Reduced Risk Golf Course Management
2008 Report

Jennifer A. Grant, NYS IPM Program and Frank S. Rossi, Dept. of Horticulture
Cornell University
Cooperators: Andrew Wilson, Kathleen Wegman, Craig Currier and David Catalano
Bethpage State Park

INTRODUCTION

2008 was the eighth year of a study assessing the feasibility and performance of golf course putting green turf comparing traditional management techniques with an IPM approach utilizing population-based pest management and to a system that utilizes biologically-based controls and reduced risk chemistry.

The work, originally funded by the USGA, was initiated on the Green Course at the Bethpage State Park, Long Island, New York in 2001. Funding for 2005-2007 was provided by NE IPM (USDA), and current funding is provided by the NYS Office of Parks, Recreation and Historic Preservation (OPRHP). The Green Course is one of five public courses at the Park and accommodates approximately 50,000 rounds of golf annually. The greens are made of push-up native soil and have been heavily sand top-dressed for the last eleven years, and are typical of a high-use public course in a northern metropolitan community. A more detailed discussion of methodology and results from 2001 through 2003 can be found at http://usgatero.msu.edu/, and the 2004-2006 reports at http://nysipm.cornell.edu/grantspgm/projects/default.asp . A research paper, published in the International Turfgrass Society Research Journal, 2009, is also available on request.

In addition, we have begun to explore reduced risk and IPM management of tees, fairways and roughs. We are also actively spreading successful practices to the Blue and Yellow courses at Bethpage State Park, and have drafted a manual on these practices—to be published in 2009.

OBJECTIVES:

- Evaluate the aesthetic and functional performance of putting greens managed with IPM or biologically-based reduced-risk practices.
- Determine the environmental and economic impact of putting greens managed with IPM or biologically-based reduced-risk practices.

PROJECT DESIGN

Current golf course pest management practices ("conventional") are compared with IPM and biologically-based reduced-risk management (formerly "non-chemical"). Further comparisons are made between conventional cultural practices and "alternative" practices that we believe will reduce turfgrass stress and thereby minimize pest problems. These practices include less frequent mowing and clean up passes; watering in the morning instead of at night; the use of seaweed-based products to provide cytokinins for heat tolerance; heavy use of acidifying fertilizers; and light frequent topdressing.

This project explores total management systems, as practiced by turf managers, rather than focusing on individual technologies and isolated practices. The experimental design results in six management systems. Each green serves as a replicate, with all 18 greens used to accommodate three replications of the 6 management systems (Table 1).

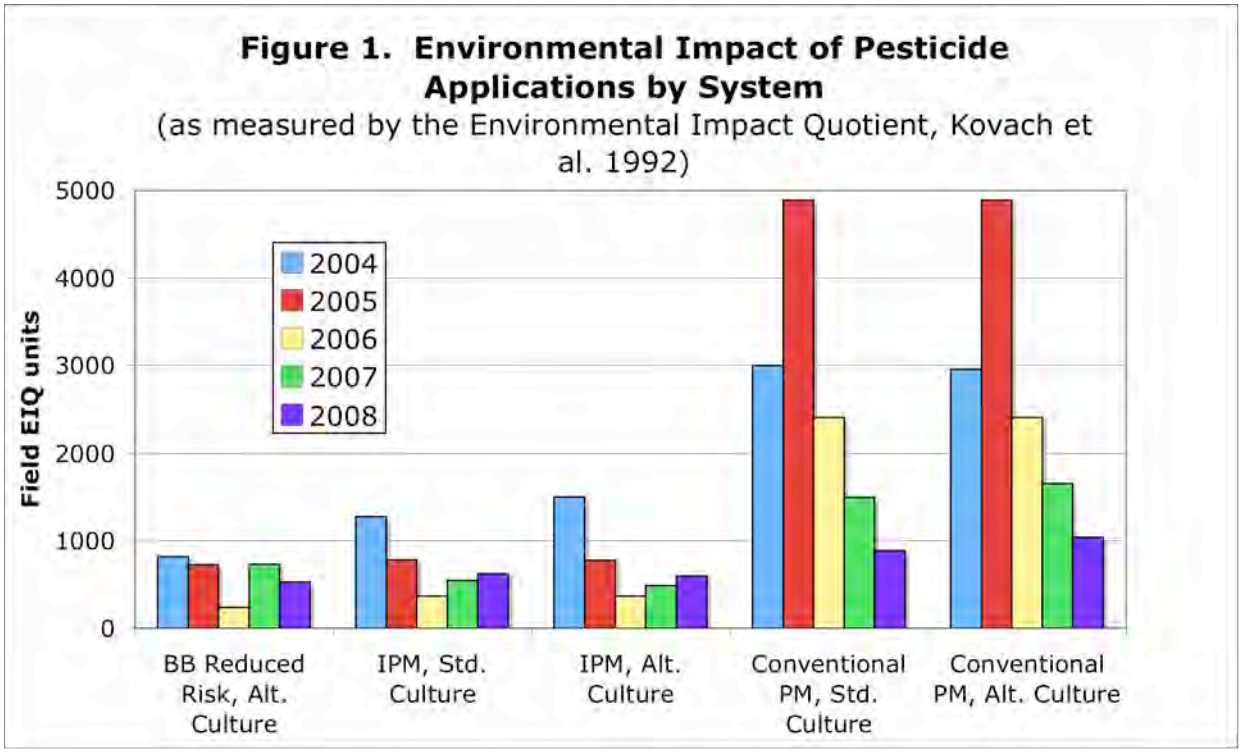
Treatments and hole numbers assigned

	CULTURAL PRACTICES	
PEST MANAGEMENT	Standard	Alternative
Conventional	1, 6,17	9, 12, 13
IPM	3, 5, 18	8, 11, 14
Bio-based Reduced Risk (prev. Non-Chemical)	discontinued	2, 4, 16
		7*, 10*, 15* *velvet bentgrass since 2002

After three years of attempting to manage 70-yr. old mixed stands of bentgrass and annual bluegrass without synthetic pesticides in the Northeastern U.S. climate, we conceded that nonchemical management (management without any EPA-classified I, II, or III chemical pesticides) was not sustainable with current technology. Therefore, in 2004, we decided that a more viable interim approach was to avail the project of tools designed to select very low risk products, even if the treatments were no longer technically "non-chemical". The treatment is now referred to as "biologically-based reduced-risk".

In 2004 we also introduced a significant change in the project by using the "Environmental Impact Quotient" (EIQ) (Kovach et al. 1992) http://nysipm.cornell.edu/publications/eiq/default.asp, to select the low-impact pest management products and practices in the IPM and reduced risk treatments. The EIQ model provides information on pesticides that will have the least harmful effects on non-target organisms, applicators and golfers. The superintendent chooses the lowest risk product amongst the legal products expected to be efficacious under the specific circumstances encountered.

Environmental Impact, 2004-2008



ADDITIONAL DATA FROM 2001-2007 ARE PRRESENTED BELOW

Table 1. Initial (2001) Soil chemical analysis of Green Course putting surfaces.

Treatment		pH	%OM	S	P	Ca	Mg	K	Na
Cult Mgt.	*Pest Mgt.*					ppm			
Conv	Conv	6.9	4.1	58	282	1711	257	95	22
Conv	IPM	7.1	3.2	56	290	1322	277	97	23
Conv	Bio-B	6.9	3.6	55	333	1586	254	95	24
ALT	Conv	7.0	3.8	56	283	1596	266	92	21
ALT	IPM	6.9	4.1	55	245	1571	254	98	20
ALT	Bio-B	6.8	4.0	58	247	1677	256	89	23
	Tukey LSD	NS	NS	NS	NS	NS	NS	NS	NS

Table 3 . 2008 Soil chemical analysis of Green Course putting surfaces.

Treatment		pH	%OM	S	P	Ca	Mg	K	Na
Cult Mgt.	*Pest Mgt.*					ppm			
Conv	Conv	6.6	4.6	35	229	1209	180	58	40
Conv	IPM	6.6	3.1	28	225	825	125	49	40
Conv	Bio-B	6.5	3.1	32	185	975	165	52	49
ALT	Conv	5.4	3.7	26	92	625	52	45	41
ALT	IPM	5.0	3.6	59	95	242	55	36	46
ALT	Bio-B	5.4	3.6	21	99	455	45	40	38
	Tukey LSD	0.5	0.4	14	35	206	27	NS	NS

Table 5. Annual turfgrass quality ratings for putting surface treatments.

Treatment	2002	2003	2005	2006	2007
CC/CPM	7	7	7	6.9	7.1
AC/CPM	7.6	6.9	7.2	6.7	7
CC/IPM	6.6	6.3	6.8	6.3	6
AC/IPM	7.3	6.2	7	6.3	5.4
CC/BBPM	5.6	5.2	6.9	6.1	5.8
AC/BBPM	5.9	5.7	6	5.9	5.4

Table 8. Five year summary of putting surface treatment effect on golfer satisfaction with ball roll and visual quality.

Treatment	Turf Quality[t]	Ball Roll
CC/CPM	3.7 a	3.1 a
AC/CPM	3.6 a	3.1 a
CC/IPM	3.6 a	3 ab
AC/IPM	3.5 a	3 ab
CC/BBPM	3.5 a	3 ab
AC/BBPM	2.9 b	2.9 b

* Turf quality response options: 1=very poor, 2=fair, 3=acceptable, 4=very good, 5=excellent; Ball roll response options: 1=too slow, 2=slow but OK, 3=acceptable speed, 4= fast but OK, 5=too fast.

[t]means within columns followed by different letters are significantly different at $p<0.05$ based on Tukeys Mean Separation.

Discussion

We are now comfortable with a suite of IPM and biologically-based reduced-risk practices that give acceptable and relatively consistent results in putting surface quality. Hence the active dissemination of successful practices to the Blue and Yellow courses, beginning in 2008. Key components are use of: progressive cultural practices; effective biological and reduced risk fungicides; and the Environmental Impact Quotient (EIQ) for guidance in selecting the least harmful pesticides.

We have observed thriving creeping bentgrass populations on the alternative culture greens, which we attribute to several factors. The regular use of ammonium sulfate in alternative culture treatments has led to significant reduction in soil surface pH. While there have been very minor disease problems, the annual bluegrass has declined primarily as a result of acidic soil conditions that likely results in increased aluminum availability. Annual bluegrass has a well-documented intolerance of lower pH and soluble metal concentrations.

The conventional pest management programs have had the most consistent high quality throughout the eight years of the study. However, IPM greens were almost always of acceptable quality, and often had quality equal to the conventionally managed greens. Quality of the biologically-based reduced-risk greens has improved over time, so that we obtain acceptable quality more often than not during the season, and we have not had to close one of these greens since 2005. Additional factors of importance are that ball roll seldom differed significantly among treatments, and golfers did not perceive a difference in quality (other than the velvet bentgrass greens). We have found that a relatively small increase in the use of pesticides (from none to some reduced risk products), results in a great increase in quality.

The environmental impact data show that the conventional pest management treatments are always significantly higher than the IPM and BBRR treatments, by as much as 96%. An important trend is also that the EIQ in the conventional pest management treatments has declined greatly since 2005. This reflects changing pesticide policies in the Park, and increased awareness of the superintendent to pest management options.

Lastly: In 2008, Robert Portmess published a Master's thesis that serves as a draft of our upcoming manual on reduced-risk and IPM practices, scheduled to be published in 2009. The manual will be a foundation for training of NYS Parks golf course personnel. Our approach incorporates cultural practices, the EIQ, and efficacy information. An example, from the manual draft, is given for dollar spot management on the next two pages.

Excerpted from ***Turf Management Guide for Reduced Chemical Inputs on New York State Parks and Recreation Golf Courses***, 2008, by Robert Portmess.

Dollar spot: Agent: *Sclerotinia homoeocarpa*

Species Affected:
All cool-season turfgrass except perennial ryegrass

Appearance:
On greens, the early symptoms are small spots of blight measuring about 2-3 inches. In early morning dew, they will be covered with white cottony patches. Unchecked, the spots will coalesce into large areas of turf. Higher cut turf will exhibit much larger blighted areas measuring from 6 inches to twelve feet.

Signs:
On closer inspection the leaves have yellow-green blotches that progress to a water soaked or hourglass appearance ending up a yellow tan with reddish brown borders.

Ideal Conditions:

- Warm days (60-90°F) and cool nights (above 50°F)
- Prolonged leaf wetness, dew and high humidity (>85%)
- Dry soils with low nitrogen fertility

Cultural Options:
Dollar spot has been shown to be most virulent on USGA specified greens and less virulent on push up greens possibly due to more consistent surface moisture that prevents drying that leads to increased dollar spot

- Rolling three times a week has reduces dollar spot infestation.
- Remove dew as early in the morning as possible (mowing, rolling, whips).
- Maintain adequate and consistent N fertility.
- Reduce compaction and minimize surface organic matter accumulation.
- Water to avoid drought stress but avoid nighttime irrigation that prolongs leaf wetness.
- Remove grass clippings.
- Check FORECAST model to asses risk level.
- Early season applications of curalan have been shown to delay onset of dollar spot and thereby reducing overall chemical use for dollar spot control over the season.

Treatment:

There are many products labeled to treat dollar spot. The following pesticides have been identified to have better efficacy in field tests.

Table ___: Pesticide Recommendations for Dollar Spot					
Fungicides	**FRAC Code**	**Some Trade Names**	**Low Field EIQ***	**Median Field EIQ***	**High Field EIQ ***
Boscalid	7	Emerald	7	8	9
Fenarimol	3	Rubigan AS	4	6	9
Iprodione	2	Chipco 26019,Lesco 18, ProTurf Fluid Iprodione Pro	36	54	73
Propiconazole	3	Banner MAXX, Spectator, Dorado	12	31	49
Thiophanate-Methyl	1	Cleary's 3336, Fungo Flo, Cavalier	65	97	130
Triadimefon	3	Bayleton, Granular Turf	18	28	37
Vinclozolin	2	Curalan, Touché	-	24	-
Biocontrols					
Bacillus licheniformis	NC	Ecoguard	0	0	`1
Bacillus subtilis	NC	Rhapsody	1	2	3
Pseudomonas aureofaciens	NC	Spot-less	<1	<1	<1
* Field EIQ can vary by mfg label % AI and/or application rates NC: Material of biological origin is not classified					

Additional Notes:

- Chemical treatments need to be rotated by FRAC codes to avoid resistance. Follow label instructions.
- Note that the use of azoxystrobin or flutolanil to treat other diseases has led to an increase in dollar spot incidence.
- Treatments made when the dew was removed have been found to be more effective.
- The use of a wetting agent has also been noted to reduce disease severity.

Recommendations based on effective control at Bethpage

Intensive applications of *Pseudomonas aureofaciens* and *Bacillus licheniformis* as biocontrols have been shown to control dollar spot.

Propiconazole and Triadimefon
Vinclozolin

Tolerance Threshold: 0.2 patches per square foot (= 1.8 / sq yd)