f. Water Dispersible Granule (WDG)
g. Soluble Concentrate (SC)
h. Oil Solutions
i. Soluble Pellets
j. Flowables (F)

2) Granulars (G)
3) Pesticide/Fertilizer Combinations
4) Baits (Insecticides only)

Depending on the target pest, product formulation can greatly affect the performance of a pesticide. For example, surface feeding insects such as sod webworms are foliage-feeding insects that consume turfgrass leaf tissue; thus, sprayable insecticide formulations typically perform better than granular formulations since the product adheres to the turf foliage that the insect ultimately eats.

Conversely, other turfgrass pests such as crabgrass are most effectively controlled preventatively with granular herbicide formulations. The granular herbicide merely creates a barrier that terminates germinating crabgrass seedlings. Specific sectors of the turfgrass industry also have vastly different product formulation needs. For example, the lawn care industry rarely has the luxury of required, immediate post-application irrigation following preventative white grub control treatments; thus they have an earnest need for an insecticide formulation that is not dependent on immediate application of water for effective control. Whereas a golf course superintendent frequently uses relatively low application rates (i.e., spray volumes often below 1 gallon per 1000 ft^2) and has a need for sprayable insecticide formulations that can be applied at relatively low spray volumes and yet provide effective control of the target pest.

Over the past decade, several new product formulations have been introduced to the turfgrass industry. These formulations have provided valuable attributes and characteristics that fulfill criteria demanded by turfgrass managers. Such formulations include granular formulations like Biodac (a paper-waste pulp that is dustless) and DG-Lite and - Pro (a combination of calcium carbonate and wood flour that is bound together with a water soluble binder that allows the granule to effectively disperse with nominal water) as well as sprayable formulations including water dispersible granules (WDG), dry flowables (DF), and water soluble packets (WSP). Be sure to consider the biology (i.e., life cycle, location, habits or behavior, vulnerable life stage, etc.) of the target pest when selecting the appropriate product formulation.

Synergistic Fungicide Combinations for Controlling Dollar Spot

By Steve Abler and Dr. Geunhwa Jung, *Turfgrass Diagnostic Lab, Department of Plant Pathology, University of Wisconsin-Madison*

While working as a graduate student at Virginia Tech in Dr. Houston Couch's turfgrass pathology laboratory, I was exposed to all aspects of turfgrass disease management. One of the most interesting aspects is the use of synergistic combinations of fungicides for enhanced disease control. A pioneer in the study of synergistic fungicide combinations for turfgrass diseases, Dr. Couch investigated the interaction of fungicides for the control of Sclerotinia dollar spot and Pythium blight. I will discuss synergy research and synergistic fungicide combinations for Sclerotinia dollar spot in this article.

What is Synergy?

Most golf course superintendents have probably heard of the term "synergy;" however many people are unsure how it is defined. When two fungicides are mixed, there will be either an interactive or independent reaction which is measured by the efficacy of the mixture compared to its individual components on the host plant. Interactive reactions between fungicides occur when one of the fungicides in the combination makes the pathogen more or less susceptible to the other fungicide in the combination. For independent reactions, neither of the fungicides in the combination affects the susceptibility of the pathogen to the other fungicide. The independent reaction (additive effect) and the interactive reactions (synergism and antagonism) were defined by Hatzios and Penner (1985), as follows:

Synergism	Cooperative action of two agrochemicals such that the observed response of a test organism to their join application appears to be greater than the response predicted to occur by an appropriate reference model.
Antagonism	A type of joint action of two agrochemicals such that the observed response of a test organism to their combined application appears to be less than the response predicted to occur by an appropriate reference model.
Additive Effect	Cooperative action of two agrochemicals such that the observed response of a test organism to their joint application is equal to the response predicted to occur by an appropriate reference model.

What is an "appropriate reference model?" The mathematical model used by Dr. Couch is one that was originally defined by Gowing (1960), which predicts the additive efficacy (E) of a combination of two herbicides given the efficacy of each of the components (X and Y) of the mixture.

$$E = X + [Y(100-X)]/100$$

How are Fungicides Tested for Synergy?

Fungicides that are candidates for synergy testing are those that are labeled for, and control the pathogen in question. Field plots are established in

which the low-label, one-half low-label, and one-fourth low-label rates of the candidate fungicide are included. All possible combinations of rates of a candidate fungicide are then combined with all of the rates of the additional candidate fungicides in the study. The mathematical model is then used to determine the expected additive control (E) of the mixture using the control data from the individual components (X and Y). If the actual control provided by the mixture is greater than the expected value derived using the model, then the mixture is classified as synergistic. If the actual level of control is less than the expected value, then the combination is classified as antagonistic. If the value is the same as the model, then the mixture is classified as additive. The mixtures that are classified as synergistic are then tested for three additional field seasons to confirm the initial findings and determine the optimum rate for each component of the mixture.

Synergistic Combinations for Dollar Spot

Out of 19 combinations of fungicides tested on dollar spot by Dr. Couch, 15 were additive and 4 were synergistic (Couch, 2002). The preventive and curative rates for each of the synergistic combinations are listed below. In the case of dollar spot, in order to achieve preventive control comparable to the low-label rate of either component by itself, one-half of the low label rate of Banner Maxx® and one-quarter the low-label for the other fungicide must be used.

Synergistic Fungicide Combinations for Control of Sclerotinia Dollar Spot

Preventive Rates*

Banner Maxx (14.3 FL) 0.25 oz fp + Bayleton (50 WP) 0.25 oz fp
Banner Maxx (14.3 FL) 0.25 oz fp + Chipco 26 GT (23.3 FL) 0.75 oz fp
Banner Maxx (14.3 FL) 0.25 oz fp + Curalan or Touche (50 EG) 0.25 oz fp
Banner Maxx (14.3 FL) 0.25 oz fp + Daconil Weatherstik (54 FL) 1.0 oz fp

Curative Rates*

Banner Maxx (14.3 FL) 0.5 oz fp + Bayleton (50 WP) 1.0 oz fp
Banner Maxx (14.3 FL) 0.5 oz fp + Chipco 26 GT (23.3 FL) 3.0 oz fp
Banner Maxx (14.3 FL) 0.5 oz fp + Curalan or Touche (50 EG) 1.0 oz fp
Banner Maxx (14.3 FL) 0.5 oz fp + Daconil Weatherstik (54 FL) 4.0 oz fp

*Rates listed are formulated product (fp)/1000 feet^2

Table adapted from Couch, 2002.

Advantages of Using Synergistic Combinations

The three main advantages to using synergistic fungicides to control dollar spot are that you will (1) reduce the amount of fungicide used, (2) minimize the risk of fungicide resistance, and (3) have enhanced curative efficacy when disease pressure is extreme (Couch, 1995).

The use of synergistic combinations at the fractional rates listed in the table will save a golf course superintendent money by reducing the total amount of fungicides that need to be purchased. Reducing the total amount of fungicides applied also minimizes the exposure of the fungicides to a superintendent, his/her staff, clientele, and the environment. Additionally, synergistic combinations result in comparable or better control with a week to ten days of increased longevity than either of the fungicides in the mixture at the low-label rate. This will save on labor expenditures by reducing the frequency of fungicide applications.

There have been reports of *Sclerotinia homoeocarpa* strains that are resistant to benzimidazole (thiophanate methyl), sterol inhibitor (propiconazole, triadimefon), and dicarboximide (iprodione) fungicides. With increasing examples of fungicide resistance and development of fungicides with single-site biochemical modes of action, strategies of resistance management cannot be emphasized enough. Samoucha and Gisi (1987) demonstrated that using synergistic mixes of fungicides greatly reduced the buildup of resistant strains of the pathogens that cause late blight of potato and tomato as well as downy mildew of grape. In fact, the Banner Maxx® and Bayleton® dollar spot synergistic mixture effectively controlled a strain of *Sclerotinia homoeocarpa* that was resistant to both fungicides and four additional demethy-

Ingersoll-Rand
Milwaukee

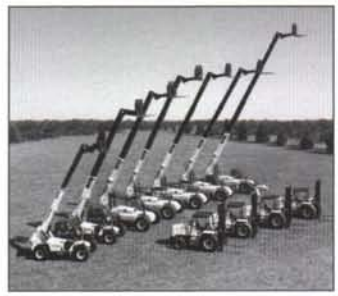
Meeting the Needs of Wisconsin's Construction Industries

Light Tower

SOLARTECH

Message & Arrow Boards

Soil & Asphalt Compactor



Forklifts:
Complete Inventory

Club Car Utility Vechicle with plow & cab

Generators from
G20 to G575

Air Compressors
up to 1600 CFM

Rentals • Sales • Parts • Service

- Soil and Asphalt Compactors
- Air Tools
- Hoist
- Generators
- Message & Arrow Boards
- Compressors
- Light Towers
- Rock Drills
- Fork Lifts
- Utility Vehicles

Club Car™
Performance Utility Vehicles

DIRECT™

On-Site Construction Equipment Service

Ingersoll Rand Equipment Service Company

1-800-338-5436

12311 W. Silver Spring Dr. • Milwaukee, WI 53225

www.irmil.com

lation inhibitor fungicides (Couch, 2003).

A final advantage to synergistic combinations for dollar spot control is the increased efficacy when using the curative rates. The curative rates are the low-label rates of each synergistic fungicide. When disease pressure is high, the curative rates of the fungicides will provide excellent knock-down control that will aid in recovery of the turfgrass. Subsequent applications can then be made at the preventive rates (Couch, 2002).

It should be stressed that although the synergistic combinations included in this article may work for other diseases, they have only been adequately tested for dollar spot. The use of these mixtures should be limited to instances in which dollar spot is the target disease. Applying fungicides at rates lower than those listed on the label should only be done when they have been proven to be synergistic in order to avoid the added potential for fungicide resistance.

We hope that we have answered some questions that you may have had regarding synergy. We believe that synergy is a valuable and relatively easy tool that superintendents can use to achieve exceptional disease control results while saving time and money. An important aspect of our job at the O.J. Noer Turfgrass Research Facility is to test standard and newly emerging fungicides for disease control efficacy so that superintendents have the tools they need to control diseases efficiently. Testing for possible synergistic combinations of fungicides is an effective technique for maximizing disease control with the limited number of fungicide chemistries available.

Literature Cited

Couch, H.B. 1995. Diseases of Turfgrasses, 3rd ed. Krieger, Melbourne, FL.

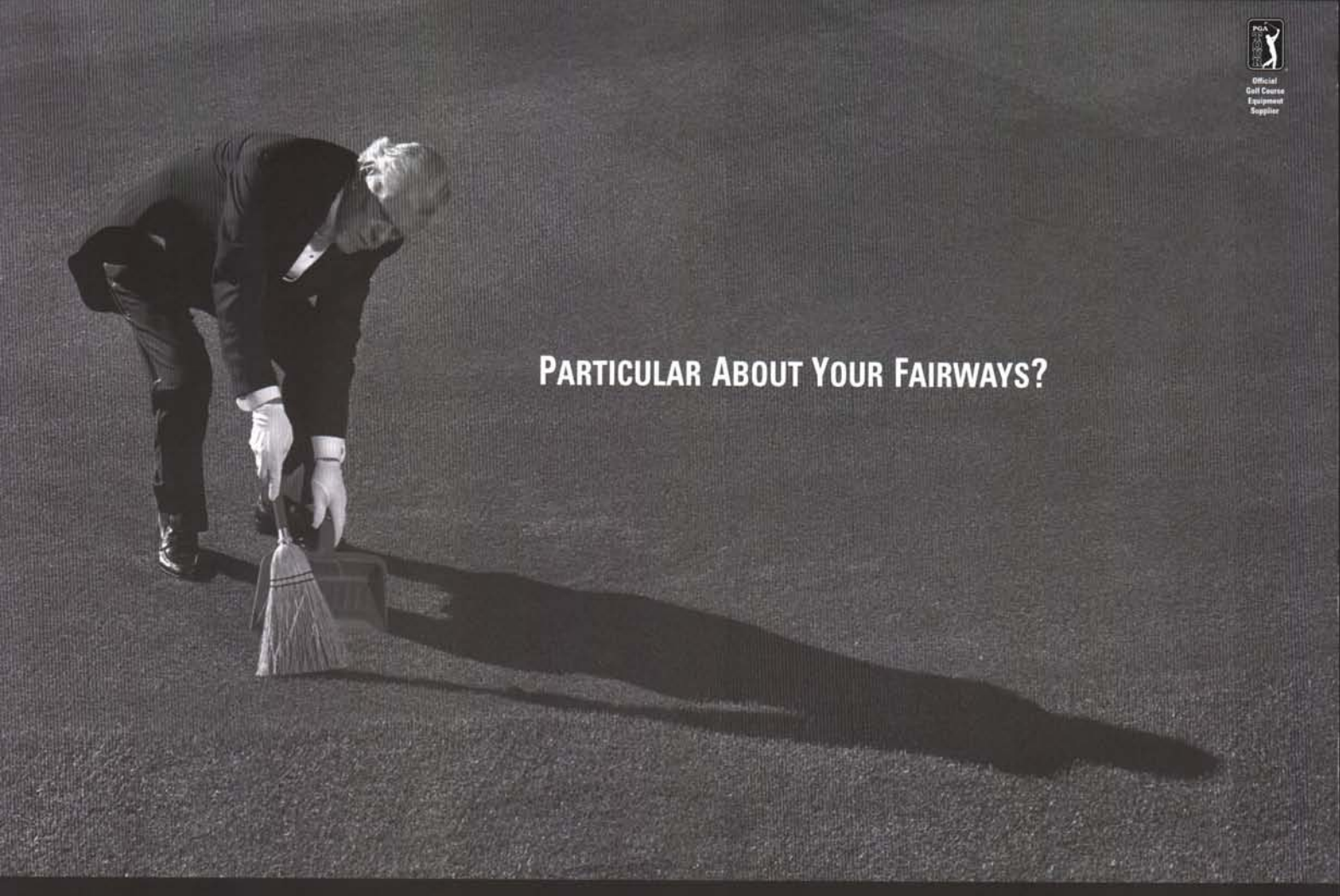
Couch, H.B. 2002. Better dollar spot control with less fungicide. Golf Course Management 70(11):89-93.

Couch, H.B. 2003. Strategies for preventing and managing fungicide resistance. Golf Course Management 71(5):111-115.

Hatzios, K.K., and Penner, D. 1985. Interactions of herbicides with other agrochemicals in higher plants. Reviews of Weed Science 1:1-63.

Gowing, D.P. 1960. Comments on tests of herbicide mixtures. Weeds 8:379-391.

Samoucha, Y., and Gisi, U. 1987. Use of two- and three-way mixtures to prevent buildupof resistance to phenylamide fungicides in *Phytophthora* and *Plasmopara*. Phytopathology 77:1405-1409.



OR DOWNRIGHT OBSESSIVE?

For those who think their fairways can never be too clean, we submit our B Series Lightweight Fairway Mowers and our Fairway Tender Conditioners (FTCs). Just by putting FTCs on our 3215B, 3235B, or 3225B, you'll discover what clean really means. Grass stands up for an even, clean cut and a true playing surface. And the rear roller power brush finishes the job up right by removing built-up material as well as dispersing any leftover clippings. You'll also find an improved yoke and ball joints for better grass collecting; and an electric fan drive for improved noise levels and engine cooling. Call your local John Deere Golf & Turf Distributor for a demonstration.

www.JohnDeere.com

J.W. TURF INC.
306 Washington Street
Horicon, WI 53032
920-485-2859
Toll Free Parts: 877-746-0614

JOHN DEERE

NOTHING RUNS LIKE A DEERE®

GT02Z406

Trempealeau Mountain G.C. Hosts April Meeting

By Mike Lyons, *Golf Course Superintendent, Old Hickory Country Club*

Superintendent Jeff Bahr hosted our first meeting of the new season on April 28th at Trempealeau Mountain Golf Club. With the wind blowing and a chill in the air, thirty-eight superintendents and affiliates enjoyed an educational session and golf. Jeff and his staff had the course in great condition and all their hard work was truly appreciated by everyone.

An enjoyable buffet was served before our guest speaker Elizabeth Scheef, a graduate student at UW-Madison. Elizabeth worked these past two seasons along with Dr. Jung identifying various types of *Typhula* spp., which is the causal pathogen of gray and speckled snow mold.

Over the past seasons Elizabeth has collected over 2,000 samples of *Typhula*. They extract DNA to identify the various species of *Typula*, mainly *T. incarnata*, *T. ishikariensis* and *T. phacorrhiza*. Also, along with identifying the various species they are able to map and identify where these species of *Typhula* are mainly found through out the state.

Some things that their research has shown is *T. incarnata* is found through out the state, *T. phacorrhiza* was also found through out the state but is very rare, and *T. ishikariensis* was mainly found north of the tension zone. They will continue to collect data and hope to find what effects temperature, snow cover length, fungicide applications have on these species.

On behalf of the WGCSA, thank you Elizabeth and Dr. Jung for taking time out of your busy schedules and for your continued research, which in the end helps us all.

Golf followed Elizabeth's presentation. The event was a four-man scramble.

The event winners were:

- 1st place went to the team of Kevin Norby, Dave Newinski and Terry Ward with a sizzling 61.
- 2nd place went to the team of Brent Peterson, Tim Chapman, Jeremy Amosson and Jeff Townley with a score of 62.
- Flag event winners for the day were Dennis Dary, Bruce Schweiger(2), Fred Anderson, Bob Speltz and Jeff Bahr.

Again, thank you Jeff, Bill Pearse and your staff for hosting this event. I think everyone knows how hard it is to get the course ready early in the year, let alone having a group of superintendents smacking it around. Great job and thank you.

USGA

Forever Spring?

By Bob Vavrek, *USGA Green Section Agronomist, North Central Region*

It's mid-June and courses across the north-central tier of states have only seen a day or two over 80 degrees. Nighttime temperatures seem to have stabilized in the mid to upper 40's with a few early June frosts thrown in for good measure. For every sunny warm day, there followed a week of cool, cloudy weather. Not exactly what the doctor ordered, if you were hoping for early warm weather to accelerate recovery from winter desiccation injury.

You would be hard pressed to find a course completely unaffected by some form of winterkill. Turf in elevated exposed sites suffered the most. Many tees and bunker banks renovated with sod last October and November needed to be re-sodded this spring. The history of the weak, thin turf seen on courses this spring often dates back to the losses of *Poa annua* that happened during the hot, stressful weather last summer. Turf died, never recovered before winter, and then was further damaged by prolonged periods of frigid temperatures and little, if any, snow cover. How cold was it? Cemetery workers in northern Minnesota reported 7 to 8 feet of frost in ground by late winter.

Localized areas of the Region experienced severe crown hydration winterkill to *Poa annua* following an early April ice storm that also damaged many trees. True to form, the injury occurred in the poorly drained, low areas on greens and fairways where water tends to puddle after rain or when snow and ice melts.

In general, greens that were aerated late last fall experienced more severe winterkill than greens aerated during early September. In fact, if you used large diameter tines last October, there are probably still partially open holes in greens even if the extra effort was made to completely fill the holes with topdressing. There is a

school of thought that coring greens late in the season and leaving the holes fully open over the winter will give water from melting ice or snow a place to go and, in effect, minimize the potential for crown hydration injury. Maybe so...maybe not; however, you might be held back a year if you attended that school last fall.

At a number of courses, more damage was seen along the spray overlaps where last November's fungicide applications were made, especially where PCNB was used. When the weather is extremely uncooperative, it seems like every turf management decision made on the course ends up making the problem worse.

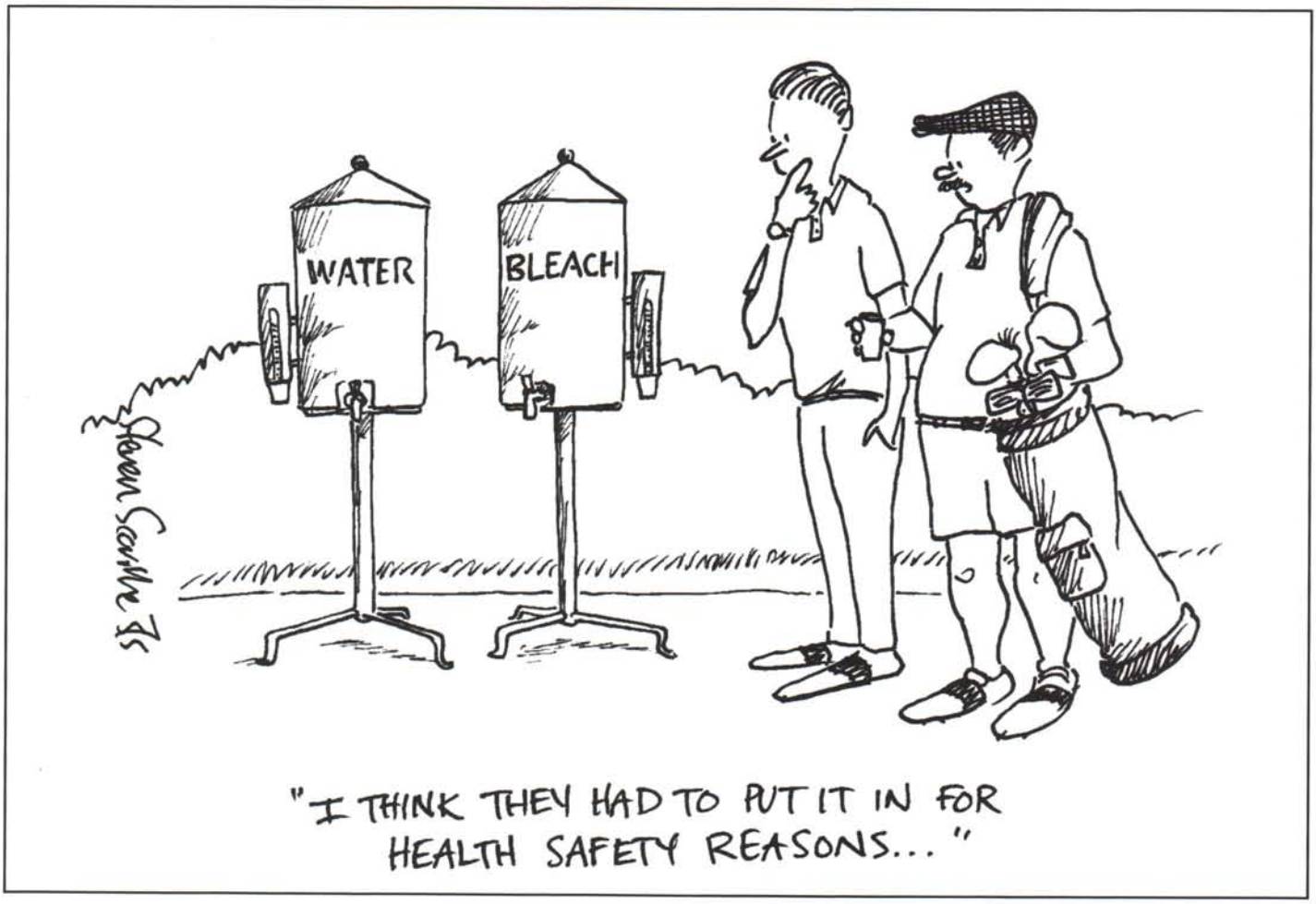
No shortage of weeds in fairways and roughs either. Turf growing at a snail's pace has little ability to compete with clover or dandelions. The effects of herbicide applications have been inconsistent due to the inability of the weeds to absorb a lethal dose of herbicide.

If there is a silver lining in the dark cloud of unfavorable weather it may be the effect on green speed. You know greens are really fast during late May when five or six greens can be mowed before baskets need to be emptied.

Unfortunately, a considerable amount of nitrogen has already been applied to turf in hope of encouraging some growth and recovery. Who knows what kind of growth surge will occur when hot, humid weather finally arrives? The effect of the cool weather on *Poa annua* seedhead development is unclear as well. Many superintendents claim excellent control from a variety of chemical suppression techniques. But has the real flush of seedhead development even occurred yet? The speed golfers enjoy now may be difficult to maintain once temperatures reach the mid-to-upper 80's.

On a positive note, some courses will return to a more sensible schedule of core cultivation this fall. The schedule of late-season events will be modified to accommodate early September aeration operations. The goal of late summer aeration being to provide ample time for open holes to heal over completely before winter.

Perhaps we will be lucky and still experience some transition period before hot, stressful weather arrives. Last summer it seemed like treatments for pink snow mold outbreaks were applied one week and the following week applications were made to prevent Pythium blight. A week or two of temperatures in the low 80's with a warm rain to get the turf moving would definitely make many people happy.



The Transition Zone

By Pat Norton, *Golf Course Superintendent, Nettle Creek Country Club*

Let's talk about the transition zone, shall we? Normally, the transition zone refers to that area of latitude in which it's damn difficult to grow grass...and damn difficult to understand the thinking of those who pursue a career there!

Today though, we're talking about a different type of transition zone. The veteran types amongst the readership will understand instantly that this transition zone refers to that period of time in which the high school senior son or daughter drags himself or herself to the graduation finish line...due to an extremely severe case of senioritis...and begins the transition into a responsible, self-motivated, independent, educationally oriented and driven college student. If only it were that simple.

Remember Mom and Dad...you were also once totally unmotivated, lazy, insolent, and possive of superior 18 year old intelligence...in your day. Your parents undoubtedly had the same problems with you as you now experience with your talented, but somewhat slow to motivate oldest child. I distinctly remember rebelling against my parents in various small ways back in the day...with varying degrees of consequences.

So, do not overreact! As a parent, understanding and compassion of the senioritis thing is totally normal and expected. Do not get too harsh during this time...because young adults need their time...and their space! Do not do to yours as your parents did to you! Let them insult, ignore, and be at times ill-behaved! It's all part of the transition into well-mannered adults...sort of the ugly duckling transforming into the beautiful swan.

The senioritis is cured and the