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Optimizing Fungicide Applications for Turfgrass Diseases

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Introduction

One of the primary management tactics for disease suppression in turfgrass systems is application of fungicides. Fungicides are, by definition, products that kill (cide) fungi, yet most of the products that we call "fungicides" are technically fungistats, or products that temporarily inhibit fungal growth. Fungicides include a diverse array of chemistries that vary in physical and chemical properties, efficacy, modes of action, and more. These chemistries should not be relied upon solely for disease control; they should be incorporated into an integrated management program and leveraged to optimize disease management in amenity turfgrasses. This article will describe four key principles to follow when using fungicides in turfgrass systems: 1) correctly identify the target disease(s), 2) select the right product, 3) apply at the correct time, and 4) choose the optimal application method.

Correctly Identify the Target Disease(s)

The first and most critical step in optimizing fungicide applications for turfgrass diseases is to properly identify the target disease(s). How can you expect acceptable disease control if you do not know what you are treating for? It is paramount to correctly identify the culprit. Proper identification can be achieved by a few methods. Experience, and an understanding of which diseases threaten the turf and when pathogens are active are important in disease identification. If there is uncertainty, the most prudent approach is to submit a sample to a reputable turf disease diagnostic lab. Non-infectious problems are often confused with disease symptoms. Dr. Jim Kerns and Lee Butler at North Carolina State University have shared data year after year from their diagnostic lab showing that the plurality, and sometimes majority, of the samples they receive are not disease-ridden. This means that some other biotic (e.g., insect damage) or abiotic (e.g., nutrient imbalance, excessive salinity, herbicide injury, etc.) stressor is the culprit.

Preventative fungicide applications are superior to curative fungicide applications for many reasons (Latin, 2021). Namely, managing turfgrass diseases curatively allows pathogen populations to build up to astronomically high levels, which leads to increased fungicide resistance risk, reduced fungicide performance, and a higher likelihood of large-scale disease outbreaks. Additionally, curative fungicide applications require substantial turfgrass recovery time; even if the pathogen population is suppressed, the damaged turfgrass must still heal and recover from the disease symptoms, which often takes days, weeks, or months.

From a preventive approach, it is crucial to identify which diseases may occur, rather than waiting until after a disease occurs to intervene with a fungicide application. Information on which diseases may occur at a given facility can be obtained by knowing which diseases are prominent in your area and climate; it is also important to be aware of which diseases occur on the turfgrass species grown at your facility. For example, turfgrass managers in Seattle would not worry about the disease spring dead spot (*Ophiosphaerella* spp.) – they would be far more concerned about Microdochium patch/pink snow mold (*Microdochium nivale*). This is because spring dead spot is a disease of warm-season turfgrasses, primarily in the transition zone, whereas Microdochium patch is a disease of cool-season turfgrasses in moist, cool climates. Therefore, turf managers in Seattle, WA can confidently exclude

Fungicide	Group Name	FRAC Code	Phytomobility
thiophanate-methyl	Benzimidazole	1	acropetal penetrant
iprodione	Dicarboximide	2	local penetrant
flutriafol	DMI	3	acropetal penetrant
mefentrifluconazole	DMI	3	acropetal penetrant
metconazole	DMI	3	acropetal penetrant
myclobutanil	DMI	3	acropetal penetrant
propiconazole	DMI	3	acropetal penetrant
prothioconazole	DMI	3	acropetal penetrant
tebuconazole	DMI	3	acropetal penetrant
triadimefon	DMI	3	acropetal penetrant
triticonazole	DMI	3	acropetal penetrant
mefenoxam	Phenylamide	4	acropetal penetrant
boscalid	SDHI	7	acropetal penetrant
cyclobutrifluram	SDHI	7	acropetal penetrant
fluopyram	SDHI	7	acropetal penetrant
flutolanil	SDHI	7	acropetal penetrant
fluxapyroxad	SDHI	7	acropetal penetrant
isofetamid	SDHI	7	local penetrant
penthiopyrad	SDHI	7	acropetal penetrant
pydiflumetofen	SDHI	7	acropetal penetrant
azoxystrobin	QoI	11	acropetal penetrant
fluoxastrobin	QoI	11	acropetal penetrant
mandestrobin	QoI	11	acropetal penetrant
pyraclostrobin	QoI	11	local penetrant
trifloxystrobin	QoI	11	local penetrant
fludioxonil	Phenylpyrrole	12	local penetrant
etridiazole	Heteroaramotic	14	contact
polyoxin D	Polyoxin	19	local penetrant
cyazofamid	QiI	21	local penetrant
propamocarb	Carbamate	28	acropetal penetrant
fluazinam	2,6-dinitro-aniline	29	contact
phosphites	Phosphonate	33	truly systemic
fluopicolide	Benzamides	43	local penetrant
mancozeb	Dithiocarbamate	M3	contact
thiram	Dithiocarbamate	M3	contact
chlorothalonil	Benzonitrile	M5	contact
picarbutrazox	Tetrazolyoxime	U17	local penetrant

Table 1. Thirty-seven active ingredients registered as standalone fungicides for turf markets are listed according to fungicide group name, FRAC code, and phytomobility.

fungicide applications for spring dead spot from their fungicide programs and confidently include fungicide applications for Microdochium patch.

Although preventive fungicide applications are recommended, a disease may occasionally manifest unexpectedly, warranting curative measures. Sometimes the disease is easy to identify, but most of the time it is not so easy. In these cases, a correct diagnosis is critical. The best way to obtain an accurate diagnosis is to send a sample to a qualified diagnostician. Sample preparation and shipping instructions are available in this article.

Correctly identify the target disease(s) for improved fungicide performance.

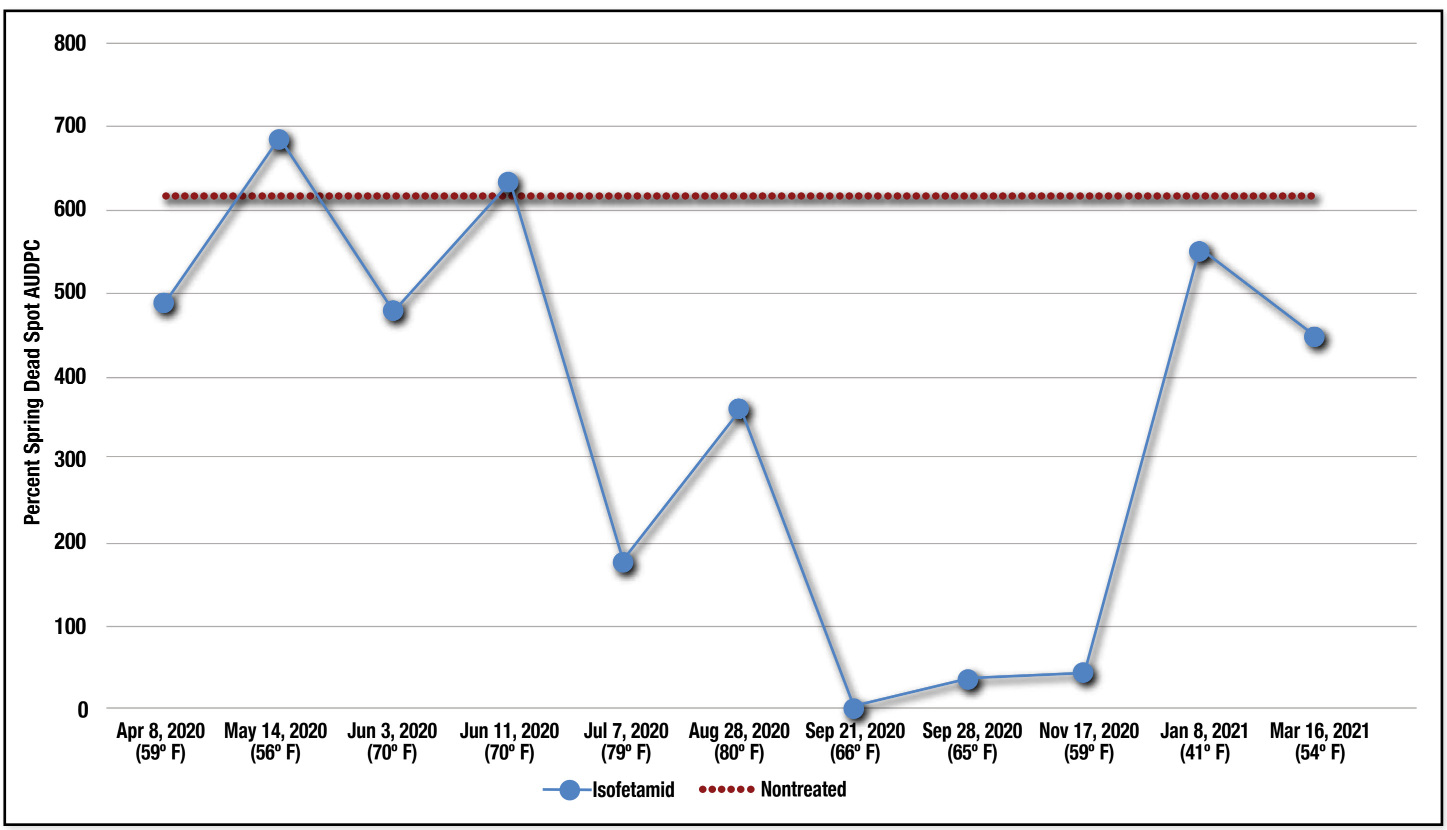
Select the Right Product

Not all fungicides provide similar efficacy. A wide range of efficacies exists amongst fungicides across many turfgrass diseases. There is often even variation of efficacy within specific fungicide groups, depending on the disease. Currently, more than 15 fungicide groups are available on the turfgrass market (Table 1), with the demethylation inhibitors (DMIs, Group 3), succinate dehydrogenase inhibitors (SDHIs, Group 7), and quinone outside inhibitors (QoIs, Group 11) being some of the most common (Clarke et al., 2024; Latin, 2021). Many fungicide groups also include multiple different fungicides. Needless to say, there are lots of fungicide options for turfgrass managers to choose from.

How does one decide which fungicide is best out of all the options? The starting point in the decision-making process should be to access reliable Extension materials and recommendations developed by turfgrass researchers. One such resource is the free publication titled "*Chemical Control of Turfgrass Diseases*," regularly updated by researchers across the U.S. (Clarke et al., 2024). The publication provides estimates of relative efficacy against a variety of diseases. Another helpful place to find information on product selection would be directly from turf pathologists, turfgrass sales representatives, and fellow turfgrass managers. Finally, although access fees are sometimes required, reading books and scientific journal articles on fungicide efficacy trials is a valuable way to retrieve information on product efficacy.

Choosing the most efficacious fungicide is important, but choosing the most economical one is also important. Selecting the most economical fungicide should not be based on cost per acre but rather on cost per day of disease control. For example, say Fungicide A costs $50/acre and provides an average of 7 days of dollar spot control while Fungicide B costs $100/acre and provides an average of 28 days of dollar spot

Figure 1. Disease severity in plots treated with isofetamid (Kabuto at 3.2 fl.oz./1000 sq.ft.) at different dates and mean soil temperatures at a 2-inch depth. The figure clearly shows that isofetamid is highly effective against spring dead spot when applied at the appropriate application window, which includes season and soil temperature.



control. Which of these two fungicides is a better value for dollar spot control? The answer is Fungicide B because it costs $3.57/acre/day of dollar spot control, whereas Fungicide A costs $7.14/acre/day of dollar spot control. If product selection is based solely on cost per acre, Fungicide A would be the best choice, even though it is not the best value. Efficacy and economics are equally important when selecting a fungicide.

Select the right product for improved fungicide performance.

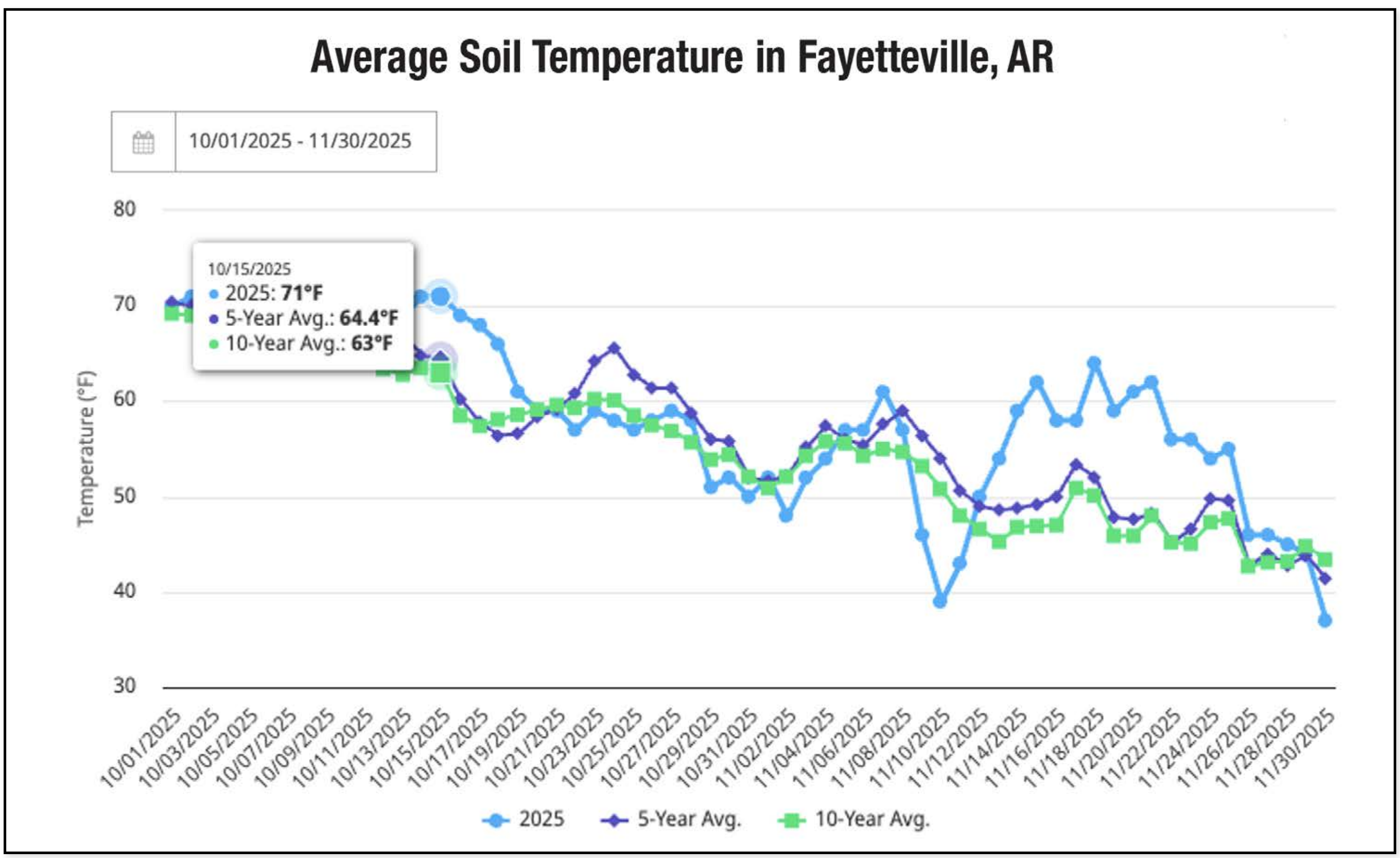
Apply at the Correct Time

Applying the correct fungicide for the correct target disease is necessary to achieve acceptable control. However, the fungicide must also be applied at the correct time to be effective. A highly efficacious product applied at the wrong time will not suppress disease (Figure 1). There are two approaches to scheduling fungicide applications: curative and preventative. The importance of applying fungicides preventively rather than curatively has already been addressed. Instead, we will focus on two approaches to scheduling preventive fungicide applications: calendar-based approach and weather-based approach.

The calendar-based approach relies on dates to schedule fungicide applications (Latin, 2021). This has been, and still is, the conventional approach in the turfgrass industry for fungicide programming. It is a highly effective approach that simplifies scheduling, budgeting, labor allocation, and record-keeping. However, it is not always the most effective approach. To use spring dead spot as an example again, historically, calendar-based fungicide applications for spring dead spot in Arkansas and throughout the transition zone have been made on September 15 and October 15. However, soil temperatures can vary greatly between years. For example, in Fayetteville, Arkansas, the soil temperature was 71°F on October 15, 2025, but the 10-year average soil temperature on October 15 is 63°F, so a fungicide applied for spring dead spot on October 15, 2025, may have performed differently than an application made during an average year (Figure 2). To mitigate this inconsistency, fungicide applications may be made using a weather-based approach (Latin, 2021).

The weather-based approach incorporates various environmental parameters such as precipitation, relative humidity, ambient air temperature, soil temperature, and more to inform fungicide application timing. These parameters have been integrated into models to reduce the uncertainty regarding application timing for certain diseases such as dollar spot (Smith et al., 2018), spring dead spot (Battaglia et al., 2025), and others. For root diseases, one of the most important environmental parameters to monitor is soil temperature,

Figure 2. Average daily soil temperatures in 2025 for Fayetteville, Arkansas. The average soil temperature for October 15, 2025, was 71°F, which was abnormally warm for that date. Figure extracted from Syngenta GreenCast website.



whereas ambient air temperature, relative humidity, and precipitation are generally more critical for foliar diseases. A mixed approach incorporating both calendar date and weather parameters is recommended.

Apply the fungicide at the correct time to improve its performance.

Choose the Optimal Application Method

Finally, beyond correctly identifying the disease and applying the right product at the right time, it is crucial for turfgrass managers to use the correct application method. Application method includes post-application irrigation vs. no post-application irrigation, carrier volume, nozzle selection, inclusion of a wetting agent or adjuvant, and so on. One of the most important considerations when strategizing about which application methods are appropriate for a given disease is whether a root or foliar disease is being targeted.

Application Methods for Root Diseases

Root diseases are generally far more challenging to manage than foliar diseases because they are physically more difficult to reach with fungicides (i.e., underground), they are tougher to identify since symptoms often appear similar to non-infectious disorders, and the symptoms remain long after pathogen infection has taken place (i.e., the summer patch pathogen infects during mild spring soil temperatures but symptoms are expressed during the heat of summer). These challenges make root diseases especially difficult to manage, so extra care is needed to optimize fungicide applications.

The primary strategy to improve fungicide performance, beyond what has previously been discussed, is to water fungicides in immediately post-application. Only the phosphite fungicides are truly systemic (translocate both up and down the plant), while the rest of the fungicides are either contacts (do not absorb in the plant but stay on the surface), local penetrants (only move locally in the plant in a translaminar fashion), or acropetal penetrants (only move up the plant through the xylem) (Table 1). Since most fungicides do not translocate throughout the entire plant, post-application irrigation is advisable to wash the product off the leaves and move it down to the basal and underground portions of the turfgrass plant, allowing more fungicide to contact root-infecting pathogens (Latin and Ou, 2018; Ou and Latin, 2018; Stephens et al., 2021). Greater concentrations of fungicide contacting the pathogen lead to greater fungicide efficacy (Hutchens et al., 2019). Most fungicides are not highly mobile and are readily bound in the thatch and the top layer of soil, but immediate post-application irrigation still improves fungicide distribution and performance (Hutchens et al., 2019; Stephens et al., 2021).

Beyond post-application irrigation, other strategies can be employed to improve fungicide performance against root diseases, but they have marginal impact relative to post-application irrigation. Nonetheless, these strategies still may be helpful. Pre-treating soils and tank-mixing with wetting agents have yielded inconsistent, but occasionally promising, results regarding fungicide distribution and performance against root diseases (Hutchens et al., 2020, 2022; Latin and Ou, 2018; Ou and Latin, 2018). Wetting agents break the surface tension of the solution and enhance moisture distribution in soils. This has been leveraged to improve fungicide distribution, but results have been inconsistent between studies (Hutchens et al., 2020; Latin and Ou, 2018; Ou and Latin, 2018). Regardless, it is still recommended to deploy a wetting agent program. Aside from post-application irrigation and wetting agent applications, few other practices have improved fungicide performance against root diseases. Recent studies have demonstrated that fungicide application strategies, such as applying at higher carrier volumes and with coarser droplet nozzles, had little to no effect on fungicide efficacy against root diseases (Battaglia et al., 2025).

Application Methods for Foliar Diseases

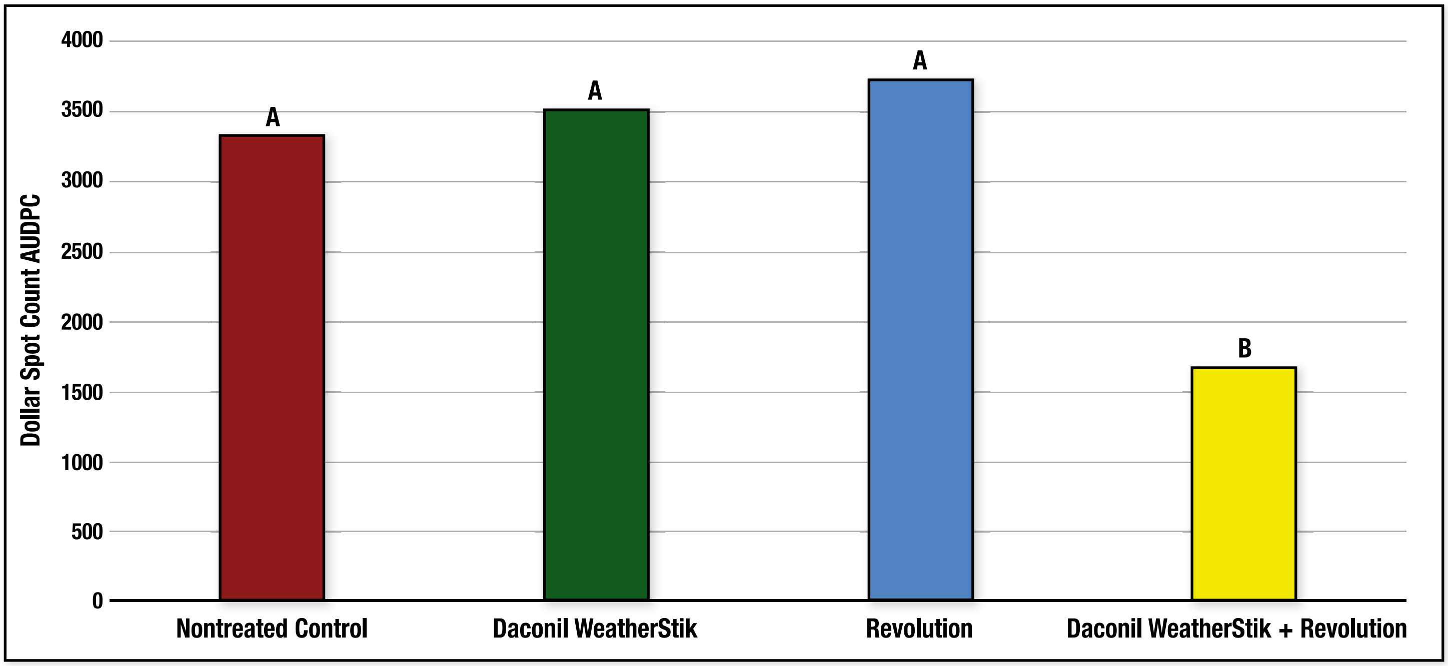
A few application methods can be deployed to improve fungicide performance against foliar diseases, especially for contact fungicides such as chlorothalonil and fluazinam. One such method is to apply fungicides using higher-coverage nozzles. Coverage is key for foliar diseases because greater coverage means more fungicide contacts the foliar pathogen(s), leading to improved disease control (Kennelly and Wolf, 2009). Carrier volume is also a major consideration for improving fungicide efficacy against foliar diseases. Fluazinam applied at a carrier volume of 0.5 gal/1,000 sq. ft. significantly reduced dollar spot compared to the product applied at 2.0 gal/1,000 sq. ft. (Kerns et al., 2018). Lower carrier volumes have a higher concentration of fungicide in the spray solution. Additionally, more spray droplets remain on the leaves at lower carrier volumes. These are two possible reasons why lower carrier volumes enhance fungicide efficacy against dollar spot. Finally, tank-mixing certain surfactants can improve fungicide performance on foliar diseases by increasing foliar coverage and displacing morning dew (Anders and Hutchens, 2024) (Figure 3).

Choose the optimal fungicide application method for improved fungicide performance.

Closing Remarks

Managing amenity turfgrass diseases is a challenge. However, fungicide application can be a highly effective control measure. Optimizing fungicide application using the four principles discussed in this article can improve turfgrass disease control and lead to substantial cost savings.

Figure 3. Influence of the fungicide, Daconil WeatherStik (chlorothalonil), and soil surfactant, Revolution, on dollar spot suppression. The trial was conducted on a 'SR1020' creeping bentgrass putting green in Fayetteville, Arkansas, in the spring and summer of 2024.



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