Building disease control programs on annual bluegrass greens in the mid-Atlantic region

Advance planning can reduce disease and lead to healthier greens.

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Annual bluegrass (*Poa annua*), which is found on golf greens all over the world, can make a good putting surface if properly maintained. However, adverse weather conditions, seedhead production, diseases, insects and the demand for fast greens make maintaining annual bluegrass greens in the mid-Atlantic region of the United States a challenging task. The good news is that a vast amount of information and research is available to superintendents. Developing a game plan for annual bluegrass survival is vital. The objective of the solutions approach to *P. annua* survival is to get the cultural and chemical practices right. This paper discusses the development of a disease control program for annual bluegrass greens in the mid-Atlantic region of the United States.

Cultural practices

Cultural practices are critical for a successful disease control program. Understanding the characteristics of annual bluegrass and the management practices necessary to maintain this species is critical for reducing disease severity. Reducing disease severity allows fungicides to perform better, and the result is healthier turfgrass.

Annual bluegrass

Although most golf greens in the mid-Atlantic region contain both annual bluegrass and creeping bentgrass (*Agrostis stolonifera*), annual bluegrass is the primary turfgrass species to consider when developing a disease control program.

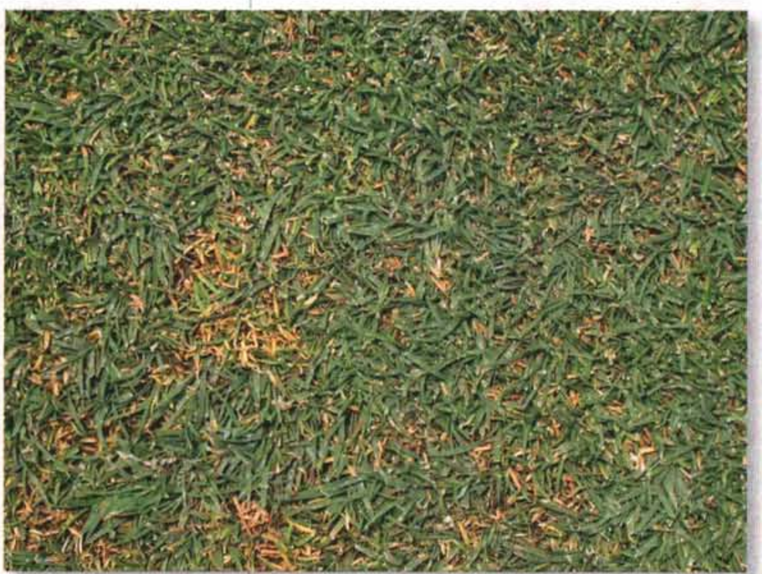
Annual bluegrass has two primary subspecies: an annual biotype (*P. annua* var. *annua*) and a perennial biotype (*P. annua* var. *reptans*) (6). Although the annual biotype is considered a winter annual weed in some areas of the country, it is a desirable turfgrass species in the mid-Atlantic region. The main advantage of the perennial biotype is its low seedhead production. It is not uncommon to have both the annual and perennial biotypes on the same green. Although perennial biotypes are more desirable, both subspecies are susceptible to infection by diseases.

For a detailed discussion of annual bluegrass as a species, see the book "*Poa annua* — Physiology, culture and control of annual bluegrass" by J.M. Vargas and A.J. Turgeon (6).

Management practices

Mowing, fertilization and seedhead control are three important factors that directly influence the development of several diseases on an annual bluegrass green.

Mowing is a necessary physical stress on any turfgrass plant, but its effects on disease development can be enormous (3,6). Recent research conducted at Rutgers University has demonstrated that increasing mowing height by 0.016 inch (0.4 millimeter) from 0.110 to 0.125 inch (2.8 to 3.2 millimeters) or from 0.125 to 0.14 inch (3.2 to 3.6 millimeters) resulted in a meaningful decrease in anthracnose on annual bluegrass greens (3). Earlier research at the University of Maryland demonstrated that reducing mowing height significantly increases summer patch in Kentucky bluegrass



Basal rot anthracnose (*Colletotrichum cereale*). **Photo by S. McDonald**

(2). Maintaining a slightly higher mowing height can help reduce disease during periods of environmental stress.

Maintaining optimal levels of nitrogen to uphold the vigor of any turfgrass plant is key to the control of many turfgrass diseases (1-6). Nitrogen levels of 2 to 3 pounds/1,000 square feet (9.8 to 14.6 grams/square meter) during the warm months and 4 to 6 pounds/1,000 square feet (19.5 to 29.2 grams/hectare) for the year have been suggested as optimal for annual bluegrass growth (6). Some researchers have found that a frequent low-rate nitrogen application (for example, 0.1 pound nitrogen/1,000 square feet/week) from late spring through summer was necessary to reduce anthracnose severity on annual bluegrass greens (3).

To maintain a good playing surface, many golf courses treat annual bluegrass greens with plant growth regulators to prevent the formation of seedheads. Seedhead production shifts spring growth from roots to shoots (6). Controlling seedheads allows the plant to channel its energy to root production. Some growth regulators that control seedheads may cause injury, which results in discoloration and can cause a temporary increase in anthracnose (3). However, if growth regulator applications for seedhead control are immediately followed by regular applications of Primo MAXX (trinexapac-ethyl, Syngenta) every one to two weeks, the amount of anthracnose is significantly decreased.

Other cultural practices such as irrigation, topdressing, cultivation, rolling and the use of herbicides can influence disease control in annual bluegrass (3,4,6). The degree to which they influence disease development depends largely on the specific pathogen and will not be discussed in this paper.

Mid-Atlantic region

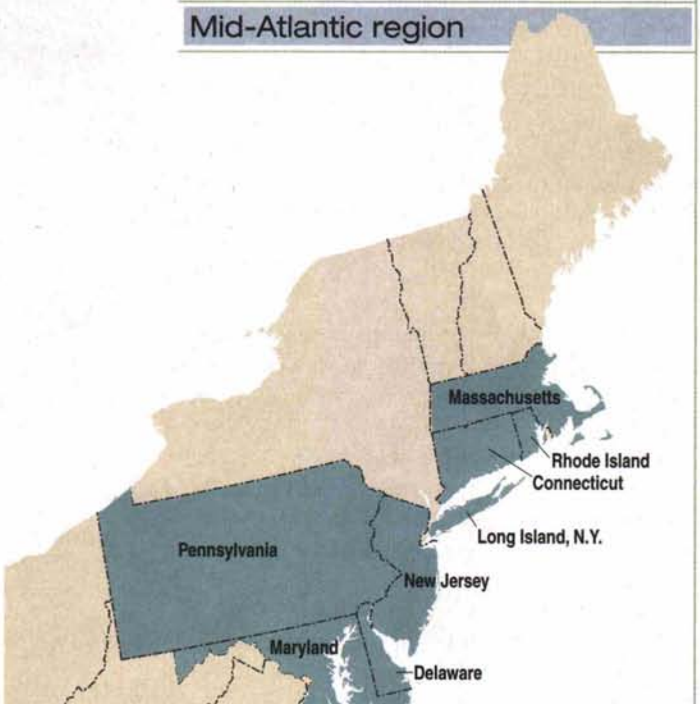


Illustration by Kelly Neis

Many courses in the mid-Atlantic states have annual bluegrass-creeping bentgrass greens.

Mapping out a fungicide program

A useful method for developing a spray program is to map it out on paper. The process involves a basic understanding of the targeted pathogens damaging annual bluegrass and the fungicides controlling those pathogens. The process of mapping the potential times for disease pressure can be done by drawing a row of 12 boxes, one for each month of the year, and labeling them by month (Figure 1). Do this for each of the targeted diseases.

Occurrence of pathogens

Many plant diseases infect annual bluegrass. In the mid-Atlantic region, the five most common diseases are basal rot anthracnose, summer patch, dollar spot, brown patch and pythium blight. The key to building a sound disease control program starts with determining when each disease is likely to attack the plant. Knowledge of the conditions under which a pathogen infects plant tissue is also critical.

Basal rot anthracnose. Basal rot anthracnose (*Colletotrichum cereale*) has fast become the No. 1 disease of annual bluegrass greens in the mid-Atlantic region. Although it is most destructive during warm weather, it can occur at almost any time of the year (4). Basal rot anthracnose can first appear during the winter or spring. Often, the early occurrence of this disease is caused by residual infected plant material from the preceding season. Therefore, it is important to make a preventive fungicide application in late fall to help protect susceptible plants the following spring. As temperatures warm up and increased physical stress is placed on the green, the potential for infection is greater. It is generally considered best to begin a preventive disease control program before annual bluegrass seedhead production, whether or not seedheads are chemically controlled.

Summer patch. Summer patch (*Magnaporthe poae*) is another important disease that can destroy annual bluegrass greens. Root infection is initiated when soil temperatures are consistently between 65 F (18 C) and 70 F (21 C), with optimal disease development occurring between 82 F (28 C) and 85 F (29 C) (4). The fungus will spread to adjacent plants by growing along the roots. Preventive disease control applications need to be initiated before the pathogen colonizes and suppresses root growth.

Dollar spot. Dollar spot (*Sclerotinia homoeocarpa*) infections are favored by temperatures between 59 F (15 C) and 86 F (30 C), extended periods of leaf wetness or continuous high humidity. Warm days, cool nights and intense dews particularly favor this disease. This fungus can be active from spring through early winter. Because late-season dollar spot can persist into spring, control in the fall is important.

Brown patch. Optimal conditions for brown patch (*Rhizoctonia solani*) include high relative humidity and temperatures higher than 85 F (29 C) during the day and 60 F (16 C) at night. It also occurs in areas that experience more than 10 hours a day of foliar wetness for several consecutive days.

Summer patch (*Magnaporthe poae*). **Photos by J. Kaminski**

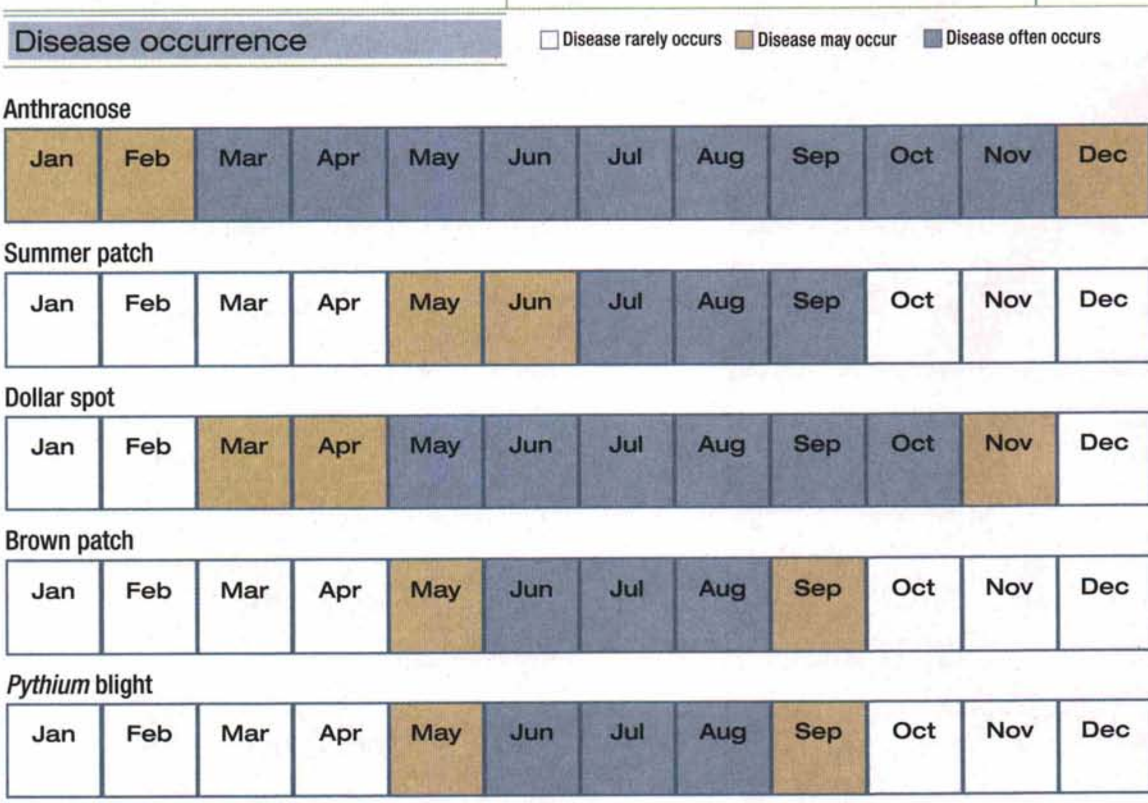


Figure 1. Mapping out when a particular disease is most likely to occur is one of the first steps in developing a fungicide spray program.

Pythium blight (*Pythium* species) on annual bluegrass.

Pythium blight. Pythium blight (*Pythium* species) appears suddenly during hot, humid weather. It is common in turf areas that stay wet and in drainage patterns. Pythium blight prefers night temperatures higher than 68 F (20 C). It occurs in areas that experience more than 10 hours a day of foliar wetness for several consecutive days.

The mapping process

The occurrence of these five diseases is represented in Figure 1. Each month is color-coded by disease activity for easy comparison. A month is color-coded white if the disease is rarely active, beige if the disease is sometimes active (three years out of 10), or blue if the disease is active in most years. Color coding allows the superintendent to visualize an overview of potential disease problems and to select fungicides that can provide protection for multiple diseases. Historical data are very useful and often the best guide. Tools exist to help predict these infection times. Syngenta has created a series of 30-year averages for key diseases across different regions of the country (www.greencastonline.com/index.aspx). This information is quite useful and makes a good starting point.

The last step is to place a square in the month where you plan to make a fungicide application to control the particular disease as shown in Figure 2. This color-coded calendar is an excellent reference to further develop a spray program.

Selecting fungicides

Selecting the proper fungicides for the spray program should be based on the fungicide chemical class and the target disease (Figure 3). Look

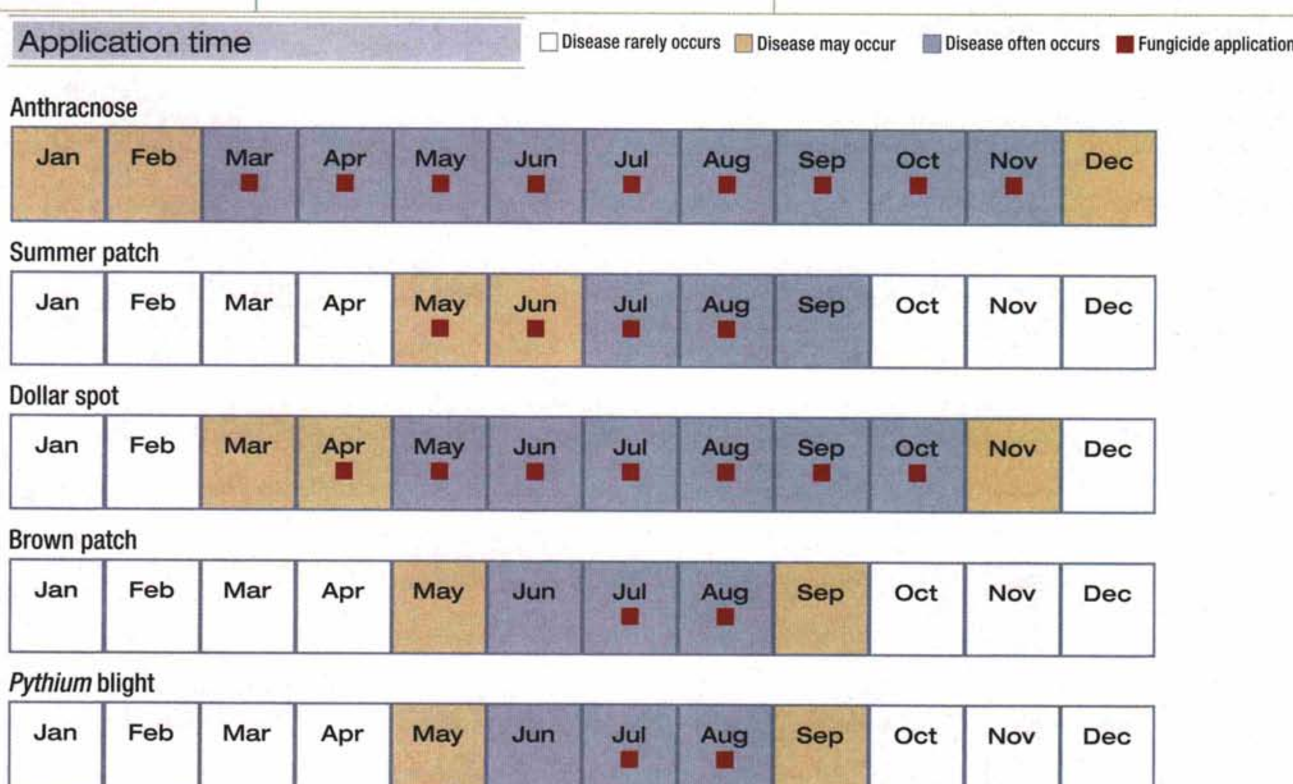


Figure 2. Mapping out the time of preventive fungicide application. A square is placed in the box that corresponds to the month in which the superintendent plans to make a fungicide application.

for fungicides that can control more than one disease, as this increases the efficiency of the fungicide application. For example, Heritage (azoxystrobin, Syngenta), Daconil Ultrex (chlorothalonil, Syngenta) and Medallion (fludioxonil, Syngenta) all provide excellent control of brown patch, while at the same time giving excellent control of anthracnose. Q_0I fungicides such as Heritage also are excellent fungicides for the control of summer patch, thus controlling three diseases with one fungicide application. Other fungicides such as the DMIs (for example, Banner MAXX [propiconazole, Syngenta]), and the benzimidazoles (for example, Cleary's 3336 [thiophanate methyl, Cleary Chemical]) are very good rotational partners for the control of dollar spot, while giving good control of anthracnose.

Before finalizing a disease control program on paper, it is important to consider the EPA maximum-use limits assigned to each active ingredient (ai). These limits are listed on the fungicide labels. Fungicide examples with EPA limits that are easy to exceed are chlorothalonil (for example, Daconil) and fludioxonil (for example, Medallion). The maximum amount of chlorothalonil that can be applied on greens is 72 pounds ai/acre/year (80.7 kilograms/hectare/year) with a maximum application rate of 7.3 pounds ai/acre (8.2 kilograms/hectare) when applied at seven- to 14-day intervals. The maximum amount of fludioxonil that can be used on greens is 2 pounds ai/acre/year (2.2 kilograms/hectare/year), and the maximum application rate is 0.7 pound ai/acre (784.6 grams/hectare) when applied at seven- to 14-day intervals. Therefore, it is important to strategically place these two active ingredients in the fungicide program before adding other fungicides. This will help avoid exceeding the limits.

Labels are usually updated every year. Reviewing each label before placing a fungicide in the spray program is very important.

The fungicide program

The first step in developing the actual greens spray program is to select fungicides that control anthracnose and summer patch. For anthracnose, fungicide applications should not exceed a 14-day interval; it has already been determined that fungicide applications should start in April and extend all the way to October (Figure 2). Because anthracnose is the primary target, select as many fungicides as possible that have activity against this disease and others. Research conducted at Rutgers showed that tank-mixing and rotating

Turf fungicides

Brown patch

Q_0I – 11
Heritage
Insignia
Compass

Benzimidazole – 1
Cleary 3336

Dicarboximide – 2
Chipco 26GT
Curalan

Phenylpyrrole – 12
Medallion

Nitriles – M
Daconil Ultrex

Polyoxins – 19
Endorse

Anthracnose

Demethylation inhibitors – 3
Banner MAXX
Bayleton*
Eagle*

Q_0I – 11
Heritage
Insignia
Compass

Benzimidazole – 1
Cleary 3336

Dicarboximide – 2
Chipco 26GT*

Phenylpyrrole – 12
Medallion

Nitriles – M
Daconil Ultrex

Phosphonates – 33
Signature*

Polyoxins – 19
Endorse
*partial control

Summer patch

Demethylation inhibitors – 3
Banner MAXX
Bayleton
Eagle

Q_0I – 11
Heritage
Insignia

Benzimidazole – 1
Cleary 3336

Dollar spot

Demethylation inhibitors – 3
Banner MAXX
Bayleton
Eagle

Benzimidazole – 1
Cleary 3336

Dicarboximide – 2
Chipco 26GT
Curalan

Carboximides – 7
Emerald

Nitriles – M
Daconil Ultrex

Pythium blight

Q_0I – 11
Heritage
Insignia

Phenylamides – 4
Subdue MAXX

Carbamates – 28
Banol

Phosphonates – 33
Signature

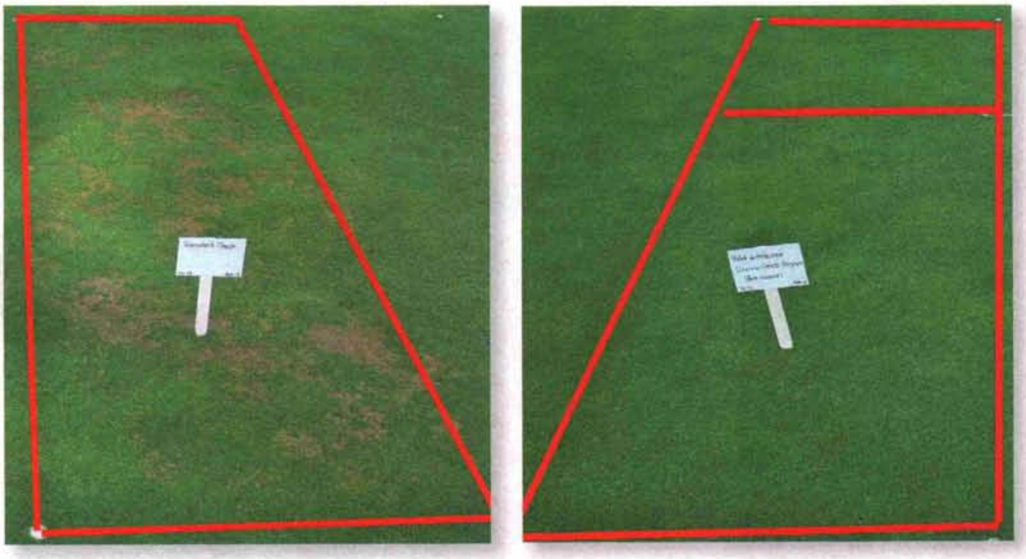
Figure 3. Fungicides that could be used in a spray program for annual bluegrass greens, listed by resistance group for each disease. The number or letter following the name of each group (for example, Q_0I–11) is the code assigned by the Fungicide Resistance Action Committee (FRAC), which classifies fungicides according to mode of action, collective and chemical group names and active ingredient common names.

Fungicide program

Application	Timing	Fungicide/PGR	Rate/1,000 ft²	Target pathogen*
1	Mar. 31	Banner MAXX	2 fl. oz.	A, DS
		Primo MAXX	0.125 fl. oz.	A[†]
2	Apr. 14	Banner MAXX	1 oz.	A, DS
		Daconil Ultrex	3.2 oz.	A, DS
		Primo MAXX	0.125 fl. oz.	
3	Apr. 28	Chipco 26GT	2 oz.	A, DS
		Signature	4 oz.	A
		Medallion	0.25 oz.	A
		Primo MAXX	0.125 fl. oz.	
4	May 12	Heritage	0.4 oz.	A, SP
		Banner MAXX	1.0 oz.	A, DS
		Daconil Ultrex	3.2 oz.	A, DS
		Primo MAXX	0.125 fl. oz	
5	May 26	Cleary's 3336	4 fl. oz.	A, DS
		Signature	4 oz.	A
		Primo MAXX	0.125 fl. oz.	
6	June 9	Heritage	0.4 oz.	A, SP, BP
		Banner MAXX	1.0 oz.	A, DS
		Daconil Ultrex	3.2 oz.	A, DS, BP
		Primo MAXX	0.125 fl. oz.	
7	June 23	Chipco 26GT	2 oz.	A, DS
		Signature	4 oz.	A, PB
		Endorse	4 oz.	A, BP
		Primo MAXX	0.125 fl. oz.	
8	July 7	Heritage	0.4 oz.	A, BP, SP
		Medallion	0.25 oz.	A, BP
		Subdue MAXX	0.5 fl. oz.	PB
		Daconil Ultrex	3.2 oz.	A, BP, DS
		Primo MAXX	0.125 fl. oz.	
9	July 21	Daconil Ultrex	3.2 oz.	A, DS, BP
		Signature	4 oz.	A, PB
		Endorse	4 oz.	A, BP
		Primo MAXX	0.125 fl. oz.	
10	Aug. 4	Cleary's 3336	4 fl. oz.	A, DS, SP
		Daconil Ultrex	3.2 oz.	A, BP, DS
		Banol	1.3 fl. oz.	PB
		Primo MAXX	0.125 fl. oz.	
11	Aug. 18	Banner MAXX	1.0 oz.	A, DS
		Signature	4 oz.	A, PB
		Daconil Ultrex	3.2 oz.	A, DS, BP
		Primo MAXX	0.125 fl. oz.	
12	Sept. 1	Banner MAXX	1.0 fl. oz.	A, DS
		Medallion	0.25 oz.	A
		Primo MAXX	0.125 fl. oz.	
13	Sept. 15	Chipco 26GT	2 oz.	A, DS
		Signature	4 oz.	A
		Daconil Ultrex	3.2 oz.	A, DS
		Primo MAXX	0.125 fl. oz.	
14	Sept. 29	Banner MAXX	1.0 fl. oz.	A, DS
		Medallion	0.25 oz.	A
		Primo MAXX	0.125 fl. oz.	
15	Oct. 13	Daconil Ultrex	3.2 oz.	A, DS
		Signature	4 oz.	A
		Primo MAXX	0.125 fl. oz.	
16	Oct. 27	Banner MAXX	2.0 fl. oz.	A, DS
		Medallion	0.5 oz.	A and winter protection

*Target pathogens: dollar spot, DS; anthracnose, A; brown patch, BP; pythium blight, PB; summer patch, SP.
†Research has demonstrated that frequent applications of Primo MAXX will lower anthracnose and summer patch pressure.
Metric equivalents (per square meter): 0.25 oz. = 0.076 gram; 0.4 oz. = 0.12 gram; 1 oz. = 0.31 gram; 2 oz. = 0.61 gram; 3.2 oz. = 0.98 gram; 4 oz. = 1.22 grams; 0.125 fl. oz. = 0.039 milliliter; 0.5 fl. oz. = 0.159 milliliter; 1 fl. oz. = 0.318 milliliter; 1.3 fl. oz. = 0.413 milliliter; 2 fl. oz. = 0.637 milliliter; 4 fl. oz. = 1.273 milliliters.

Table 1. Fungicide spray program for annual bluegrass.



An anthracnose trial on a golf course in upper New Jersey in 2002. **Left:** An untreated plot with anthracnose infection. **Right:** A plot treated according to a USGA disease control program.
Photos by M. Agnew

fungicides results in optimal disease control.

The disease code is placed to the right of each fungicide (Table 1) to allow the comparison of the actual fungicide program to the map previously built in order to avoid mistakes. Obvious omissions should be apparent.

Every spray program should be evaluated at the end of the season. If a disease outbreak occurred during the season, the superintendent should review previous management practices, fungicide applications and weather conditions. If fungicide resistance is suspected, the superintendent should send samples of infested turf to a reputable disease diagnostic lab and request that the causal agent be screened for potential resistance to the fungicide in question. This should help the superintendent when he or she revises the fungicide program for the following year. Building a sound game plan for the next season should always start with the review of the preceding season. This helps to reduce future problems.

Disclaimer

The fungicide program listed in Table 1 and discussed in the text is an example developed by the author, a Syngenta employee, who based many of his recommendations on the work of university researchers. The products in the program provide high levels of protection, and the products are rotated to lessen the possibility of the development of resistance and to ensure turf protection. An effort was made to choose products that work best for multiple diseases. *GCM* is publishing this table as an example of a program for controlling disease on *Poa annua*/creeping bentgrass greens in the mid-Atlantic states. Other products from other manufacturers can be used in developing an effective disease control plan. This plan has no direct reference to any particular golf course in the mid-Atlantic region. Each golf course is different, and no program is perfect for all.

Acknowledgments

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The research says

→ A disease control program for annual bluegrass greens in the mid-Atlantic states was used to demonstrate the process of developing a disease control program.

→ Understanding the characteristics of the grass and the management practices needed for maintaining the species is critical for reducing disease severity.

→ Determine which diseases are most common and when they are likely to attack the grass.

→ For each disease, map its likely occurrence time in a series of 12 boxes representing each month of the year.

→ Select the appropriate fungicides for the program, using products that control more than one disease.

→ Evaluate the program at the end of the season.