to continue my adventure into the wilderness.

Stymied by a frozen sheet on the east shore, I was limited to backtracking my steps and creating a new game plan. This move had to be made rapidly, for I feared a shift

in the wind would ice-lock me to my campsite with a horny grouse for the rest of my experience.

Isn't this truly the way of the turf manager as well as the wilderness adventurer? Even the best-laid plans can be altered quite quickly by weather, staffing challenges and even the notorious “surprise” change of a tee time tournament to a last minute shotgun. But as pliable administrators, you plug away always trying to provide the best playing conditions possible taking into account weather thrusts, economic lunges and scheduling parries.

In my early years as a superintendent, I often became frustrated with all of the unanticipated events that messed up my neat and tidy scheduling. Surely my staff thought I was crazy to torture the NOAA ‘weather radio’ in a bench vice when Thor ravaged the trees on the course. Or my never acted upon threats to flatten all the tires in the cart shed to give the pro shop boys a taste of a real



“scramble”. Of course the later would only come back to haunt me as they likely didn’t know how to fill the tires and to what pressure.

It took a few years, but I soon realized that agronomists, and in particular, golf course managers, are plagued by many challenges beyond their control. I could not control somebody else’s actions any more than I could stop a three-inch rain event during the state two-man event. Realizing and acknowledging my impotency in these matters was actually quite empowering. With patience, I learned that rather than wrestle with the “what ifs” and “shoulda, couldas”, I only needed to take a deep breath and implement a plan “B”.

You could say that my up-north reprieve was moist, no, it actually was quite wet, and cold too. Very little precipitation fell (just a nuisance snow), but the lakes were high and streams overflowing, often atop of and down the portages. Enter another life lesson learned at a golf course. Dry and warm feet are hard to beat.

For my birthday I received

from my understanding bride a pair of Chota Hippies and Portage Trekker boots. Supportive, warm and completely dry, these protective coverings allowed me to step from my canoe up to my high thighs into frigid water, wade through portages normally above the river level, and my toes toasty warm the whole time. Amazing technology that really made the trip comfortable.

As a turf manger, perhaps like you, I was constantly plagued with damp feet caused by morning dew, broken irrigation heads, malfunctioning water coolers and pond fountain corrections often placed my feet in wet and uncomfortable situations. In the winter time it was perspiration soaked Sorrell boots that seemed to get cold quickly and made it feel like my feet were encased in ice cubes.

My first remedy was a series of footwear to be exchanged through the day as conditions changed. Low cut muck shoes to sneakers and then onto boots or sandals depending upon my task of the day. Typically, if I remembered to place the wet shoes

in the sun, I could begin the process over the following day and maintain dry feet once again. However, the hottest ticket for foot bliss came with the investment of a Peet Shoe Dryer.

This incredible device, <http://www.peetdryer.com/>, became an indispensable tool in my extremity management toolbox. Gloves, sox, hats, shoes and of most importance, boots were dried overnight to provide a bit of luxury to my often wet days. Perhaps you should consider one or even several to share at your shop.

My choice for propulsion in a solo canoe is double blading. During the third day of my travels, following 25 miles of wet and then dry hands, my thumbs developed serious skin cracking adjacent to the nails. This very painful condition reminded me of cup cutting, and the wear and tear I used to place upon my whole hand.

The soil tended to dry skin out and when combined with wet followed by dry conditions, my digits were often lined with deep and agonizing fissures. The persistent seasonal condition, as well as the continuously dirty hands, required me to wear thin, rubber palmed, gloves

made from bamboo fiber. The dirt never impacted my skin and thus the damage was limited. When I did develop a cut or sore, I would slather my hands with three-in-one antibiotic ointment prior to donning my gloves. The recovery was incredibly fast.

With limited means, I performed the same task in the wilderness. My trusty first aid kit contained all of the tools I needed to clean, anoint and protect my thumbs and after a few hours I was rewarded with comforting relief.

Why solo tripping you ask? I suppose it is all about the freedom and often-personal challenges to do what I want or need to do with no external resources. The accomplishment of which brings it own rewards. Soloing also affords me a time for reflection. No noise pollution, emails, phone calls, meetings or obligations beyond what I need interrupts my thoughts and prevent me from contemplation... or wondering how my pesky spruce grouse could possibly mistake me for a potential mate.





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**Count on it.**  
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# *Norma O'Leary, CGCS, and the U.S. Women Win Bronze at 2014 World Senior Curling Championship*

(STEVENS POINT, Wis. World Curling Federation) - After two previous attempts, Margie Smith is a world medalist. Smith (St. Paul, Minn.) and the U.S. ladies defeated Sweden's Ingrid Meldahl rink, 8-3, to win the bronze medal this morning at the 2014 World Senior Curling Championships in Dumfries, Scotland.

"We're very excited. We've been here a couple of years and we've yet to do this (win a medal)," Smith said after the win. "We worked hard; we just needed to stay tough. We were reading the ice well and the girls were throwing the rocks really well so patience was the key." Smith's teammates include Norma O'Leary (Silver Bay, Minn.), Debbie Dexter (St. Paul, Minn.), and Shelly Kosal (Edgerton, Wis.). They are coached by Jim Dexter (St. Paul, Minn.).

Curling is a sport in which players slide stones on a sheet of ice

towards a target area which is segmented into four concentric rings. It is related to bowls, boules and shuffleboard. Two teams, each of four players, take turns sliding heavy, polished granite stones, also called rocks, across the ice curling sheet towards the house, a circular target marked on the ice.[2] Each team has eight stones. The purpose is to accumulate the highest score for a game; points are scored for the stones resting closest to the centre of the house at the conclusion of each end, which is completed when both teams have thrown all of their stones. A game may consist of ten or eight ends.

The curler can induce a curved path by causing the stone to slowly turn as it slides, and the path of the rock may be further influenced by two sweepers with brooms who accompany it as it slides down the sheet, using the brooms to alter the state of the ice in front of the stone. A great deal of strategy and teamwork





go into choosing the ideal path and placement of a stone for each situation, and the skills of the curlers

determine how close to the desired result the stone will achieve. This gives curling its nickname of “chess

on ice”.

Much like most of the week, the U.S. ladies got off to a strong start to the bronze-medal game scoring a deuce in the opening end. After holding the Swedish ladies, who have won a medal in nearly every appearance at this event, to a single point in the second end, the U.S. again scored two points. A steal of one point in the fourth gave the Americans a comfortable lead at the halfway point at 5-1. The teams exchanged deuces as the second half developed. Another steal by the U.S. ladies in the seventh end sealed up

the bronze medal win for Smith's team.

“You realize that it's any team, any day. You just go out there and we were pretty confident in the second year that we were going to be up there. We struggled a little bit, but it's all about finishing and we did that this week,” Smith said.

Editors note: *While in Scotland, Norma made great use of her spare time and visited The Old Course at Saint Andrews. Congratulations Norma on bringing home the Bronze.*





*“Standing on the medal stand – as they raised the American flag – was an absolute AMAZING experience... My trip to Scotland kept getting better though, one win at a time.”*





I have been in the industry over 30 years, and have been a Golf Course Superintendent since 1983. My husband Mike, who is a former World Bronze medal winner himself, introduced me to curling nearly 20 years ago.

I love the sport of curling, but the only reason I curl is because I can't grow grass or play golf during the winter months in Northern Minnesota.

I came up to Northern Minnesota when I got married in 1988, with the intention of working on the golf course up here for about 10 years, and then relocate to the Southern part of the state where the golf season is 4 to 6 weeks longer. Sixteen years later I am still up here because the members here in Silver Bay have been very good to me, and it is really hard to quit a job you love!

I did not score very well at St. Andrews, nor did I care. I have wanted to visit that golf course since I was in college, so just being there was an absolute thrill for me. I was also



fortunate enough to have my sister walk the course with me and take over 300 pictures. I actually got to play the Old Course twice. The course is actually pretty easy if you stay out of the bunkers. I did not stay out of the bunkers. Several of the bunkers I went in were over my head, and on two occasions, my only shot was to bounce my ball off of the bunker wall to get back far enough to make a swing. The Caddie's are very professional and I had a blast with all of them. Gordon Moir, the Superintendent came to visit me on the golf course, which also added to my experience. When



MINNESOTA GOLF COURSE SUPERINTENDENTS' ASSOCIATION  
PRESENTS:  
**MGCSA SOUTHERN EXPOSURE Golf Event**

Sponsors:



**Monday June 30, 2014**

**The Bridges Golf Course in Winona**

**Registration with Pizza Buffet Lunch between 11:00 and 12:00**

**Shotgun Start at Noon**

**Host Superintendent: Kyle Kleinschmidt**

***\$25 per player includes lunch and golf***

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Player Name \_\_\_\_\_

Club \_\_\_\_\_ Address \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

E Mail Address \_\_\_\_\_ Phone \_\_\_\_\_

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**MGCSA**

**10050 204th Street North**

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I left the golf course after my second round I said to my sister, “no matter what happens from here on out – this trip has been spectacular!”. My trip to Scotland kept getting better though, one win at a time.

My experience at the World Championship was spectacular as well. I knew my team was capable of medaling, but we did make it to the World Championship last year, and did not fare so well, finishing in 6th or 7th place. This year was a different story. We played very well all week long going unde-

feated throughout the round robin and gaining the #1 seed from our pool of 8. We faced Scotland in the Semi-finals, losing on the last shot of an extra end. Scotland was playing in their home club and the crowd was spectacular. Their were obviously cheering extremely loud for their home team, and as much as I wanted to win, I could not help but feel thrilled for Scotland when they made the last shot to beat us. The crowd erupted and I genuinely felt very happy for them. This winter I also had the experience of winning the Women’s Club National Cham-





pionships that were held at the Two Harbors Curling Club. It is the first time I have ever won a big event in front of a home crowd, and the feeling is truly amazing when the entire crowd is as happy as you are when you win.

It was my fifth national championship in curling, but by far the most memorable, just because of the excitement of winning in front of the home crowd. When Scotland won our game, I sort of relived that feeling I had in Two Harbors, and I suppose that is why I was so happy for them. After losing to Scotland in the Semi-finals, we went on to beat Sweden in the Bronze medal game, and Scotland went on to beat Canada for the gold. Standing on the medal stand – as they

raised the American flag – was an absolute AMAZING experience. I truly felt like one of the luckiest people in the world! Especially when I got back home to Silver Bay to find that my golf course had wintered in the best shape in perhaps 25 years or so. I'm still riding on cloud nine.







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MINNESOTA GOLF COURSE SUPERINTENDENTS' ASSOCIATION  
PRESENTS:

# MGCSA NORTHERN EXPOSURE Golf Event

Sponsors:



## WINFIELD™



Monday July 28, 2014

## The Wilderness at Fortune Bay in Tower

Registration with coffee and donuts between 9:00 and 10:00

Shotgun Start at 10:00/ lunch at the turn

Host Superintendent: Vince Dodge, CGCS

***\$25 per player includes lunch and golf***

Player Name \_\_\_\_\_

Player Name \_\_\_\_\_

Club \_\_\_\_\_ Address \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

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*Lock and Load  
Buckthorn...You're Dead!!!*

*By Dr. John Lloyd*



The shrub buckthorn (*Rhamnus cathartica*), was introduced into the United States as an ornamental plant from Europe, where it is used as a hedge and as a border plant.

Unfortunately, in North America it

has choked out under-story plants in native forests and has become a major issue in edge rows where it creates an almost impenetrable barrier with its angular branches and thorn-like branchlets.

Buckthorn is common on the outside of roughs in golf courses and can grow in any wild areas where birds may perch and release seeds. While little whips can be managed through mowing and routine applications of herbicides, prob-

lems can occur when edges are not maintained and the plants are allowed to become established. Once the shrubs become woody, they will out-compete native vegetation and begin encroaching into the rough.



Due to the density of their canopies they will affect sightlines and can impact play in the rough.

When buckthorn becomes a barrier to play, the primary option is to bring in

the chainsaws and herbicide concentrates to clear the impacted area and treat the stumps to reduce the chance for re-germination from the roots. However, this effort is usually only temporarily successful due the seed bank that has been left in the soil. Seeds can germinate up to five years after they have been dropped from



the shrub into the soil and can return in a much higher density than before the initial treatment.

Buckthorn management is a long term commitment. The key to successful buckthorn management is early intervention and annual treatments based on a long term management plan, where acceptable outcomes and techniques can be merged with budgetary and staff limitations.

Over time, the seed bank will be depleted, as long as birds are re-infesting the area. The standard methods of management require mechanical removal and stump

treatments with glyphosate or triclopyr. Spray applications can also be effective, but aren't recommended where buckthorn is adjacent to other trees and desirable plants, or where drift into water ways may be an issue.

We are currently testing a buckthorn remediation system that uses a tool called the EZ-Ject Lance. The lance contains herbicide in 22 caliber shells that are stabbed into the base of the

buckthorn plant. The sap from the plant activates the herbicide and it is translocated throughout the buckthorn. In previous research death of treated plants occurs within one season and trunk and root re-sprouting appears to be minimal. A key





benefit of the system is that there is no risk of drift, or the possibility of impacting adjacent plants with the herbicides.

We are working with Heritage Shade Tree Consultant, Inc. and Greenlife Supply, Inc. in the Twin Cities to evaluate the effectiveness of this system for the control and long-term management of buckthorn. Demonstration projects have been developed with collaborating communities in the metro, but we would like to work with superintendents with buckthorn problems to examine its use and its effectiveness for management of buckthorn and

other undesirable woody species on golf courses.

Collaborators will be provided with equipment, supplies and training on how to use the system and will be supported on treatment and evaluations that will be required for proper scientific validation. In addition collaborators will be allowed to purchase the equipment at a greatly reduced cost at the end of the study.

*Interested superintendents should contact Manuel Jordán with Heritage Shade Tree Consultants at [manuel@heritageshade-tree.com](mailto:manuel@heritageshade-tree.com) or 763-717-9366*



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# Issues With Ants?

Dr. Vera Krischik, Associate Professor, UMN



Ant mounds on greens can be a nuisance on golf courses, as the mounds create obstacles and dull mower blades. These are secondary nests, while the main nest chamber with the queen is much more likely to be in the natural soil of the roughs. The mounds around the nest openings are the soil carried out by the ant in their mouth as they excavate tunnels and brood chambers under the surface. *Lasius niger* is the most common ant species on roughs, fairways, lawns and other sunny turf sites, according to Dr. Dan Potter of the University of Kentucky, who has studied this pest/beneficial insect for many years.

Ants are social insects that have a division of labor among the queen and workers, and have perennial colonies. The egg laying queen and her larvae are underground and the workers forage for insect larvae, eggs, and adults. The number of mounds increase from spring to fall as the colony grows in numbers and needs more real estate for their tunnels and mounds. In late summer new females and males take flight into the air and mate. The male dies, but the female drops her wings and tunnels into the soil to initiate a nest, but she does not start to lay

eggs until the spring. These new queens produce new nests, while her mother stays in the old tunnels. This process is repeated every fall.

Dan Potter's research demonstrated that 62% of 1,600 newly hatched cutworms placed near *Lasius* nests on collars or putting greens were eaten by ants. In other research, turf grass plugs on which black cutworm moth eggs were laid, were implanted into fairways or roughs at two golf courses, and the mortality of the eggs was monitored. *Lasius* ants consumed as many as 85 percent of the eggs in untreated roughs in 24 hours. In treated fairways where ants were less abundant, many more cutworm eggs survived to hatch. In research, significantly higher numbers of white grubs occurred in turf plots where ants were selectively eliminated. Before it was removed from the market, the organophosphate (class of insecticide) insecticide diazinon that was used to control grubs, also managed ants and caused secondary outbreaks of sod webworms, which we rarely see today.

When the ant mounding starts

getting bad, superintendents should focus control on the collar and a couple of meters beyond it. Controlling ants is difficult because fast-acting insecticides, such as pyrethroids and organophosphates, usually kill only a portion of the workers foraging on the surface, but fail to eliminate the queen. Consequently, the colony recovers and new mounds appear.

Dan Potter recommends treating a 20 to 30 foot band around greens and tees. Mid-season applications are probably the least effective at colony elimination and may require another application. Treating when the mounds first appear in the spring seems to be the best approach but fall treatments were surprisingly effective. Dan has a recent online article at Grounds Maintenance ([http://grounds-mag.com/golf\\_courses/grounds\\_maintenance\\_managing\\_nuisance\\_ants/](http://grounds-mag.com/golf_courses/grounds_maintenance_managing_nuisance_ants/)). Spraying of a mixture of classes of insecticides may be more effective than solely spraying a pyrethroid. Spray a formulated mixture of a pyrethroid and neonicotinyl insecticide, such as Aloft (bifenthrin and clothianidin), or Triple Crown (bi-

fenthrin, zeta-cypermethrin and imidacloprid) or using your own tank mix (lamda-cyhalothrin and thiamethoxam). Acelepryn (chlorantranilipole) does not have activity on *Lasius*. Superintendents who switch from pyrethroids to Acelepryn for extended control of cutworms may see more ant mounds, as the ants are no longer controlled by the former multiple seasonal sprays of pyrethroids.

Ant baits are too expensive for broadcasting on fairways, but they are cost-effective for spot-treating putting greens. Superintendents who have tried them report good results and the labels allow use on golf courses. A small amount of bait will eliminate a nest in about 2 days. Then, once the mounds are raked or knocked down by mower blades, they will not be rebuilt. Currently Dan Potter's minimum effective rates are about  $\frac{1}{4}$  teaspoon of bait per mound. *Lasius* takes baits both day and night, but delay irrigation for 24 h when baiting because they don't take soggy bait. Dan Potter's research demonstrated reduced numbers of ant mounds when spot-treating with Advion Fire



Ant Bait (AI (active ingredient), indoxacarb, Syngenta, available in MN) and Maxforce Professional Insect Control Fine Granule Insect Bait (AI, hydramethylnon, Clorox Co.) which in Minnesota is registered as Maxforce Complete Brand Granular Insect Bait. Note that a similarly named product, Advance Granular Ant Bait, was not as effective. Neither bait is specifically marketed to the golf industry, but their labeling does allow use on golf courses. Spot-treating with bait allows selective control, while preserving beneficial ants in fairways and roughs.

For now, controlling ants with fipronil (class phenyl pyrazoles), which is used for termites, is only available to southern turf managers. The manufacturer is seeking to broaden the fipronil label, so that granular products for nuisance ant control on northern golf courses may be available soon. TopChoice, containing fipronil, is presently labeled for use only in the 13 states: Alabama, Arkansas, California, Florida, Georgia, Louisiana, Mississippi, New Mexico, North Carolina, Oklahoma, South Carolina, Tennes-

see and Texas, where imported fire ants occur. Fipronil is slow-acting so foraging workers that contact or feed on the material do not die right away. This allows them to return to the underground nest where body grooming and exchange of food among nest-mates transfers the insecticide throughout the colony, including the queen and her brood. Granular fipronil often provides 95 percent control of existing ants within four to six weeks.

Spot treatments of greens may permit ant suppression, while maintaining ant colonies in roughs and fairways may allow the ants to feed on pest insects, thereby lowering your insecticide use and expenses.

***Vera Krischik, Associate Professor and Extension Specialist, University of Minnesota, 612. 625. 7044, [krisc001@umn.edu](mailto:krisc001@umn.edu)***

***Photo on page 28: Ant can collect honeydew from a scale (this picture), as well as aphids.***

***Bugwood, University of Georgia,***

## ***DNR rolls out new online water permit application***

A newly designed web-based system that simplifies the steps to getting water permits and paying for them online is being rolled out by the Minnesota Department of Natural Resources. The new MNDNR Permitting and Reporting System (MPARS) is part of Gov. Mark Dayton's initiative to streamline state government services.

The new application at [www.mndnr.gov/mpars](http://www.mndnr.gov/mpars) will save an anticipated \$255,000 annually and allows DNR employees to devote more time to technical assistance and field work.

"DNR employees will have 5,000 more hours every year to protect and improve our environment, thanks to this 'Unsession' reform," Dayton said. "I thank Commissioner Tom Landwehr and his staff for making these commonsense changes that will dramatically reduce the time to process more than 10,000 water permit applications each year."

The old paper application process was time consuming and inefficient with department staff spending hours hand-sorting applications and on manual data entry.

"We've tried to make it as easy and as

pain-free as possible for water users while giving us a way to more precisely manage and conserve a precious natural resource," said Landwehr.

"We'll be able to better track our water use, identify permit violations and increase compliance."

The department processes more than 10,000 permit applications and transactions each year, including reports on annual water use. Cities, farmers, businesses and landowners that use 1 million gallons of water each year, or more than 10,000 gallons a day, or work in public waters are required to get a water use permit or permit to work in public waters.

Applicants now have access to maps and can track the progress of their applications online. They are also automatically alerted if they don't need a DNR water permit.

Under the new electronic system, customers find out if their application is complete within 15 days of applying. Final decisions are made within five months. On average, permits are issued or denied a month faster than under the manually-intensive, former way of doing business. The system also improves inter-agency coop-



eration on permitting. When applicants enter their information into the MPARS system a report is generated and can be easily forwarded to other permitting agencies.

Inga Foster, environmental project manager for St. Louis County in Duluth, is using the system to apply for permits to work in public waters for culvert and bridge replacement projects. The dashboard view gives her a quick way to check on the status for many different permits. "I like how transparent it is," she said. Now when project managers come to her and ask where their permit is in the process,

she can quickly tell them.

She's received 30 permits through MPARS so far and has 30 applications in the works. "It's difficult when you have 60 different balls in the air to capture what is happening with all those applications at any one moment," Foster said. "MPARS does that for me."

The mapping tool enables staff to quickly view 60 different data layers, for trout streams, endangered species and infested waters, to name a few, to determine if a project location is near sensitive natural resources.



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# *Member Driven Research Update*

*Dr. Brian Horgan, Professor Turfgrass Management, Matt Cavanaugh,  
Research Scientist and Sam Bauer, Extension Educator  
University of Minnesota*

Currently, it's raining very hard. In fact about an additional two inches today on the St. Paul campus. Although I love watching water move, I do not like being delayed by weather. However, a day like today does allow us to take some time to update the Member Driven Research. The initiative started last year by looking at a growing degree day (GDD) model for trinexapac-ethyl (Primo Maxx) on creeping bentgrass greens, a GDD model with paclobutrazol (Trimmit 2SC) on Kentucky bluegrass fairways, a wetting agent study looking at surface firmness and winter turfgrass health and also a fun one to watch: melting ice on putting greens study. This year will focus on many of the same topics, but with some changes as well.

2014 projects:

**Trinexapac-ethyl Growing Degree Day Model for Creeping Bentgrass Putting Greens:** Data collected in 2014 will validate the work that was done in 2013. This study will offer a better recommendation of when to apply trinexapac-ethyl based on its metabolism in the plant and not based the calendar. This will help prevent the rebound effect and maintain a more consistent playing surface. We know that as the temperatures



rise, the growth regulation provided by trinexapac-ethyl reduces and thus reapplication is needed sooner than the calendar will allow us. As you may recall, trinexapac-ethyl was applied at or below label rates monthly and every 200 GDD (Table 1). Initial GDD studies conducted at the University of Wisconsin-Madison with trinexapac-ethyl indicated little difference observed with rates even twice as high as label recommendations. By choosing lower rates for the MGCSA study, we were able to observe the rate effect on growth suppression. We are finding that as trinexapac-ethyl rate decreases, so does the level of growth suppression, but duration of suppression stays the same. Although one year of data is not enough to provide solid recommendations, data suggests that 200 GDD with trinexapac-ethyl may be conservative. 2014 will provide additional data to back up the quality data from 2013.

***Table 1. Trinexapac-ethyl treatments and rates.***

<b>Treatment</b>	<b>Rate</b>
Monthly	0.125 fl oz/M
Monthly	0.094 fl oz/M
Monthly	0.063 fl oz/M
Monthly	0.031 fl oz/M
Every 200 GDD	0.125 fl oz/M

**Wetting Agents and Their Effect on Surface Firmness and Winter Health of Bentgrass Putting Greens:** This is the second year of the wetting agent trial (addition of new products for 2014). This study is focusing on wetting agent's influence on surface firmness and winter health of putting greens. Table 2 shows the products that are being used this year and also the category of each product. There is much discussion about the surface firmness and winter health benefits that wetting agents may provide, but to date nothing has been published on the topic. With this member driven project, we hope to answer these questions. With that said, 2013 data showed very little difference in surface firmness between the products and absolutely no benefit or negative effects on winter health; we observed complete health following winter at the study location. With the increase in products during 2014, we hope to see some differences and we will also be putting these products to the test during the summer by reducing the irrigation to look at performance.





**Table 2: Wetting agent rates, type and manufacturer used in surface firmness & winter injury of bentgrass putting greens.**

Treatment	Rate (oz/M)	Type	Manufacturer
AquiFlo	4	Infiltration	WinField
AquiCare	3	Retention	WinField
Cascade Plus	4	Infiltration & Retention	Precision Laboratories
Duplex	1	Infiltration	Precision Laboratories
Cascade Plus/Duplex	4/1	Infiltration & Retention	Precision Laboratories
Fleet	8	Infiltration	Harrell's
Revolution	6	Retention	Aquatrols
Tournament Ready	4	Infiltration	Kalo, Inc.
Dispatch Sprayable	4	Infiltration	Aquatrols
Primer Select	4	Retention	Aquatrols
Sixteen 90/Dispatch Sprayable	4/1	Retention & Infiltration	Aquatrols
Sixteen 90	4	Retention	Aquatrols
TriCure AD	2	Retention	Mitchell Products

**Flurprimidol & Paclobutrazol Growing Degree Day Model for Creeping Bentgrass Fairways:** This trial is being taken to a new level. During 2013, we looked at finding a paclobutrazol growing degree day model for Kentucky bluegrass fairways. The data suggested that at an 8 or 16 fl oz/A rate, a good model is 400 growing degree days (remember that we use a base temperature of 0C, so we just add up degrees Celsius). At 16 to 24 fl oz/A rate, a good model is 800 growing degree days. Keep in mind that more than 100% growth reduction was achieved with the higher rates. We are in the process of analyzing data from Tartan Park and the University of Wisconsin-Madison from 2013 and expect a detailed up-

date soon. For 2014, we have added flurprimidol (Cutless 50w) and we have moved the study to a creeping bentgrass fairway at Medina Golf and Country Club. We are also doing this in collaboration with the University of Illinois providing additional data. The study is designed to find the most accurate model by incorporating multiple growing degree days on both the low and high side (Table 3).

**Table 3: Flurprimidol & Paclobutrazol Growing Degree Day Model Study on Creeping Bentgrass Fairways.**

Treatment	Rate (oz/A)	Application Interval (GDD in Celsius)
Cutless 50 W	10	200
Cutless 50 W	20	200
Trimmit 2 SC	10	200
Trimmit 2 SC	20	200
Cutless 50 W	10	350
Cutless 50 W	20	350
Trimmit 2 SC	10	350
Trimmit 2 SC	20	350
Cutless 50 W	10	500
Cutless 50 W	20	500
Trimmit 2 SC	10	500
Trimmit 2 SC	20	500







Growth regulator plot at Medina G&CC

**Melting Ice on Putting Greens:** This study was conducted here at the University of Minnesota and at Michigan State University. There was a very nice article in the January/February addition of Hole Notes discussing the study. A quick highlight, as you can imagine the solar absorption products increased surface temperatures the most, and the most visible ice melt was from some of the fertilizer applications and also black sand. The standard salts and safer ice melt treatments produced very little visible ice melt.

Currently, the wetting agent and the flurprimidol & paclobutrazol GDD study have been initiated. The trinexapac-ethyl GDD study will be initiated the first week of June. The projects put forth by the Member Driven Research are looking to answer some very common questions we have in our industry. We are excited for the support the MGCSA has given to the University of Minnesota. Please contact us with any questions, comments or suggestion on future projects. We look forward to showing you all the progress at the Minnesota Turf and Grounds Foundation Field Day on August 7th.





# *Using Clouds to Predict the Weather*

*by Marci Goodwin, Home School Scientist*



## **On the right: Cirrus Clouds**

For centuries people have been using clouds to forecast the weather. High wispy cirrus clouds, sometimes called mare's tails, mean that within 24 hours the weather will change.

## **Below: Altocumulus Clouds**

Altocumulus clouds are mid-level clouds that look like a layer of white and gray puffy cotton across the sky. The presence of these clouds on a hot and humid morning could mean that afternoon rain is on its way.



# Fair weather clouds:

## **Cumulus clouds:**

These are fair weather clouds when they are fluffy mounds of white cotton in a blue sky. Fair weather is likely to continue.



## **Cumulus congestous clouds:**

These clouds look like large heads of cauliflower. Although considered fair weather clouds they can sometimes produce short bursts of rain showers.



# Storm Clouds:



## **Cumulodimbus clouds:**

These clouds are often called thunderheads. The most dangerous of clouds, they are huge and towering with dark bottoms and are capable of producing great winds, hail, heavy rain, lightning and tornados.

## **Stratus clouds:**

Stratus clouds are low gray clouds that mean misty rain or snow. Sometimes these clouds reach the ground and form fog.



# MGA Spring Forum Event



Bob Vavrek, USGA Green Section Regional Specialist, share the information on growing annual bluegrass



Dr. Brian Horgan from the University of Minnesota, discusses the merits associated with the Science of The Green Project.



*L to R: Joel Comstock, MGA, Matt Pringle, USGA, Brian Horgan, UMN, Bob Vavrek, USGA, Roger Stewart CGCS, MGCSA and Dale Parske, Reinders*

**Thank you Minnesota Golf Association, The USGA, UMN, MGCSA and Reinders for hosting the Event.**



# *Affiliate Appreciation Event*

*The Lost Spur, Host Tony Kellen*







# Within the Leather

by David Kazmierczak, CGCS

## **Perspective.**

An amazing word that essentially means

one's point of view of a situation or happening. I guess the word itself isn't so amazing but its meaning sure is. What's amazing is how many different ways any number of people can look at something and come up with a different perspective; a different angle or thought about what some other person might think.

So far this spring the general consensus, or perspective, has been that Mother Nature has once again, for the second year in a row, dealt us a crummy hand. A lousy winter, followed by near record rainfall coupled with cold and wind has left all living things stagnant and begging for warmer temperatures in order to get on with the task of growing and reproducing. While the weather certainly hasn't been without precedent, that doesn't mean it hasn't put a major strain on our industry.

For courses, business is down. For superintendents, projects and overall maintenance has had

schedules disrupted, plans cancelled, and the inevitable question of when is it ever going to warm up and when am I going to get out of this crabby mood I'm in? General grumpiness seems to be the order of the day, followed by stress of all that needs to be done. Well, let me lay one superintendent's perspective on you: Buck up Turfbob Crabbypants, it's just not that bad.

The month of May, 2014 has been a bit of a rocky road for this superintendent. For starters, two good friends discovered or are fighting the scourge of cancer at way too young an age, like there is any good age to have to do so. I'm betting well over half the people reading this column have had to go through this either personally or with loved ones and unfortunately the other half probably will.

Last Monday my daughter, Susan, underwent a procedure to try to help her deal with Cerebral Palsy, which she has had since birth. She had to spend five days in Gillette Children's Hospital and while she is home now and recovering it will still be a long road to recovery. My boss, Dave Mooty, hit the nail on the head with this line in an email he sent offering encouragement: "It is very hard to watch your children suffer."



There are no truer words ever offered to me.

However, it is my perspective that despite this, things will be ok and, in fact, things could be so much worse. Any trip to Gillette for us is a smack in the face reminder of how fortunate we are to be in the position we are in. If you have never been to a clinic/hospital like Gillette you have no idea how many kids there are with serious, serious problems. For every kid, there is a family of any number of people directly affected by the problem. My parents, who visited Gillette for the first time were shocked by what they witnessed on just a normal day as they passed by the clinic to the rehabilitation ward.

The same can be said for when we take Susan to Courage St. Croix for therapy or swimming. One peek around there and you instantly are amazed with how many people are fighting, surviving and thriving under a seemingly infinite number and range of afflictions. It's inspiring at times, and yes, it puts things into: perspective.

Even if you don't know anybody with these kinds of problems or, thankfully, your family is healthy, you need to look no further than the recipients of our own Wee One tournament for some perspective on how hard life can really be and what really matters.

I don't bring this all up to make you feel bad. I don't bring this up to cavalier some cause or tell you to pray three times a day for a cure for everything. I simply want to illustrate that if you put your job into perspective, you might find some of your grumpiness might wane. You might be able to roll with the punches a little bit better. You might be able to see the silver lining in the grey skies and downpours. Blighted turf is not the end of the world. Sluggish greens will eventually grow, irrigation leaks eventually fixed. It's human nature to get down when facing adversity, but with a little resolve and a solid perspective that there are a whole lot of others facing way more important issues than anything happening on a golf course, things become a little easier to digest, game plan and accomplish. That doesn't mean you shouldn't care about the job, or take pride in what you do, but don't allow it to become all-encompassing and turn you into something you are not.

I leave you with this thought: the golf course was there before you. It will be there after you, and they don't erect bronze statues of golf course superintendents. They just don't. But, that's one man's perspective.

# **MGCSA Environmental Stewardship**

## **Supplemental Information**

### ***EIQ What Does It Mean?***

## **A Method to Measure the Environmental Impact of Pesticide**

### ***Introduction and Background***

For several years, increased attention has been focused on integrated pest management (IPM) programs and alternative methods of pest control to reduce pesticide use in agricultural systems because of food safety issues, groundwater contamination, and increased environmental awareness. By definition, IPM is a pest management strategy that uses a combination of methods (sampling, thresholds, forecasts, biological and cultural controls, etc.) to manage pests without solely relying on chemical pesticides to produce a safe, economic crop. If, however, no other control measure is effective in preventing pest damage, a chemical pesticide is recommended. In past IPM programs, pesticides were generally chosen based on their efficacy or cost rather than on their potential environmental impact. Although some growers and pest management practitioners did take into account the effect of the pesticides on the applicator or beneficial natural enemies such as predatory mites when making pesticide recommendations, no formal method was available to assist them in making environmentally based pesticide choices. Because there is no easy method to assess pesticide impacts, each individual had to rely primarily on their own judgment to make these decisions. Some growers (organically approved growers) felt that only natural pesticides should be used in agricultural production systems because they are naturally occurring and are perceived to be less harmful to the environment. Other growers felt that any pesticide registered by the United States Environmental Protection Agency (US EPA) and used according to the label must be environmentally safe. In addition, IPM programs throughout the country use various methods (number of sprays, the amount of active ingredi-



ent or formulated product used per acre, dosage equivalents, etc.) to quantify pesticide use and environmental impact to compare different pest management strategies or programs. None of these methods estimates the environmental impact of specific pesticides.

Because of the EPA pesticide registration process, there is a wealth of toxicological and environmental impact data for most pesticides that are commonly used in agricultural systems. However, these data are not readily available or organized in a manner that is usable to the IPM practitioner. Therefore, the purpose of this bulletin is to organize the published environmental impact information of pesticides into a usable form to help growers and other IPM practitioners make more environmentally sound pesticide choices. This bulletin presents a method to calculate the environmental impact of most common fruit and vegetable pesticides (insecticides, acaricides, fungicides and herbicides) used in commercial agriculture. The values obtained from these calculations can be used to compare different pesticides and pest management programs to ultimately determine which program or pesticide is likely to have the lower environmental impact.

## *Methods*

Extensive data are available on the environmental effects of specific pesticides, and the data used in this project were gathered from a variety of sources. The Extension Toxicology Network (EXTOXNET), a collaborative education project of the environmental toxicology and pesticide education departments of Cornell University, Michigan State University, Oregon State University, and the University of California, was the primary source used in developing the database (Hotchkiss et al. 1989). EXTOXNET conveys pesticide-related information on the health and environmental effects of approximately 100 pesticides.

A second source of information used was CHEM-NEWS of CENET, the Cornell Cooperative Extension Network. CHEM-NEWS is a computer program maintained by the Pesticide Management and Education Program of Cornell University that contains approximately 310 US EPA - Pesticide Fact Sheets, describing health, ecological, and environmental effects of the pesticides that are required for the reregistration of these pesticides (Smith and Bar-

nard 1992).

The impact of pesticides on arthropod natural enemies was determined by using the SELCTV database developed at Oregon State (Theiling and Croft 1988). These authors searched the literature and rated the effect of about 400 agrichemical pesticides on over 600 species of arthropod natural enemies, translating all pesticide/natural enemy response data to a scale ranging from one (0% effect) to five (90-100% effect).

Leaching, surface loss potentials (runoff), and soil half-life data of approximately 100 compounds are contained in the National Pesticide/Soils Database developed by the USDA Agricultural Research Service and Soil Conservation Service. This database was developed from the GLEAMS computer model that simulates leaching and surface loss potential for a large number of pesticides in various soils and uses statistical methods to evaluate the interactions between pesticide properties (solubility, adsorption coefficient, and half-life) and soil properties (surface horizon thickness, organic matter content, etc.). The variables that provided the best estimate of surface loss and leaching were then selected by this model and used to classify all pesticides into risk groups (large, medium, and small) according to their potential for leaching or surface loss. Bee toxicity was determined using tables by Morse (1989) in the 1989 New York State pesticide recommendations, which contain information on the relative toxicity of pesticides to honey bees from laboratory and field tests conducted at the University of California, Riverside from 1950 to 1980. More than 260 pesticides are listed in this reference.

In order to fill as many data gaps as possible, Material Safety Data Sheets (MSDS) and technical bulletins developed by the agricultural chemical industry were also used when available.

Health and environmental factors that addressed some of the common concerns expressed by farm workers, consumers, pest management practitioners, and other environmentalists were evaluated and are listed in Figure 1 (1Mb pdf file). To simplify the interpretation of the data, the toxicity of the active ingredient of each pesticide and the effect on each environmental factor evaluated were grouped into low, medium, or high toxicity categories and rated on a scale from one to five, with one having a minimal impact on the environment or of a low toxicity and five considered to be highly toxic or having a major negative effect on the environment.



Figure I. A diagram showing the individual environmental factors that were evaluated in developing the environmental impact quotient of pesticides (EIQ) model.

return to A Method to Measure the Environmental Impact of Pesticides.

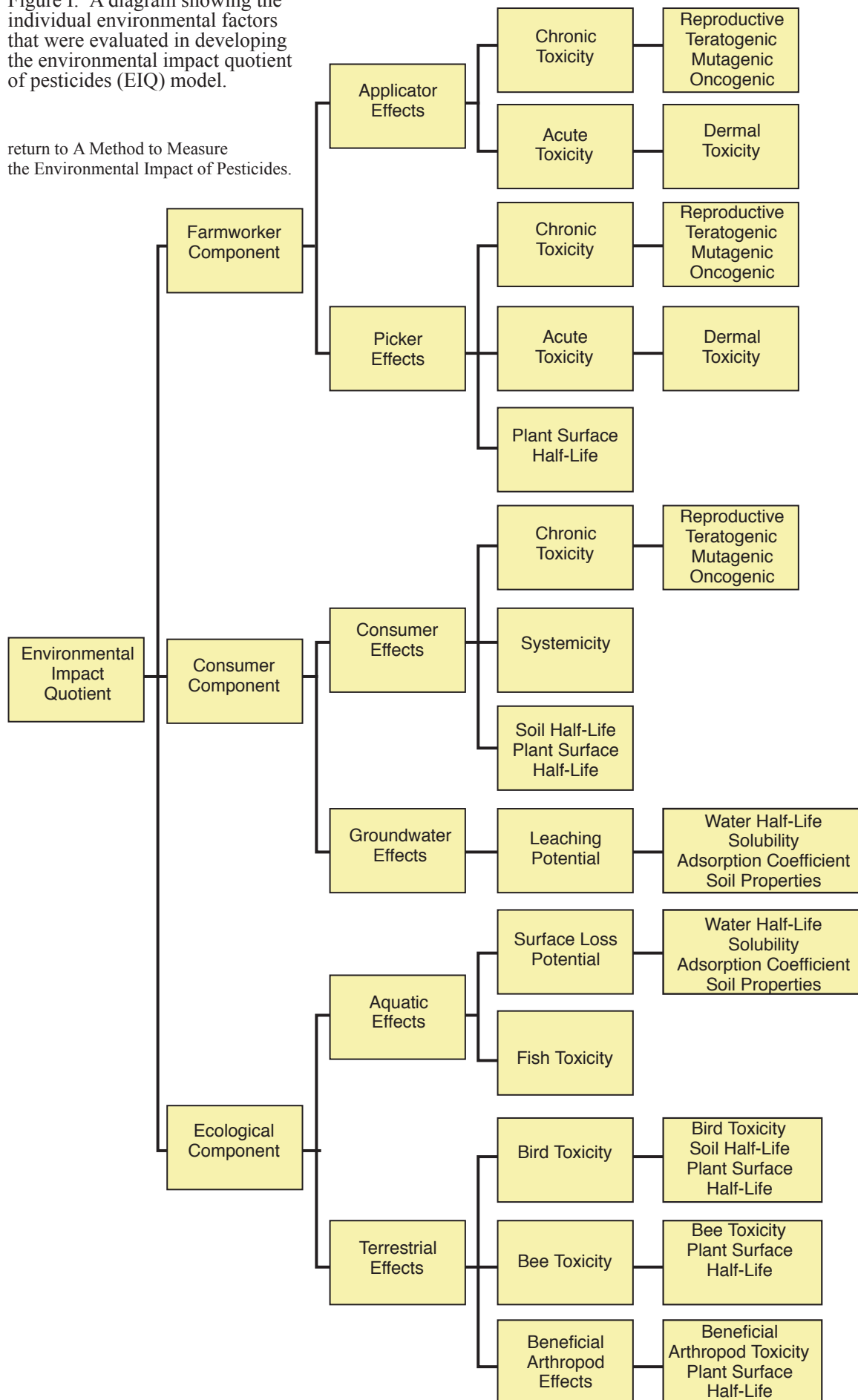


Table 1 lists the specific ratings for the individual factors evaluated. All pesticides were evaluated using the same criteria except for the mode of action and plant surface persistence of herbicides. Because herbicides are generally systemic in nature and are not normally applied to food crops we decided to consider this class of compounds differently, so all herbicides were given a value of one for systemic activity. This has no effect on the relative rankings within herbicides, but it does make the consumer component of the equation for herbicides more realistic. Also, since plant surface persistence is only important for post-emergent herbicides and not pre-emergent herbicides, all post-emergent herbicides were assigned a value of three and pre-emergent herbicides assigned a value of one for this factor.

**Table 1. The rating system used to develop the environmental impact quotient of pesticides (EIQ) model. 1 = least toxic or least harmful, 5 = most toxic or harmful.**

<b>Mode of Action</b> non-systemic- 1 all herbicides - 1 systemic - 3	<b>Toxicity to Fish-96 hr LC50</b> > 10 ppm - 1 1-10 ppm - 3 < 1 ppm - 5
<b>Acute Dermal LD50 for Rabbits/Rats(mg/kg)</b> >2000 - 1 200 - 2000 - 3 0 - 200 - 5	<b>Toxicity to Birds-8 day LC50</b> > 1000 ppm - 1 100-1000 ppm - 3 1-100 ppm - 5
<b>Long-Term Health Effects</b> little or none - 1 possible- 3 definite - 5	<b>Toxicity to Bees</b> relatively nontoxic - 1 moderately toxic - 3 highly toxic - 5
<b>Plant Surface Residue Half-life</b> 1-2 weeks- 1 2-4 weeks- 3 > 4 weeks - 5 pre-emergent herbicides - 1 post-emergent herbicides - 3	<b>Toxicity to Beneficials</b> low impact- 1 moderate impact - 3 severe impact - 5
<b>Soil Residue Half-life</b> T1/2 <30 days - 1 T1/2=30-100 days - 3 T1/2 >100 days - 5	<b>Groundwater and Runoff Potential</b> small - 1 medium - 3 large -5



In order to further organize and simplify the data, a model was developed called the environmental impact quotient of pesticides (EIQ). This model reduces the environmental impact information to a single value. To accomplish this, an equation was developed based on the three principal components of agricultural production systems: a farm worker component, a consumer component, and an ecological component. Each component in the equation is given equal weight in the final analysis, but within each component, individual factors are weighted differently. Coefficients used in the equation to give additional weight to individual factors are also based on a one to five scale. Factors carrying the most weight are multiplied by five, medium-impact factors are multiplied by three, and those factors considered to have the least impact are multiplied by one. A consistent rule throughout the model is that the impact potential of a specific pesticide on an individual environmental factor is equal to the toxicity of the chemical times the potential for exposure. Stated simply, environmental impact is equal to toxicity times exposure. For example, fish toxicity is calculated by determining the inherent toxicity of the compound to fish times the likelihood of the fish encountering the pesticide. In this manner, compounds that are toxic to fish but short-lived have lower impact values than compounds that are toxic and long-lived.

### *The EIQ Equation*

The formula for determining the EIQ value of individual pesticides is listed below and is the average of the farm worker, consumer, and ecological components.

$$EIQ = \{C[(DT*5)+(DT*P)] + [(C*((S+P)/2)*SY)+(L)] + [(F*R)+(D*((S+P)/2)*3)+(Z*P*3)+(B*P*5)]\} / 3$$

DT = dermal toxicity, C = chronic toxicity, SY = systemicity, F = fish toxicity, L = leaching potential, R = surface loss potential, D = bird toxicity, S = soil half-life, Z = bee toxicity, B = beneficial arthropod toxicity, P = plant surface half-life.

Farm worker risk is defined as the sum of applicator exposure (DT\* 5) plus picker exposure (DT\*P) times the long-term health effect or chronic toxicity (C). Chronic toxicity of a specific pesticide is calculated as the average of the ratings from various long-term laboratory tests conducted on small mam-

mals. These tests are designed to determine potential reproductive effects (ability to produce offspring), teratogenic effects (deformities in unborn offspring), mutagenic effects (permanent changes in hereditary material such as genes and chromosomes), and oncogenic effects (tumor growth). Within the farm-worker component, applicator exposure is determined by multiplying the dermal toxicity (DT) rating to small laboratory mammals (rabbits or rats) times a coefficient of five to account for the increased risk associated with handling concentrated pesticides. Picker exposure is equal to dermal toxicity (DT) times the rating for plant surface residue half-life potential (the time required for one-half of the chemical to break down). This residue factor takes into account the weathering of pesticides that occurs in agricultural systems and the days to harvest restrictions that may be placed on certain pesticides.

The consumer component is the sum of consumer exposure potential ( $C*((S+P)/2)*SY$ ) plus the potential groundwater effects (L). Groundwater effects are placed in the consumer component because they are more of a human health issue (drinking well contamination) than a wildlife issue. Consumer exposure is calculated as chronic toxicity (C) times the average for residue potential in soil and plant surfaces (because roots and other plant parts are eaten) times the systemic potential rating of the pesticide (the pesticide's ability to be absorbed by plants).

The ecological component of the model is composed of aquatic and terrestrial effects and is the sum of the effects of the chemicals on fish ( $F*R$ ), birds ( $D*((S+P)/2)*3$ ), bees ( $Z*P*3$ ), and beneficial arthropods ( $B*P*5$ ). The environmental impact of pesticides on aquatic systems is determined by multiplying the chemical toxicity to fish rating times the surface runoff potential of the specific pesticide (the runoff potential takes into account the half-life of the chemical in surface water).

The impact of pesticides on terrestrial systems is determined by summing the toxicities of the chemicals to birds, bees, and beneficial arthropods. Because terrestrial organisms are more likely to occur in commercial agricultural settings than fish, more weight is given to the pesticidal effects on these terrestrial organisms. Impact on birds is measured by multiplying the rating of toxicity to birds by the average half-life on plant and soil surfaces times three. Impact on bees is measured by taking the pesticide toxicity ratings to bees times the half-life on plant surfaces times three. The effect on beneficial arthropods is



determined by taking the pesticide toxicity rating to beneficial natural enemies times the half-life on plant surfaces times five. Because arthropod natural enemies spend almost all of their life in agroecosystem communities (while birds and bees are somewhat transient), their exposure to the pesticides, in theory, is greater. To adjust for this increased exposure, the pesticide impact on beneficial arthropods is multiplied by five. Mammalian wildlife toxicity is not included in the terrestrial component of the equation because mammalian exposure (farm worker and consumer) is already included in the equation, and these health effects are the results of tests conducted on small mammals such as rats, mice, rabbits, and dogs.

After the data on individual factors were collected, pesticides were grouped by classes (fungicides, insecticides/miticides, and herbicides), and calculations were conducted for each pesticide. When toxicological data were missing, the average for each environmental factor within a class was determined, and this average value was substituted for the missing values. Thus, missing data did not affect the relative ranking of a pesticide within a class. Table 2 lists over 120 pesticides by chemical class, fungicides, insecticides/miticides, and herbicides.

Table 2: List of Pesticides

- [http://www.nysipm.cornell.edu/publications/EIQ/files/EIQ\\_values\\_2012entire.pdf](http://www.nysipm.cornell.edu/publications/EIQ/files/EIQ_values_2012entire.pdf)
- [http://www.nysipm.cornell.edu/publications/EIQ/files/EIQ\\_values\\_2012fung.pdf](http://www.nysipm.cornell.edu/publications/EIQ/files/EIQ_values_2012fung.pdf)
- [http://www.nysipm.cornell.edu/publications/EIQ/files/EIQ\\_values\\_2012herb.pdf](http://www.nysipm.cornell.edu/publications/EIQ/files/EIQ_values_2012herb.pdf)
- [http://www.nysipm.cornell.edu/publications/EIQ/files/EIQ\\_values\\_2012insect.pdf](http://www.nysipm.cornell.edu/publications/EIQ/files/EIQ_values_2012insect.pdf)

The values of individual effects of each pesticide (applicator, picker, consumer, groundwater, aquatic, bird, bee, beneficials), the major components of the equation (farm worker, consumer, and ecological) and the average EIQ values are presented in the tables. The tables also include the factors in the evaluation process that contained missing data. Less confidence should be placed on the EIQ values of pesticides that have many data gaps and more confidence

placed on EIQ values with few or no data gaps. Using the tables, comparisons of environmental toxicity of a given weight (pounds, grams, etc.) of the individual active ingredients can be made within a class of compounds. Field comparisons should not be made with these data. Other considerations, such as the percent of active ingredient in a formulated product and the dose required to provide control, need to be assessed before the desirable or least toxic pesticide choice can be made in the field.

### ***EIQ Field Use Rating***

Once an EIQ value has been established for the active ingredient of each pesticide, field use calculations can begin. To accurately compare pesticides and pest management strategies, the dose, the formulation or percent active ingredient of the product, and the frequency of application of each pesticide need to be determined. To account for different formulations of the same active ingredient and different use patterns, a simple equation called the EIQ Field Use Rating was developed. This rating is calculated by multiplying the EIQ value for the specific chemical obtained in the tables by the percent active ingredient in the formulation by the rate per acre used (usually in pints or pounds of formulated product).

$$\text{EIQ Field Use Rating} = \text{EIQ} \times \% \text{ active ingredient} \times \text{Rate}$$

With this method, comparisons of environmental impact between pesticides and different pest management programs can be made. For example, if several pesticides can be used against a particular pest, which pesticide is the least toxic choice? Table 5 shows an example comparing the environmental impact of three insecticides: carbaryl (Sevin 50WP), endosulfan (Thiodan 50WP), and azinphos-methyl (Guthion 35WP). Although carbaryl has a lower EIQ (22.6) than endosulfan (40.5) or azinphos-methyl (43.1), it may take more of it to provide equivalent control. For example, 6 lbs/acre of Sevin may provide the same level of control of a certain pest as 3 lbs/acre of Thiodan or 2.2 lbs/acre of Guthion. In this situation, Guthion would have the lowest EIQ Field Use Rating (33.2) and would be the least toxic choice. Thiodan (60.8) would be the second choice and Sevin (67.8) would be the last.

By applying the EIQ Field Use Rating, comparisons can be made between different pest management strategies or programs. To compare different



pest management programs, EIQ Field Use Ratings and number of applications throughout the season are determined for each pesticide. and these values are then summed to determine the total seasonal environmental impact of the particular strategy. Table 6 compares the theoretical environmental impact of several different pest management approaches that have been used in research projects to grow ‘Red Delicious’ apples in New York. In this example, a traditional pest management approach to growing ‘Red Delicious’ apples that does not rely heavily on pest monitoring methods would result in a total theoretical environmental impact of 938 due to pesticides. An IPM approach that incorporates pest monitoring methods, biological control, and least toxic pesticides would have an environmental impact of only 167. The organic pest management approach, which uses only naturally occurring pesticides, would have a theoretical environmental impact of 1,799 according to the model. The environmental impact of the latter approach is so much larger than the other strategies primarily due to the larger quantities of sulfur required and more frequent applications needed to provide the same level of control of apple scab in this variety. By using the EIQ model, it becomes possible for IPM practitioners to rapidly estimate the environmental impact of different pesticides and pest management programs before they are applied, resulting in more environmentally sensitive pest management programs being implemented.

**Table 3. An example showing the EIQ field use rating of three different insecticides to determine which pesticide should be the least toxic choice.**

Material	EIQ	ai	Rate	EIQ field use rating
Sevin 50WP (carbaryl)	22.6	0.50	6.0	67.8
Thiodan 50WP (endosulfan)	40.5	0.50	3.0	60.8
Guthion 35WP (azinphos-methyl)	43.1	0.35	2.2	33.2

**Table 4. Theoretical environmental impact of different pest management strategies used to grow ‘Red Delicious’ apples in New York. Traditional Pest Management Strategy**

<b>Traditional Pest Management Strategy</b>					
<b>Material</b>	<b>EIQ</b>	<b>ai</b>	<b>Dose</b>	<b>Applications</b>	<b>Total</b>
Rubigan EC	27.3	0.12	0.6	4	8
Captan 50WP	28.6	0.50	3.0	6	257
Lorsban 50WP	52.8	0.50	3.0	2	158
Thiodan 50WP	40.5	0.50	3.0	2	61
Guthion 35WP	43.1	0.35	2.2	2	66
Cygon 4E	74.0	0.43	2.0	3	191
Omite 6EC	42.7	0.68	2.0	2	116
Kelthane 35WP	29.9	0.35	4.5	1	47
Sevin 50WP	22.6	0.50	1.0	3	34
<b>Total Environmental Impact</b>					938
<b>Integrated Pest Management (IPM) Strategy</b>					
<b>Material</b>	<b>EIQ</b>	<b>ai</b>	<b>Dose</b>	<b>Applications</b>	<b>Total</b>
Nova 40WP	41.2	0.40	0.3	4	20
Captan 50WP	28.6	0.50	3.0	1	43
Dipel 2X	13.5	0.06	1.5	3	4
Sevin 50WP	22.6	0.50	3.0	1	34
Guthion 35WP	43.1	0.35	2.2	2	66
<b>Total Environmental Impact</b>					167
<b>Organic Pest Management Strategy</b>					
<b>Material</b>	<b>EIQ</b>	<b>ai</b>	<b>Dose</b>	<b>Applications</b>	<b>Total</b>
Sulfur	45.5	0.90	6	7	1720
Rotenone/pyrethrin	25.5	0.04	12	6	73
Ryania	55.3	0.001	58	2	6
<b>Total Environmental Impact</b>					1720



## *Conclusion*

The Environmental Impact Quotient has been used to organize the extensive toxicological data available on some common fruit and vegetable pesticides into a usable form for field use. It addresses a majority of the environmental concerns that are encountered in agricultural systems including farm worker, consumer, and wildlife, health, and safety. By using the EIQ Field Use Rating, IPM practitioners and growers can incorporate environmental effects along with efficacy and cost into the pesticide decision-making process. IPM programs can also use the EIQ model as another method to measure the environmental impact of different pest management and pesticide programs. As newer biorational pesticides are marketed with lower EIQ values and more emphasis is placed on biologically based IPM practices, the EIQ field use ratings will continue to decrease. Eventually these ratings may approach zero, resulting in an environmentally neutral or benign agricultural production system.

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The EIQ Calculator:

**<http://nysipm.cornell.edu/EIQCalc/input.php?cat=3>**

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