

Preventive Pest Control: What it Takes to Be the Early Bird

Was Mom right? Is an ounce of preventive REALLY worth a pound of curative? With regards to pest control and fungicides in particular, this motto has been echoed over and over in the research community. However, in reality, how can a superintendent justify a costly pesticide application when the turf is rolling like a perfect porcelain green carpet and not showing any symptoms of infection?

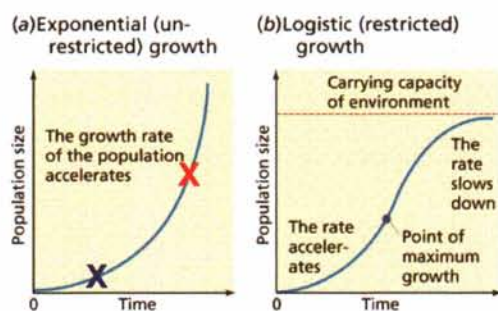


Figure 1

These two graphs represent the exponential and logistic types of increase of a pathogen population.

In a turf situation, where the environment is conducive and the food (the turf) is amply available, the pathogen will increase in an exponential (i.e. rapid) fashion. Because of this, preventative controls aimed at the red X on the curve are more beneficial than curative controls where the pathogen population is increasing at a more rapid rate.

If pressed, just say that population dynamics are exponential and unfortunately don't follow a slower linear progression. If that gets a quizzical look, then say fungal cells in a conducive environment replicate a lot faster than it takes an animal to find a partner, mate, incubate eggs, and rear their children to child bearing age. If the conversation still persists, then read the following.

Justifying the Preventive Approach

In *Figure 1*, the true nature of how a pathogen population grows is graphed vs. time. One pathogen spore or cell splits into two. Those two cells can split and become four, four cells become eight, eight becomes sixteen, etc. As the curve begins to ramp up, the amount of infecting cells overwhelm the plant's defenses and it becomes diseased. At this point, the population engine is really firing, and subsequent infection of nearby plants and additional turf damage is only a heartbeat away. Also, which of the two graphs on the figure is more representative of pathogen population growth on a uniform stand of juicy, very dense turf? With so many individual plants to dine on, the pathogen is only limited by its environment, so the disease takes a while to level off naturally (and if it ever does, there is no grass left and the superintendent is in real trouble!).

Let's take the two scenarios of applying a fungicide at the red X (curative) vs. the blue X (preventive) on the growth curve (*Figure 1*). At the red X, let's say the number of cells (individuals) is around 200,000. If the spray application and delivery is absolutely perfect, infection and growth of these 200,000 cells will stop (notice I didn't say "kill"). Unfortunately, fungicide applications don't

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make this curve behave like the big slide in Chutes and Ladders, and dramatically decrease pathogen numbers. When control wears off and if the environment is right, 200,000 cells are ready to re-infect, become 400,000 cells, and start to climb the vicious curve where they were stopped by the original fungicide application. This explains why in 2004, a bad dollar spot year, many superintendents felt like they could never “catch up” to the disease. At the blue X (early dollar spot application), let’s say the number of cells is around 2,000 and growth of the pathogen is stopped at this level. When fungicide control starts to wear off, the pathogen number is still only at the 2,000 level, well below the threshold of 200,000. The benefit of the early application is realized in the time it takes this smaller number of cells to grow to a population of 200,000 when disease symptoms start to appear.

Other variables come into play when employing an “early bird” strategy which may enhance disease control. Using dollar spot as an example, the actual pathogen cells just coming out of over-wintering may be easier to control with fungicides than dollar spot cells that have had their engine (metabolism) running for a few days or weeks. As with all pathogens, it is important to know to what environments are conducive to pest outbreaks throughout the growing season. The optimum temperatures for dollar spot growth occur in the spring and fall. If early fungicide control can delay dollar spot growth into the (normally) warmer

summer months, the overall amount of dollar spot will be lessened because the environment most conducive to pathogen growth has been skipped.

The Definition of Early = Measuring the Environment

Some recommendations say to make early applications using a pre-determined calendar date. However, past data shows (see Figure 2) that dollar spot initially occurs at different times each year, sometimes differing by as many as two to three weeks. Another recommendation has been to make preventive applications at the second full mowing of the turf surface after green up. This is a better link to the environment and its relation to turf’s growth habit, however it still leaves quite a bit of room for interpretation. What about slower growing bent types that don’t green up very fast? What about *Poa annua*? This indicator is still not precise.

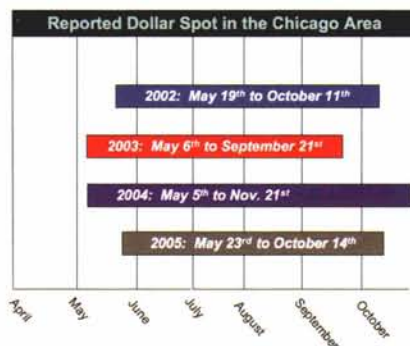


Figure 2
Reported outbreaks of dollar spot in the Chicagoland area. Notice there can be a two – three week difference between initial outbreaks depending on the type of Spring that occurs.

Early indications suggest the measuring of the heat units throughout a growing season may be the best way to figure pathogen progression. For many years, a measure called degree days was used by weed scientists and entomologists to predict weed and insect development. Degree days are calculated by:

$$\frac{\text{High Air Temperature} + \text{Low Air Temperature} - \text{"the base"}}{2}$$

For example, a high temperature of 80 degrees and the low temperature of 60° for any given day, and accumulated degree days with a base of 50 (most commonly used) would be 20° days $[(80-60)/2] \times 2 = 20 \text{ DD}_{50}$. Adding this to the total from the previous days, you get a running total of the amount of heat that has accrued during the season. (As a little secret though, the easiest way to get degree day totals is through the Plant Health Care Report published weekly by the Morton Arboretum (<http://www.mortonarboretumphc.org/>) – which also is a really great read for the horticulturists!)

Another method to measure the amount of heat that has gone into the system during a season is to examine soil temperatures. Soil temperatures are moderated by the soil and thatch layer and aren’t subjected to great swings from day to day like air temperature. Furthermore, soil temperatures follow a fairly regular bell curve during the season (see Figure 3). Many pest outbreaks are directly dependent on the timing of

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when soil temperatures reach a certain level that corresponds to the pathogen's optimal growth. A warm or cool spring can shift this soil temperature curve left or right, either sparking or delaying pest problems.

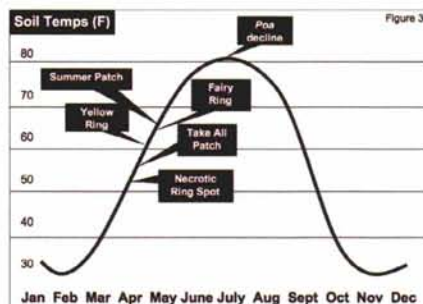


Figure 3

Average soil temperatures follow a normal bell curve when plotted throughout the season.

As temperatures rise in the Spring, pest outbreaks get "sparked".

Events such as Poa decline can also be attributed to times when soil temperatures spike to above 80° F.

Research

When is the best time to catch a pathogen population on its more level and initial rise on the graph? What is the best fungicide to use as an early application? Research is being conducted at the Midwest Golf House (MGH) and several other universities throughout the country to answer these questions for dollar spot control.

Currently, we are testing six fungicides, at high label rates and four early application dates using Degree Day base 50 to determine the best combination for longest control (see Table 1). Sprays were applied in 2 gallons of water per 1,000 square feet with a flat fan nozzle. Plots were fertilized with one-half of a pound of nitrogen per month (important for dollar spot!). In addition, we are replicating this test on two very different types of fairway environments. The first at Midwest Golf House is on a newly established bentgrass fairway. The dollar spot has been tested as sensitive to most fungicide chemistries. On the flip side, we are also testing at North Shore Country Club (NSCC) which has old, mixed *Poa annua*/bentgrass fairways, and does have dollar spot exhibiting reduced fungicide sensitivity to the DMI fungicides (Banner, Bayleton, Eagle, Rubigan).

The Experiment

Six Fungicides	Four Application Dates			
Chipco 26 GT	DMI Sensitive Site		DMI Resistant Site	
Bayleton	2005	2006	2005	2006
Banner Maxx	April 15 th (77 DD)	April 14 th (77 DD)	April 11 th (93 DD)	April 11 th (93 DD)
Banner/Daconil	April 28 th (133 DD)	April 21 st (129 DD)	April 18 th (75 DD)	April 18 th (72 DD)
Daconil	May 5 th (134 DD)	May 4 th (129 DD)	May 10 th (151 DD)	May 2 nd (142 DD)
Emerald	May 12 th (210 DD)	May 18 th (252 DD)	May 16 th (188 DD)	May 15 th (258 DD)

Two Different Test Sites

Pure bent, DMI sensitive	Bent/Poa, DMI resistant
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Table 1

Preliminary results from 2005 suggest some conclusions.

Early applications can dramatically reduce the first wave of disease pressure, but the timing and fungicide choice is critical to providing long term control. Nearly every early application reduced the level of dollar spot severity in the plots somewhat when compared to the untreated plots. However, many of these treatments did not control dollar spot at an acceptable level when rated a month after dollar spot initially started. As expected, systemic fungicides tend to provide the longest amount of control.

Early applications can be applied too early. Applications in the first few weeks of April, or below 100 DD₅₀, did not perform as well as those applied at the beginning of May or around 150-200 DD₅₀. Best performing fungicide and application date combinations are listed in Tables 2 & 3.

DMI Sensitive Population
— July 6th, 2005 rating

Fungicide	App. Date	Degree Day	Mean \$ Spot Severity	LSD
Emerald	April 28 th	133	0.5 %	A
Banner	May 12 th	210	1.25 %	A
Banner + Daconil	May 5 th	134	2.25 %	AB
Emerald	May 12 th	210	2.5 %	AB
Emerald	May 5 th	134	2.75 %	AB
Bayleton	May 12 th	210	2.75 %	AB
Banner	May 5 th	134	4 %	AB

Table 2

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Photo 1

6/27/05: This photo shows the difference in dollar spot severity between Emerald (on the left) and Banner+ Daconil (on the right) which were applied on 5/16/05. This result makes sense since the underlying dollar spot population on this bent/Poa fairway is DMI resistant.



Photo 2

This photo shows the early breakthrough on some treatments that occurred on June 5th of 2006. The plot shown is the earliest application (April 11th) of Daconil.

DMI Resistant Population
— July 5th, 2005 rating

Fungicide	App. Date	Degree Day	Mean \$ Spot Severity	LSD
Emerald	April 18 th	75	2.25 %	A
Emerald	May 10 th	151	2.75 %	AB
Emerald	May 16 th	185	3.25 %	AB
Bayleton	May 16 th	185	6.75 %	ABC
Bayleton	May 10 th	151	7.25 %	ABCD
Emerald	April 11 th	53	7.75 %	ABCDE
Daconil	April 18 th	75	8.5 %	ABCDE

Table 3

The level and types of fungicide resistance must be taken into account before embarking on an early application strategy. For the most part, DMI fungicides did not perform very well when applied early at a DMI resistant site (although Bayleton did perform fairly well at NSCC). However, when applied early at a site with sensitive dollar spot (MGH), the DMIs performed as well as other fungicides (See Figures 4 & 5).

Turf type can play an integral role in the development of dollar spot. Dollar spot on the NSCC plot occurred much earlier and was much more severe than that experienced on the MGH plots. *Poa annua* is much more susceptible than pure bentgrass, making dollar spot much harder to control no matter what application strategy is employed.

This year, dollar spot started firing up at the NSCC plots over Memorial Day weekend, while the plots at MGH were still clean (see Photo 1). The first two ratings on the NSCC plots have been conducted. True to last year's data, the earliest applied materials (first few weeks of April) seem to be having the hardest time maintaining disease control.

Summation

Getting behind the dollar spot 8-Ball is a bad thing, and early dollar spot strategies are a good way to jump ahead of (or in reality stop) the curve. However, as with all recommendations your particular situation can vary (turf type, spray application, budget, fungicide resistance), and fungicide control lasting for eight weeks or more is still not a plausible expectation.

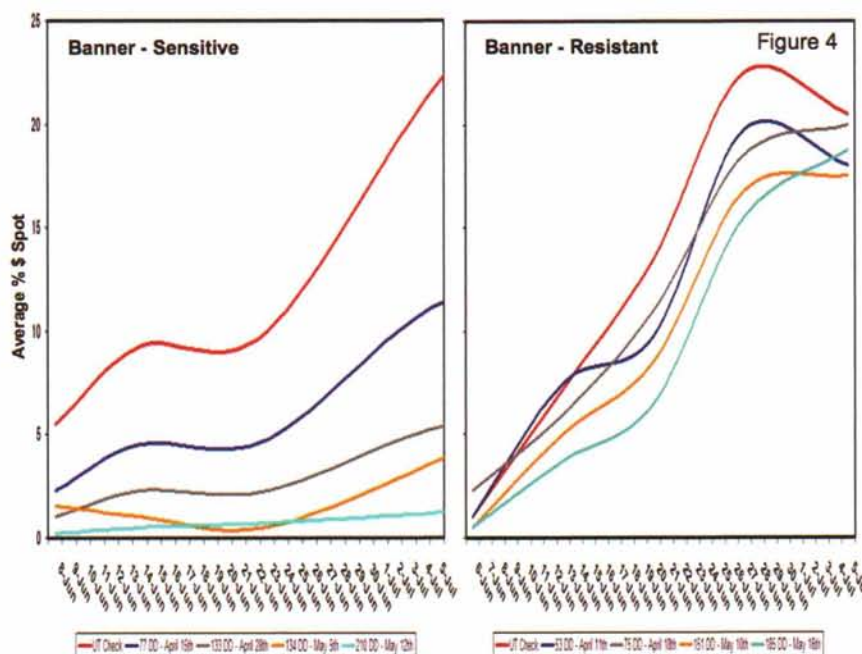


Figure 4

These graphs show that preventative Banner applications work better on DMI sensitive dollar spot populations than on DMI resistant populations.

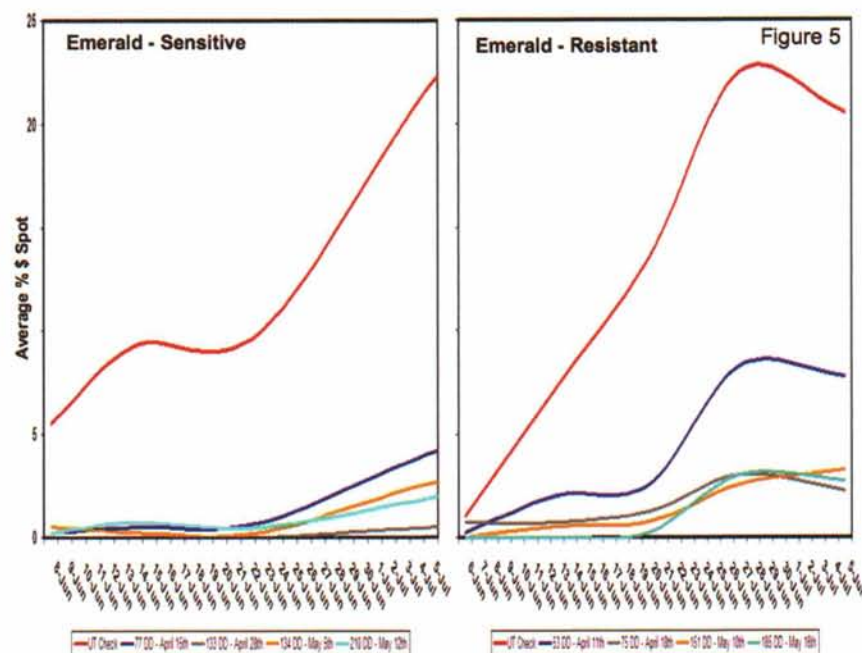


Figure 5

Unlike Banner, Emerald (a non-DMI fungicide) works well on both DMI sensitive and DMI resistant dollar spot populations.

A special thanks to Dan Dinelli, J.D. Dinelli, Chris Bordeleau and the rest of the staff at North Shore for letting me grow dollar spot freely on their #8 fairway. As many of you may already know or will soon see in the Bull Sheet, I am moving on to pursue my PhD at North Carolina State University.

Thanks to Randy Kane for his mentorship and all of you that I have learned so much from. I will look back on the time spent here with fond memories. - Lee .

Lively Readies Medinah for the 2006 PGA Championship

Part of the 13th tee will be removed in order to bring in 11 inches of gravel that will serve as a base for 4 inches of asphalt that will cover about 1½ acres of the 13th fairway on Course 1. This will create a perfect bus staging area! WHAT!?!?!?

This is the life of Tom Lively, CGCS at Medinah Country Club.

Medinah Country Club, the 54 hole layout in suburban Chicago, will host the 2006 PGA Championship, August 14th-20th on the No. 3 Course. This layout has played host to many professional golf tournaments in its history and this event will be the 5th major at the Top 100 venue. I wanted to find out what was involved in preparing for an event of this magnitude. This is the first in a two or three or four part series (heck I may start a reality show). In this visit I wanted to find out what has changed at Medinah Country Club since the last time it hosted a PGA Championship in 1999. I also wanted to know how the daily routine changes in order to prepare for this event. I found out it is not so much the week of the event that appears daunting but the activities leading up to it.



The effect of sand topdressing program is already apparent on the fairways at Medinah No. 3.

The Set-Up

The good news is that Medinah Country Club is fantastic on a daily basis. The putting surfaces consistently roll between 11 and 11½ ft, everything is green and the birds sing the song of your choice. Well, maybe the last one was a stretch. The club normally has a 73-person maintenance crew. This year the number was elevated to 80. The staff began working seven days a week in May and they are not expected to reduce their hours until at least September. The level of maintenance is tremendous. It takes 37 people to mow everything on Course No. 3, and this occurs everyday.

The Penn A1/A4 greens only average 4,200 square feet. The expected height of cut for the tournament will be 0.115 inch and the desired speed of 12-13 feet should be easily obtained with double mowing or single mowing and rolling according to Lively. The fairways, tees and collars are all maintained at 0.350 inches and it is not expected that the tournament mowing height will dramatically differ. The fairways are verti-cut weekly and top dressed every 4-5 weeks. This practice has vastly improved the playability of these surfaces and in a short time 1-2 inches of sand has accumulated on top of the course's native clay medium. The rough is being currently maintained at 3 inches and it is expected to be between 4½-5 inches for the start of the tournament. Two fertilizer applications have already been

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TOURNAMENT TIME

Rusty Stachlewitz *Turf Producers International*



The 13th from the new tee, the hole is now 247 yards.

applied to the roughs and two more are scheduled before the start of the tournament. It is furious. At 3-3½ inches it is thick and a ball nestles down in it to the point where a sand wedge is the only option for all but the best players. Accuracy will be at a premium tournament week.

The Changes

Under the guidance of Rees Jones the course underwent a renovation in 2002. Changes were made to every hole on the course with the exception of #12. The course was stretched to 7561 yards, a PGA Championship record. I will not list all of the changes do to space limitations, but I will highlight the ones that struck me. A hole by hole run-down of changes can be found at www.pga.com/pgachampionship/2006/. Some changes were

drastic such as lowering the landing area on three holes by six feet to allow golfers a vantage of the green from the tee. Several greens were moved or altered. Many tee complexes were changed and additional tees were constructed to help lengthen the layout. The bunkers were altered to include more contour and to better frame approach shots. The new sand that was brought in, closely matches what Lively uses for topdressing. Many of the new bunker complexes have pop-up spray irrigation heads added to them to allow the staff to water the Kentucky bluegrass surrounds and also moisten the 4-5 inches of sand to keep it from getting too soft. Over 300 trees were removed, most around greens to allow more light and air movement to certain areas. In print these changes may seem

excessive but it looks fantastic and will play just as well. When asked what he would have done differently Lively's response started, "I usually don't get talked into things..." It was suggested that Penn G6 be used to grass the collars. It turned out that it could not handle the stress of foot traffic and turning mowers and had to be replaced with a similar mixture to the greens. In such an undertaking one mistake of that magnitude seems allowable.

Beyond the changes made by the Rees Jones, Medinah No. 3 has seen many improvements preparing for the PGA Championship. Sod and seed have been established inside the tree line. Trees have been trimmed, pruned and moved. Lively estimates that 90% of the trees on the property have been affected by an intensive maintenance program implemented

One of the many grandstands and hospitality tents being constructed in ready for the Championship.





The back of 12 green on Course No. 3. The understory brush has been cleaned out and the area seeded.

over the last few years. Brush areas have been removed to increase the space available for corporate chalets and spectators. The Course No. 3 maintenance road will be removed and replaced. A perimeter fence will be heightened from six feet to twelve feet and a new screen will be installed for increased privacy. Many areas have been re-sodded that were showing wear from cart traffic. The greens received an additional aeration this spring. A new fresh water line has been installed to serve food service needs. An internal fence has been removed to beautify the grounds as well. All of this culminates into a course that is awesome to behold. The PGA pros that have played the layout recently are very excited.

Behind the Scenes

Anyone who has attended a PGA tournament has noticed the tents and bleachers that accompany such a sporting event. There is a lot of infrastructure that goes into an event of this size. People need to park, eat, drink and perform other natural human functions. The benefit that Medinah Country Club has is that they own a lot of land adjacent to Course No. 3. The downfall is that most of this land lies under the other two courses. The start of this article sets up a real world example of what is happening at Medinah Country Club. The back nine at Course No. 1 closed on June 13th in order to allow for construction to

begin. The 13th fairway of Course No. 1 is adjacent to Medinah Road and it will serve as a bus stop for the 38 buses that will be transporting attendees in air conditioned bliss from the free offsite parking areas set up for the event. After removing the corner of the tee and taking down the perimeter fence, a fabric barrier will be laid down to insure the 11 inches of gravel sub-base for the 4-inch thick asphalt parking lot will not be pushed into the clay strata below. The 1-½ acre area that was a creeping bentgrass fairway will be the functional entrance to the 88th PGA Championship. Just beyond the entrance parking lot is the 12th fairway of Course No.1. This will be the

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home of the food and beverage services and the 38,000 square foot PGA Championship Pro Shop. These tents will be constructed on top of wood decking and carpet. A similar set up will be employed for the media tent on the 11th hole. The 14th hole at Course No. 1 will play host to the vendor tents. These will be situated on top of 11 inches of gravel over the fairway. Adjacent to this area is a temporary transformer that was brought in to accommodate for the electrical needs of the event. A gravel path will also be installed across hole numbers 10, 11 and 14 of Course No. 1. It will serve as an egress point for the players to enter the clubhouse from their parking area.

The flow of foot traffic will allow patrons to enter Course No. 3 near 18 green and 1 tee. The distance from the bus lot to Course No.

3 is very short and convenient. This is a departure from other events that have had walks of 2 miles or more from the parking lot to the clubhouse. In order to accommodate the parking and tent areas 60 irrigation heads needed to be removed and the irrigation line needed to be rerouted. There can be no live lines under any of the temporary surfaces. In total, 4 acres of creeping bentgrass will need to be replaced on Course No. 1 after the tournament. On Course No. 3 itself, there will be 53 corporate chalets of which 33 are located along the 1st and 18th fairways. The PGA is also in the process of selling corporate bleachers on the course.

Anticipation

The day I visited the course I would have characterized play as brisk. There appears to be anticipation from everyone as to what is

coming. I know the members at Medinah Country Club appreciate the effort that must be put forth to have an event like this go well. Cart traffic will be discontinued July 14th and the closing date for Course No. 3 will be determined based upon weather and conditions. It is anticipated that the course will have about one week to brace itself for the onslaught of golfers, spectators and media. Tom looks forward to the 60 volunteers that will arrive tournament week to help with maintenance before and after play each day. The volunteers can look forward to being involved with a first class staff at a first class facility. Tom Lively has a great attitude about the entire process. He puts it best when he said "You can't have an event like this unless you really want to."



225 yards to the fairway on the 605 yard 14th on Course No. 3.

