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Fred D. Opperman, CGCS
810 Greenwood Avenue
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Fax (708) 854-1497

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President's Message



Ray Schmitz

The NCTE was held at Pheasant Run Mega Center, Dec. 2-4 and was highly successful again this year. The actual attendance was 1064 for the 3 day event of which 263 attendees were members of the MAGCS. This was a very good showing for our association and good support for the Illinois Turfgrass Foundation by other associations in general.

Golf course maintenance is a multimillion dollar business and continues on the upswing. A sampling of 1,164 golf courses or 9% of the 12,846 golf courses in America listed by the National Golf Foundation, shows golf courses spent \$3.4 billion on maintenance in 1991. This figure includes maintenance and labor expenditures but excludes capital expenses.

I feel that, we as superintendents, are doing a good job of managing the money that is allocated to us for running our golf courses and we are doing our share to fight the recession that is effecting many other industries.

March is an important month for meetings before we really get busy on the golf course. The following are three meetings that I feel are important for us to attend.

March 11th — Environmental Seminar, sponsored by Rory Bancroft. This is an all day session.

March 16th — MAGCS monthly meeting at Nordic Hills, luncheon meeting.

March 19th — Chicago District Golf Association Greens Seminar, morning meeting.

When you consider it, these are very exciting times to be involved in the golf industry, so many things are happening so fast. New pieces of equipment along with products for pest control, both chemical and biological, are coming into the marketplace. Not to mention the area of government legislation where new laws are being created almost daily. Fortunately, we have many sources at our disposal to help us make decisions which effect our daily operations.

Director's Column

by Ed Braunsky



“El Nino”

Last fall one cool November night, I stood up at the Geneva Golf Club annual meeting and thanked a number of people for the support they had given me during the past season. I ended my comments with the following, “I finally would like to thank my wife for putting up with me for always looking at the TV to watch the weather report!”

Like most golf course superintendents, I eat, sleep, and live for the weather. This past season was a bear. Early heavy spring rains, a summer drought, a very cold fall temperatures gave us a wide range of crazy weather.

Well, that stuff is old hat. With the cold weather we had in the fall, it looked like easy sailing for the winter, but as the famous beer commercial states, “NOT!”

This past winter has had more ups and downs than my checking account. For kicks, I thought I would look back at the first weeks of weather we have had in Februarys since 1988. I keep a daily journal with activities, weather data, and the many times Jim Burdett takes me to lunch. 1988 and 1989 were very cold and snowy, but 1990 and 1991 were very mild and snowless. What about 1992? Well, as I write this article, the weather man is talking about how the temperature on this day, February 2nd, was a record setting 57°.

What is causing this yo-yo winter? The culprit seems to be a weather trait called “El Nino”. Translated into English, “El Nino” means “the Christ child”. This childlike weather is as wild as my four year old son, Benjamin.

I came across an interesting book entitled “Ice Time” by Thomas Levinson. In it he has several items on the El Nino. He states, “El Nino is just a current of warm water moving southward from Ecuador to the northern coast of Peru during December and January, bringing with it a characteristic pattern of sea breezes. Full-scale El Nino, with strange and dangerous events that include bath-warm ocean currents and several months of heavy rains, recur every three to eight years.”

Levinson continues, “As far as Peru was concerned, until very recently El Nino was a familiar, unwelcome, but tolerable companion. It has been a feature of the climate of the area for as long as anyone has been able to check ... and there are records dating back to 1726 that mention El Nino’s effects.”

I also thought I would try and talk to one of my heroes on the subject. Since Art Benson, Jr. was busy building a lake, I called the weather office at WGN Television. One of my other heroes, Tom Skilling, was out to lunch, but I was able to get

some answers from a very knowledgeable person — Steve Goolsby.

Steve said that the Pacific Ocean was a lot warmer and the winds were flowing in a different direction than the normal winter breezes. The jet stream was also split and allowed for a more moderate temperature range. The storms of winter have gone either north or south. Someone up there must know I have two paddle tennis courts to keep clear of snow. Steve also went on to talk about how we have had very little snow so far this winter. He additionally brought up a few other points. It seems that the average lows have been a lot higher than the average highs over the last two years. He added that the “El Nino” really does not have any bearing on the weather to come.

“El Nino” — friend, foe, or frustrated weather cycle? All in all, it is an interesting weather pattern. Maybe the rest of 1992 will be “El No Problemas”. Let’s hope!

Just one side note: Clubs are needed for meetings in 1993. Please give me a call at 708/232-0627. 1992 is already full, so get your club in line before all the slots are gone for 1993.

Gooses

by John Stephenson, CGCS
Pottawatomic G.C., St. Charles, IL

Goose-geese-flocks-herds-gaggles or geeses or other verbs — adjectives — cuss words, etc.

They are a problem on a golf course, and the one of which I am Superintendent of is located on a river, which is on a major flyway.

I have seen as few as one and as many as five thousand geese during the migrating periods, and annually 20 to 30 pair during the nesting season, which amounts to an average of four goslings per pair. When you add this all up it amounts to a lot of stuff which geeses are best at, and if you didn’t know, geese are the closest to perpetual motion of anything I know, in one end and out the other.

Over the years I have tried most everything I have heard of to solve the problem with practically no success.

Then a player said, “John I can solve your problem”. With skepticism, I said, “let’s have a go”. He gave me some rolls of tape, silver on one side, red the other. I put up stakes along the mighty Fox and attached my ribbon. Lo! and behold, two days went by and no geese on the course, the third day I saw about 15. Aha! I knew it wouldn’t work. I checked along the river and saw the ribbon was down. I tried to herd them back and as they approached the ribbon they would panic. I finally get them back into the river, and then repaired the down section. Five days passed with no geese on the golf course. I couldn’t believe it. This was May, 1991, and the rest of the molting season, the only geese that were on the course would come in where the ribbon was down.

Then I said, “wait till they start to fly”, but to my surprise, they would land on the areas far from the river and would not stay long. Don’t ask me why or how, but it works.

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Development of fungicide resistance or tolerance on Illinois Golf Courses

by Dr. Randy Kane, Turfgrass Advisor
Chicago District Golf Assn.

Over the past few years, I have observed several instances of disease control failures on golf courses in Illinois that can be attributed to development of fungal resistance or tolerance to certain systemic fungicides. In most cases, this has resulted from long term, repeated use of these fungicides under conditions of high disease pressure and highly susceptible grasses. First, let me define what I mean by resistance or tolerance. In this report, "resistance" refers to situations where there is near total to total loss of control under field conditions, accompanied by little or no sensitivity of fungal isolates to the fungicide(s) **in vitro**; "tolerance" is where there is some measurable loss of control in the field (not total), accompanied by moderately reduced sensitivity **in vitro** when compared to other strains of the same fungal species.

In order to determine the relative sensitivity of suspected resistant/tolerant fungi, I conducted standard **in vitro** toxicity tests called radial growth assays. These assays are carried out by incorporating known concentrations of a fungicide in agar media, then growing the fungi on the media and measuring their growth responses over a range of concentrations. From this, one can estimate an "EC50" value (effective concentration to reduce the growth rate by 50%), which is very much like an LD50 value (lethal dose for 50% of the population). The higher the EC50, the more resistant the fungus is to the fungicide **in vitro**, and gives a strong indication of **in vivo** or field resistance. Following are the results of the **in vitro** tests.

Pythium/Subdue. Possible metalaxyl (Subdue) resistant *Pythium* blight was observed on a fairway at the Knollwood Club in August of 1988 followed Subdue applications. Samples of diseased grass were collected and yielded a fast growing *Pythium* spp., later identified as *P. aphanidermatum*. EC50 values were calculated from radial growth assays as presented in Table 1. *Pythium* isolates from the Knollwood site were capable of growing at 500 ppm. The calculated EC50 value for this isolate was approx. 350 ppm; a sensitive isolate would have an EC50 value of around 1-2 ppm. These values are similar to those reported by Pat Sanders and coworkers at Penn State (*Plant Disease* 74:690-692). I have not documented any other case of Subdue resistant *Pythium* blight in northern Illinois, and this fungicide remains an effective control at most golf courses. (I have heard several anecdotal accounts of *Pythium* blight control failures, but I believe that most of these were probably due to misapplication of Subdue or misdiagnosis of the disease, and not due to resistance).

Table 1. Subdue resistant *Pythium* blight at the Knollwood Club, 1988.

concn(ug/ml)	Per cent of control growth rate					EC50 (ppm)
	10	50	100	250	500	
resistant	100	100	92	76	28	>300
sensitive	25	0	0	0	0	<5

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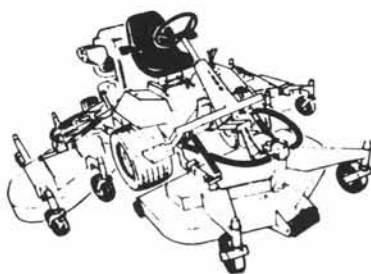
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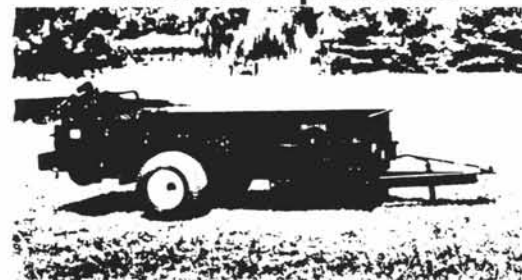
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(Fungicide Resistance cont'd.)

Anthracnose/benzimidazoles. We have come to recognize the basal stem, crown, and root rot phases of anthracnose to be of major importance on **Poa annua** and creeping bentgrass in Illinois. Only systemic fungicides such as the benzimidazole derivatives (Tersan 1991, Fungo 50, Cleary 3336) and ergosterol biosynthesis inhibitor (EBI) products (Banner, Bayleton, Rubigan) have provided control; contact products such as chlorothalonil have not been as effective. However, in 1991 two cases of failed anthracnose control by benzimidazole products were observed. Both golf courses have long term histories of benzimidazole use. Isolates of **Collectotrichum graminicola** from diseased areas were tested *in vitro* for resistance/tolerance to benomyl (Table 2). EC50 values were 100 times higher for the resistant isolates than for isolates from other area courses with no history of benzimidazole resistance. On both courses where benzimidazoles failed to control anthracnose, applications of Banner or Rubigan controlled the disease; also, *in vitro* tests of these isolates illustrates their sensitivity to these EBI fungicides (Table 3).

Table 2. Resistance to benomyl among isolates of *C. graminicola* and "Sclerotinia" (dollar spot).

	Tersan 1991 (ppm a.i.)	
	EC50	EC95
Anthr.		
MMGC	>50	>100
PaH	>50	>100
RFor	<.5	>10
Thg	<.5	1
D. Spot		
Rmr B1	9	>50
Rmr B3	5	25
Srd 01	<.5	<.5

Key: MMGC=Manteno Muni. GC; PaH=Palatine Hills GC; RFor=River Forest GC; Thg=Thorngate CC; Rmr=Ridgemoor CC Srd=Sunset Ridge CC; MMGC, Rmr, and Srd are from bentgrass, all others from *Poa annua*.

Anthracnose/triadimefon. I have also observed quite a difference among the EBI fungicides and their ability to control anthracnose. Bayleton (triadimefon) does not control the crown or stem base infections as well as Banner or Rubigan. This has also been observed in Wisconsin for anthracnose and "Poa decline" by Prof. Gayle Worf (*The Grass Roots* Vol. XIX, no. 6, pp. 23-25). I examined several *C. graminicola* isolates from courses where Bayleton had not provided adequate control and from courses where Bayleton had not been used. The results (Table 3) indicate that, regardless of prior exposure, Bayleton is less toxic *in vitro* to *C. graminicola* than other EBI fungicides. (This includes the experimental EBI fungicide Lynx, which is a Mobay product that is a close structural analog to Bayleton.) This reduced toxicity probably accounts for the mixed results we see in the field with Bayleton on anthracnose. There is no evidence of a developing tolerance to other EBIs among anthracnose fungi.

Table 3. Toxicity of Bayleton and other EBI fungicides to *Collectotrichum graminicola*.

	Approximate EC50 (ppm a.i.)			
	Bayleton	Lynx	Banner	Rubigan
MMGC (2)*	5-8	.3-.5	.3-.5	.3-.5
PaH	4-5	.3-.5	.3-.5	.3-.5
RFor (2)	4-5	.3-.5	.3-.5	.3-.5
Thg	6-7	.3-.5	NT	NT
Mdl, BBr	10-15	NT	NT	NT

*number in parenthesis indicates number of isolates tested per site. NT = not tested

Key: MMGC (Manteno - 1991); PaH (Palatine Hills - 1991); RFor (River Forest - 1991); Thg (Thorngate - 1987); Mdl (Midlane - 1987); BBr (Bonnie Brook - 1987); MMGC is from bentgrass, all others are from *Poa annua*.

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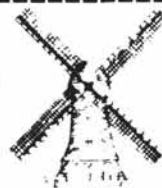
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(Fungicide Resistance cont'd.)

Dollar spot control failures at Ridgemoor C.C. Over the past three seasons, dollar spot disease has become increasingly difficult to control with EBI fungicides on the bentgrass fairways at Ridgemoor CC. Fungicide efficacy plots were established on a fairway in 1991 by researchers from Ciba-Geigy Corp. (Dr. C. Pearson, Field Research Repr.) which demonstrated reduced control of EBI fungicides — especially in terms of length of residual control. EBI fungicides have been used to control dollar spot at this site since the registration of Bayleton in 1982, primarily in tank mixes with contact fungicides such as chlorothalonil, thiram, and anilazine. By 1988, residual control was notably diminished; by 1991 control was unacceptable for all registered EBI products. In order to test for resistance or tolerance of the dollar spot fungi to EBI fungicides, several isolates were collected from Ridgemoor and compared to isolates from two other area golf courses (Shoreacres and Sunset Ridge CC) where no control problems have been observed.

The results of *in vitro* toxicity tests appear in Table 4. Isolates Rmr B1 and Rmr B3 were taken from an affected fairway at Ridgemoor. These isolates were, in general, five to ten times less sensitive to EBI fungicides than “wild type” isolates, even though EC50 values were less than 1 ppm for all isolates. (I would call this “tolerance”.) Note that isolate Rmr R3, which was from an untreated *Poa pratensis* rough at Ridgemoor, was more sensitive to EBI products than the fairway isolates. Also, I found that greater than 25 ppm active ingredient of Bayleton and Rubigan are required to totally inhibit growth of the tolerant Rmr isolates, a concentration which the fungi are unlikely to face in nature. *In vivo* studies of these dollar spot isolates may demonstrate a greater difference between tolerant and sensitive types, since the actual process of infection of the host would be taken into account. These studies are being conducted by Ciba-Geigy.

Table 4. Tolerance of dollar spot fungi to selected EBI fungicides based on EC50 and EC95 values.

	Approximate EC50 and EC95 (ppm a.i.)							
	Banner		Bayleton		Lynx		Rubigan	
	EC50	EC95	EC50	EC95	EC50	EC95	EC50	EC95
Rmr B1	.25	3-5	.4-.6	>25	.25	<5	.6-1	>25
Rmr B3	.30	10	.6-1	>25	.25	<5	.6-1	>25
SATD	.20	3-5	.1-.2	<5	NT	NT	.2-.3	2.5
Rmr R3	.05	1-2	.1-.2	<5	.15	<1	.2-.3	2.5
Srd 01	.05	1-2	.1-.2	<5	.1	<1	<.1	10

Key to isolates: Rmr B1,B3 (Ridgemoor CC, bent fairway)
 Rmr R3 (Ridgemoor CC, bluegrass rough)
 SATD (Shoreacres, bent fairway)
 Srd 01 (Sunset Ridge CC, bent fairway)

It is also interesting to note that benzimidazoles failed to control dollar spot at Ridgemoor in the mid to late 1970's, which was the primary motivation to switch to Bayleton and other EBI products for dollar spot control in fairways. Even though little if any benzimidazole products have been applied to Ridgemoor fairways since 1978, the EBI tolerant fairway isolates from 1991 remain resistant to fairly high concentrations of benomyl (Table 2). Apparently, benzimidazole resistance in dollar spot fungi is fairly stable and does not lead to reduced “fitness” of resistant populations.

Avoiding resistance/tolerance problems. Systemic fungicides are advantageous for us to use because of their (generally) low application rates and long-term control. Unfor-

(cont'd. page 10)

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(Fungicide Resistance cont'd.)

tunately, some of the systemic fungicides we use are single-site inhibitors, i.e. there is only one very specific site of action that confers toxicity to fungi. Therefore, only a single gene (point) mutation could alter the sensitivity to a single-site fungicide and allow a fungal population to develop resistance.

Repeated, exclusive use of a single-site fungicide places a large selection pressure on fungal populations for development of resistant or tolerant mutants. To avoid high selection pressure, the best practice (in my opinion) would be to alternate single-site fungicides with unrelated multi-site fungicides. Also, I would not use the single-site product more than once or twice per year. Examples of single-site fungicides are Subdue and the benzimidazoles (Tersan 1991, Fungo 50, Cleary 3336). Tolerance of fungi to ergosterol inhibitors, Dyrene, and Chipco 26019 has been reported for turf or other crops; these products may also be single-site inhibitors. Please note that not all systemic fungicides are single-site inhibitors, and not all contact fungicides are multi-site inhibitors.

Avoiding resistance is an often complex and controversial topic, and would probably be better addressed in more detail in another article.

Underground Storage Tank Regulations

by Steve Berning

Underground storage tanks (USTs) are regulated under subtitle C of the Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA) of 1984. The act imposes standards on all owners and operators of new and existing USTs containing petroleum and other regulated substances. The standards address tank design, construction, upgrading of existing tanks, operation and maintenance, spill and leak cleanup and closure.

What You Have to Do

It is not difficult to comply with the UST regulations. USTs of unknown age and those installed in 1979 and older, must be tested by December, 1992. The 1988 and prior USTs must be tested by December, 1993. These USTs must be tested **annually** thereafter to assure that they are not leaking. This is all you have to do with an outside contractor.

Tank levels should be measured with a stick and reconciled every month against usage records for each tank; look for discrepancies which may indicate a leak. In addition, you should supervise fuel delivery so as to assure that the quantity will fit in the UST space available.

What Kind of Contractor Do You Look For

As with any vendor, you should consider such things as experience, promptness, professionalism, and reputation. Don't hesitate to ask for and call references. You may also want to ask potential contractors about their operating philosophy and determine whether they support your industry association.

With regard specifically to USTs, contractors are required to register with the state, use certified equipment for tank testing,

(cont'd. page 12)

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