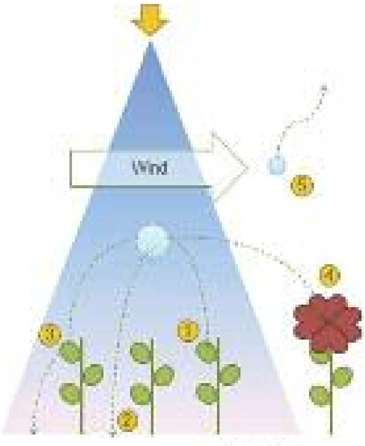
Maximizing pesticide performance

Editor's note: The author is the product manager and technical specialist for WinField's Professional Products Group.

Pesticides are one tool turfgrass managers use to create quality playing conditions. Using pesticides can increase the financial investment in a field and can raise concerns from stakeholders. Improving pesticide performance can reduce reapplications, thus optimizing financial investments and possibly reducing stakeholder exposure. Pesticide performance is influenced in three areas of the application process: in the spray tank, between the equipment and the target, and on the surface of the target. There are several adjuvant technologies on the market that can be used to improve pesticide performance in each of these areas.

In the environment

1. On-Target application: the goal is 100%!
2. Missing the target
3. Run or bounce off of leaf - > 600 µm
4. Drift: off-target deposition - 20-200 µm
5. Evaporation: very small droplets - < 50 µm



In the spray tank

Pesticides typically make up a fraction of the material in a spray tank. The quality of the carrier water is often overlooked, but the quality of the carrier water can have a significant impact on pesticide performance. The pH and presence of positively charged ions are the two main concerns with carrier water.

Mixing pesticides with too acidic or basic water can decrease pesticide performance. Under the wrong pH the rate of pesticide breakdown increases, which reduces the activity of the pesticide. With some pesticides, the activity can be reduced by half in a matter of minutes. Most pesticides prefer to be in slightly acidic water.

Buffering agents and acidifiers are two chemistries that can alter carrier water pH, thus limiting pesticide breakdown. Buffering agents lower the pH to around 6 and then maintain the pH in that range as other products are added. Acidifiers can lower the pH below 6. Unlike buffering agents, the addition of more carrier water or pesticides can raise the pH of a solution containing acidifiers, which could take the pH into a bad range for the pesticide being used. Both buffering agents and acidifiers must go in the spray tank before the pesticides to have the desired effect. Additionally, it is best to fill the spray tank almost completely before adding these products to limit pH fluctuations with additions to the tank.

Most everyone has witnessed an ineffective application of glyphosate, which is the active ingredient most effected by positive ions in carrier water. Positively charged ions in carrier water also decrease pesticide performance. Ions, such as calcium, iron, potassium, sodium and magnesium, can attach themselves to active ingredients. This attachment alters the chemistry of the active ingredient, therefore, rendering the individual molecule ineffective. Although positive ions cause problems with only a few pesticides, mainly weak acid herbicides, they can really limit pesticide performance.

Water conditioners can be used to remove free positive ions in the water. In one study at Kansas State University, the addition of the water conditioners, AirTech, Dispatch or Bronc Plus Dry EDT to a mix containing glyphosate and hard water (452 ppm) more than doubled the control of large crabgrass. Just like buffering agents and acidifiers, water conditioners must go in the tank before the active ingredient and it is ideal to have the spray tank mostly filled before using water conditioners.

As a spray droplet leaves the nozzle, the droplet can hit the target, miss the target, bounce off the target, drift away from the target, or evaporate. Numerous studies have concluded that pesticide performance is increased when more droplets reach the target. Too big and small droplets need to be minimized in order to get the most droplets on the target. The greatest concern should be over small droplets as they have the potential to drift away from the site and cause off target damage. Equipment modifications and adjuvants are the two main ways to alter droplet size.

Spray pressure, nozzle pattern, nozzle spray angle and nozzle age have the most impact on droplet size. As spray pressure increases, the average size of spray droplets decrease. Flat fan nozzles produce the finest spectrum of droplets, while air induction nozzles produce a coarser droplet spectrum. Wide angle nozzles, such as 110o, produce more small droplets. Brass and stainless steel nozzles wear the fastest and worn nozzles produce more small droplets. Spray pressure should be lowered and new nozzles with an 80o angle that produce a coarser droplet size, but still provide adequate coverage, should be selected to minimize the number of small droplets created.

Polymer and oil based drift adjuvants are two technologies that minimize small droplets. Polymer adjuvants increase surface tension by thickening the spray solution. This significantly increases the size of droplets, which makes them less prone to drift. Polymer products are known to create droplets that are too large and mix poorly in spray tanks. Oil-based drift adjuvants increase droplet size, but mix more easily and do not create substantially bigger droplets. This makes them the ideal adjuvant to optimize droplet size. Drift adjuvants should be considered for every spray, even when wind is not present, because the improved spray spectrum leads to significant improvements in pesticide performance.

On the target

Once a spray droplet reaches the target it must be absorbed to have the desired effect. Increasing droplet spread increases the contact area, thus increasing the potential for absorption. The longer a droplet remains in the liquid state the better chance there is of absorption. Droplet spread and droplet longevity can be improved with two different classes of adjuvants.

Droplet spread can be increased with the addition of non-ionic or organosillicone surfactants. Both of these technologies increase droplet spread by reducing surface tension. Organosillicones increase the droplet spread substantially, up to four times as much as a water droplet. The increased spread of organosillicones leads to faster drying time, which can limit overall uptake. Organosillicone surfactants are best used with contact insecticides and fungicides. Non-ionic surfactants are best used with systemic pesticides and herbicides.

Droplet longevity can be increased with the addition of crop oil concentrate and methylated seed oil adjuvants. Crop oil concentrate adjuvants do not increase the size of the droplet, while methylated seed oil adjuvants increase the size of the droplet. The difference in droplet size tends to lead to greater pesticide uptake with methylated seed oils. When using crop oil concentrates and methylated seed oils increased absorption occurs in both the target and the desirable species in the area. Thus, these oil adjuvants can lead to damage in non-target organisms. Both of these technologies are best used with herbicides.

Improving pesticide performance begins with recognizing the factors that limit pesticide performance. Pesticide performance can be increased by making sure the pesticide remains active in the spray tank, the spray droplets reach the intended target and the pesticide is absorbed by the target. Buffers, acidifiers, water conditioners, anti-drift, non-ionic surfactants, organosillicone surfactants, crop oil concentrates, and methylated seed oil adjuvants are useful products to manage factors impacting pesticide performance. The pesticide applicator is responsible for analyzing spray conditions and making the appropriate decisions that maximize pesticide performance. When pesticide performance is high, fewer reapplications are needed. ■

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◀ **BERMUDAGRASS** football field with spring dead spot.

Field Science | By Dr. Dave Han

Fungicides:
what they do (and don't)

Your turf has a disease! What do you do? Reach for a fungicide? What kind? And what's the best way to use it? What exactly do fungicides do? How can I maximize my chance of getting a good result from a fungicide? There are several ways in which fungicides are classified: By when they are used, by how they move (or don't move) inside a plant, by their chemical structure, and by their mode of action (how they kill a fungus, or prevent it from growing).

TIME OF USE

Fungicides can be used both preventively, before any disease symptoms are present, and curatively, after disease occurs. This distinction is important because some fungicides are much better suited for one of these uses than others. For example, fungicides that work by activating a plant's natural defense responses to infection must be used preventively. By the time a disease is ravaging a plant, its defenses are already being overcome.

Although a fungicide application made after disease symptoms appear is called curative, it's important to remember that fungicides don't actually bring dead plants back to life. If a lawn or field is suffering from a disease, a curative fungicide application can stop the dead patches from getting bigger. But for the turf to recover takes either good growing conditions for the grass to fill back in if it can spread vegetatively, or to re-establish via new seed if it can't spread vegetatively. This is why turf managers should be much more aggressive about treating (and preventing!) diseases at the end of the growing season: it is much harder to repair damage then than during good growing weather.

Some fungicides are able to be absorbed into plant tissue and moved in a plant's vascular system, while others are not. In general, fungicides that do not move inside a plant are called contact fungicides. These fungicides work by coating the leaf with a protective fungicide barrier that will prevent any spore or piece of fungal mycelium that lands on a leaf from growing and being able to infect the plant. Since contact fungicides can only protect plant parts that the spray lands on, they are useless for treating root diseases like spring dead spot, summer patch, *Pythium* root rot or anything else that infects below ground.

Because the contact fungicides work outside the plant, they must coat the entire leaf on both sides. Getting even spray coverage can be tricky in turfgrass, which has many small leaves that overlap each other. This is why fungicide labels specify using large volumes of water, often as much as 5 gallons per 1000 square feet (more than 217 gallons per acre)! This is much more water than is used for spraying herbicides, but it is needed to ensure there is enough fungicide solution to cover every leaf thoroughly. One problem that turf managers often have is that they have only one sprayer and setting it up for both herbicide and fungicide applications can be time consuming. The time it takes to refill a sprayer tank also has to be taken into consideration when deciding on spray volumes for fungicide applications over large areas, like multiple field sports complexes, but the large volumes are on the label for a reason.

Nozzle design also can have a large impact on the effectiveness of fungicide applications. In general, nozzles that produce many smaller droplets or droplets that are designed to shatter into many tiny droplets on impact (flat fan or air induction type nozzles) give better results than raindrop type nozzles designed to produce fewer, large droplets. However, smaller droplets also drift much more easily. Air induction nozzles may offer the best combination of reduced drift and good coverage.

Some fungicides can be absorbed into a leaf and diffuse around different parts of a single leaf, but they do not enter a plant's vascular system and so cannot be transported from leaf to leaf. These are called local penetrant fungicides. Local penetrants, by entering a leaf and diffusing through it, reduce the need for absolutely perfect spray coverage although they are not able to move down from a plant's leaves to the roots and so are, like the true contact fungicides, not effective against root diseases.

With both true contacts and local penetrants, the recommended re-application intervals are relatively short, on the order of 5 days to 2 weeks depending on the individual product and disease pressure. New grass leaves that formed since the last application are not protected, and the fungicide coating can be susceptible to being washed off the leaves or degraded by sunlight. The tradeoff for a relatively short window of protection is that contact fungicides usually are the cheapest.

A fungicide that is able to move throughout an entire plant is called systemic. Systemic fungicides are generally very useful in preventive applications, because they are able to be absorbed by and remain present in a plant for several weeks. Re-application intervals for these types of fungicides are generally in the two to four week range. However, most systemic fungicides can only move upwards in a plant. If they are absorbed by the roots they will be moved to leaves, and they will move from lower leaves to newer leaves, but they will not move from leaves down to roots. The only exceptions to this rule are the phosphite fungicides.

Because these fungicides are actively taken up by plants, they can be effective against root diseases—provided that there are actually roots there to absorb the fungicide! The problem with root diseases is that above-ground symptoms often don't appear until the root system is almost totally destroyed. In some cases, such as spring dead spot, symptoms don't appear until months after the initial infection. It is much, much better to use a preventive application than a curative application to fight root diseases in almost every case.

It is very difficult to predict where a root disease will occur without complete and accurate records. With most root diseases, the fungus stays in the soil year after year and disease occurs in the same areas over and over again when the weather is favorable for the fungus. So keeping good records of a disease occurrence will allow the proper preventive applications to be made before the next outbreak. When making fungicide applications to prevent a root disease, remember that the fungicide has to move down through the canopy, through the thatch and into the soil before a root can absorb it. Many times a preventive fungicide application will fail because it wasn't sprayed in enough water to wash it thorough the canopy (or it wasn't irrigated in after application), or because the fungicide became bound to organic matter in an excessively thick thatch layer. Again, following label directions for spray volume and irrigation and managing the thatch layer are critical factors in using fungicides successfully against root diseases.

Mode of action refers to the specific biochemical processes in a fungus that a fungicide interferes with in order to kill it, or at least stop it from growing. There are many different modes of action available in the fungicides labeled for use on turfgrass. Some fungicides interrupt a fungus' cell division, some interfere with cell wall or cell membrane synthesis, some disrupt a fungus' ability to make DNA, RNA, or proteins, some stop energy production, and some have more than one mode of action.

One mode of action relatively new to the turfgrass market is the activation of plant defense responses. Chemicals that do this are not toxic to fungi, but they "fool" plants into activating their array of physical and biochemical responses to infection before they are exposed to a fungus. This in turn boosts the plant's ability to resist infection and reduces disease incidence and severity. As noted above, however, this only works if the defense response activator is applied before any infection takes place. This type of fungicide does not work as a curative application.

While there are many different modes of action available, many of the most popular fungicide products for turf contain ingredients with the same mode of action. This brings up the potential problem of fungicide resistance. Fungi are highly diverse and repeatedly spraying the same mode of action selects for any resistant individuals that happen to be present in a given population. If they are, then they multiply while susceptible ones are killed and soon the majority of the fungal population is resistant and the fungicide stops working to prevent disease.

Modern fungicides tend to have very specific sites of action in fungi. For example, many target just one enzyme in a fungus, binding to it and making it no longer able to function. This is good, since it means that the fungicides are very specific and less likely to cause harm to non-target organisms. But it is also bad from a resistance standpoint because it means that all that has to happen for a fungus to become resistant is a small change in that one enzyme such that the fungicide can no longer inactivate it. This happens in nature and often just one or two mutations are enough to make a fungus resistant.

Because of the potential for many turfgrass diseases to become resistant to fungicides, managers have been advised for years to rotate modes of action or to tank mix more than one mode of action at a time in a given application. The international Fungicide Resistance Action Committee (FRAC, www.frac.info) maintains a listing of currently registered fungicide active ingredients and their modes of action. They are sorted into groups of individual ingredients sharing the same mode of action and each group is assigned a unique code.

Recently, manufacturers have begun placing the FRAC mode of action group codes on their product labels. This is a tremendous help to the turf manager trying to manage resistance as now it is immediately obvious which products contain ingredients that have the same mode of action. Now it is possible to tell at a glance whether rotating to a given product will actually mean switching modes of action.

It is important to remember, though, that even though resistance has been documented in many turfgrass diseases, not every failed fungicide application is due to resistance. It is still more common to see fungicides fail due to improper calibration, reading labels incorrectly, not using enough spray volume and/or the wrong nozzles, and plain old misdiagnosis of the disease. Nevertheless, if you suspect resistance, it is a good idea to contact your local Extension agent or plant pathology lab. They will be able to assist you in identifying possible problems with your fungicide application and, if needed, can collect samples and screen them for resistance. ■

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Using canopy reflectance tools in turfgrass management

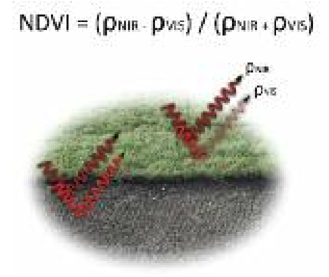
Turfgrass managers can tell a lot about turf just by looking at it—and the more experienced they are, the better their judgment. Nutrient status, pest damage, abiotic stresses (drought, traffic, etc.) are all visible to the trained eye. Sometimes, however, it's good to have some tools to help; the highly trained manager may not be available to see everything, or the problem may produce very subtle effects. This article discusses some recent innovations in assessing turfgrass, developed and widely used in turf research, which might be useful to the turfgrass manager.

What we see when we look at a turfgrass sward could be termed "canopy reflectance"; it's just the ambient sunlight reflected off the leaves in the full visible light spectrum. A trained researcher or turfgrass manager learns to record and interpret the details of what they see, whether it's the off color of nutrient deficiency or spray damage, or the darkening of drought stress. However, both in research and in practical management situations, we work with less well-trained helpers, and will benefit from techniques that remove the subjectivity and observer bias, and reduce the need for training.

One very familiar tool is a camera, and with improved digital cameras this is a very useful adjunct to assessing problems. However, even though they can form an important permanent record, the digital photos still need to be interpreted. Researchers are working on improving software to analyze digital images to document and quantify turf characteristics (weed and disease infestation, drought and nutrient stress), but these full spectrum techniques are still relatively early in development for widespread turf use.

A more mature, and somewhat simpler, technology for assessing turf involves restricting the wavelengths observed to ones that we have learned through experience are indicative of turfgrass problems. Photosynthesis in plants involves chlorophyll absorbing light to power the plant, and the wavelengths that chlorophyll absorbs are a subset of the sunlight hitting the plant (Fig. 1). Light that chlorophyll absorbs is not reflected, and the light hitting the plant looks different from that reflected. Of the visible wavelengths, chlorophyll absorbs red light, generally, so the light reflected is white minus red = green. The wavelengths that chlorophyll absorbs are often termed photosynthetically active radiation or PAR.

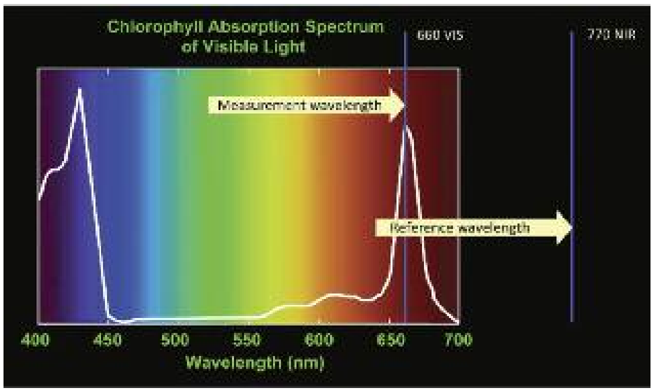
Various sensors have been developed which all function in a similar fashion, comparing the reflectance off a surface (e.g. turf) of a wavelength that chlorophyll absorbs (measurement wavelength), with one that chlorophyll does not absorb (reference wavelength). Fig. 2 shows light reflecting from turf and bare soil. The longer (reference) wavelength is not absorbed by chlorophyll and is reflected equally from both surfaces; the shorter (measurement) wavelength is partly absorbed by the plant, and the reflected amount is reduced. Usually the meas-

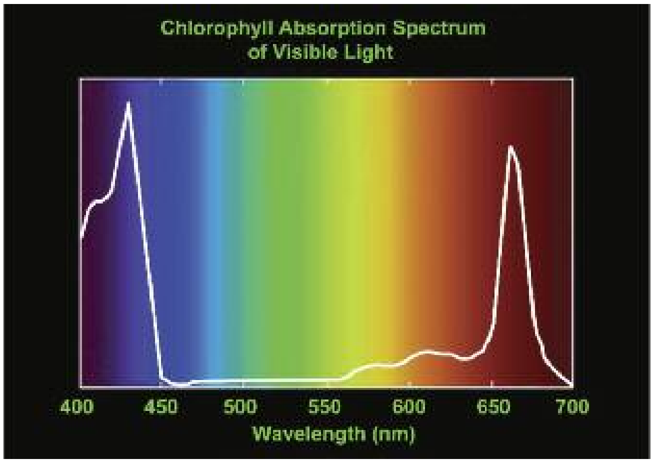


▲ **Figure 2**. Measurement (VIS) and reference (NIR) waves of light reflecting off bare soil and turf.

▼ **Figure 1. Top:** The peaks show the wavelengths of visible light that are absorbed by chlorophyll (Photosynthetically active radiation).

▼ **Figure 3. Bottom:** Measurement (660 nm) and reference (770 nm) wavelengths used by the Greenseeker to calculate NDVI.





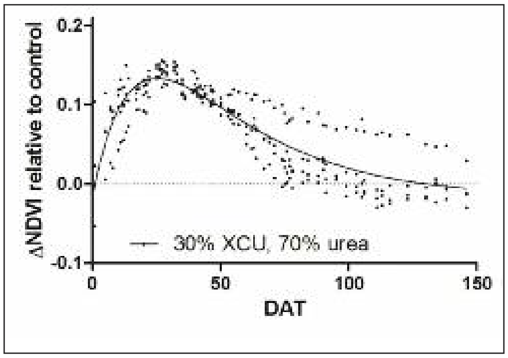
◀ **Figure 4. Left:** Greenseeker canopy reflectance sensor system.
◀ **Figure 5. Right:** Spectrum FieldScout chlorophyll meter.

urement wavelength used is in the red (visible) part of the spectrum and the reference in the near-infrared (Fig. 3). Canopy reflectance sensors like this will report/record an index which is usually of the form (ρNIR - ρVIS) / (ρNIR + ρVIS). Rho (ρ) is the reflectance, and you can see from the formula that when there is no absorbance by chlorophyll (ρNIR = ρVIS) the top of the ratio is zero, and the index is zero. When all of the measurement wavelength is absorbed (ρVIS = 0), the ratio becomes ρNIR / ρNIR or 1. Some sensor systems, like the Greenseeker (Fig. 4), will report an index between 0 and 1 (sometimes called the normalized-difference vegetation index, or NDVI), others like the Spectrum FieldScout (Fig. 5) multiply the index and report a value between 0 and 1000 (chlorophyll index).

CANOPY REFLECTANCE IN TURF MANAGEMENT

The key feature of canopy reflectance indices like NDVI and the chlorophyll index is that the values observed in turfgrass are very sensitive to a multitude of things of interest to a turf manager. Changes in nutrient status, moisture status, traffic, insects, disease, rootzone problems, and other biotic and abiotic stresses can all produce subtle shifts in canopy reflectance, some of which are even undetectable by a trained human eye.

Canopy reflectance, especially as it is affected by nutrient status, has become an important tool in precision agriculture, where maximizing yields and optimizing fertilizer inputs is tied to systems that measure reflectance. The uses in turfgrass management will likely be more complex as they develop, since yield and nutrient stress are only a small part of the stresses that turf experiences. For example, research is currently being done to examine the potential in water management, but most of the current use is in turf research.



▲ **Figure 6.** Change in canopy reflectance following a single application of slow-release nitrogen fertilizer (points represent data from four replicate plots; the line is the best fit release curve; DAT = days after treatment).

A few examples of the power and sensitivity of the system will, we hope, convince you that it is a technique to watch. The more the system is used in research, the faster the applications to the real world will be developed.

FERTILIZER PERFORMANCE AND RELEASE CHARACTERISTICS

Fig. 6 shows a sample of data collected from recent fertilizer performance trials at the Guelph Turfgrass Institute (GTI). The points show the change in NVI as a fertilizer application at day 0 gradually releases and increases the absorption of PAR to the maximum at ~25 days after treatment, then gradually declines as the fertilizer runs out at ~100 days. Using these techniques we can help fine tune release characteristics of fertilizers, but the same data could help a turf manager track nutrient status.

GERMINATION, ESTABLISHMENT AND COVER DEVELOPMENT IN TURF

Canopy reflectance can be used to track the establishment of newly seeded turf. In research trials, we can use this to assess different cultivars, blends and mixtures, or different management techniques in establishment. Fig. 7 shows cover development in a recent trial at the GTI, and Fig. 8 shows the change in canopy reflectance in one of the entries over the first 26 days after seeding. Fig. 9 shows data from an earlier trial, in this case using the chlorophyll index rather than NDVI. Sixteen Kentucky bluegrass cultivars show clear differences in speed of establishment as measured by canopy reflectance.

▲ **Figure 7.** Cover development in turf trial.

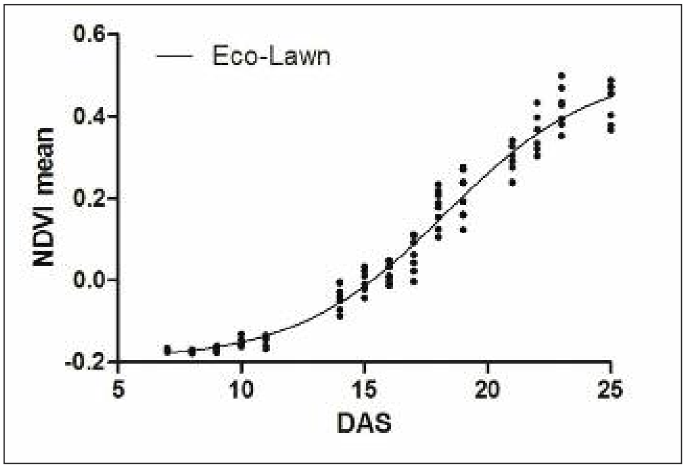
DROUGHT STRESS, WATER USE AND LOCALIZED DRY SPOT

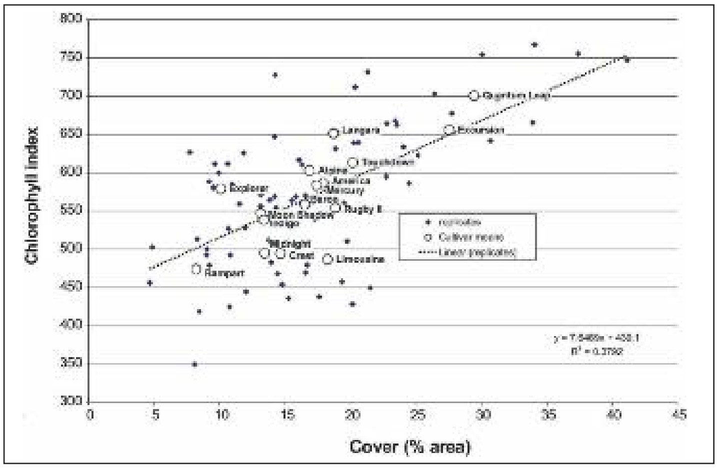
Fig. 10 shows localized dry spot and treatment effects of wetting agents in a recent trial. If we look at the canopy reflectance and independent assessments of soil moisture (Fig. 11) and localized dry spot (Fig. 12), the potential of canopy reflectance to detect and help manage water problems is clear. We have also used the technique in assessing the effectiveness of different irrigation regimes in establishing turf from dry seeding, hydroseeding, and sod.

OTHER BIOTIC AND ABIOTIC STRESSES

As mentioned above, many stresses that affect turfgrass will be detectable in changes in canopy reflectance. We routinely use the

Figure 8. Left: Increase in canopy reflectance with germination and cover development in seeded turf. **Figure 9. Right:** Association between grass cover and canopy reflectance (chlorophyll index) in Kentucky bluegrass cultivars.



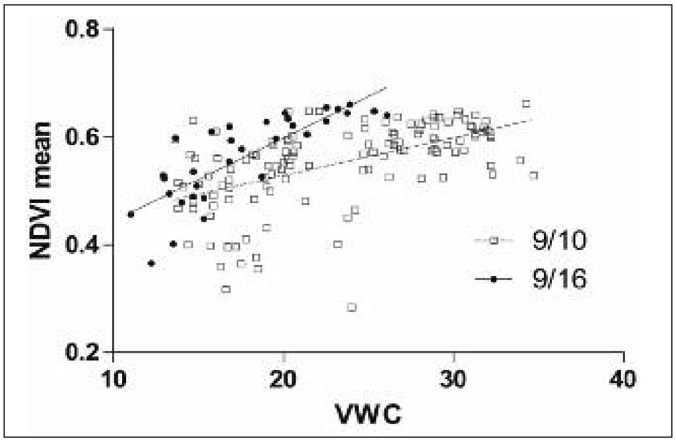


technique in assessing trials involving dollar spot disease, for example. Fig. 13 shows symptoms of dollar spot as they develop in a recent trial, and Fig. 14 shows how the disease pressure shows up in the canopy reflectance data.

WHAT'S NEEDED BEFORE THE TOOLS ARE WIDELY USED BY TURF MANAGERS?

Experience. We need to have a better grasp of how the numbers change across species, management conditions, etc. It is a very

▼ **Figure 11. Left:** Association between soil moisture (volumetric water content – VWC) and canopy reflectance in wetting agent trial. ▼ **Figure 12. Right:** Association between localized dry spot (rated visually) and canopy reflectance in wetting agent trial.



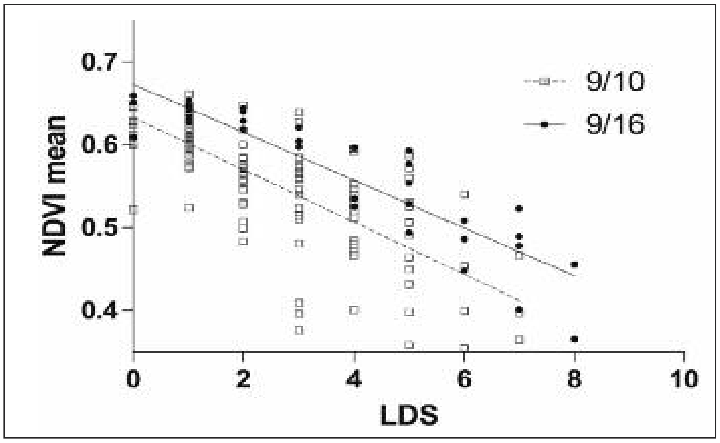


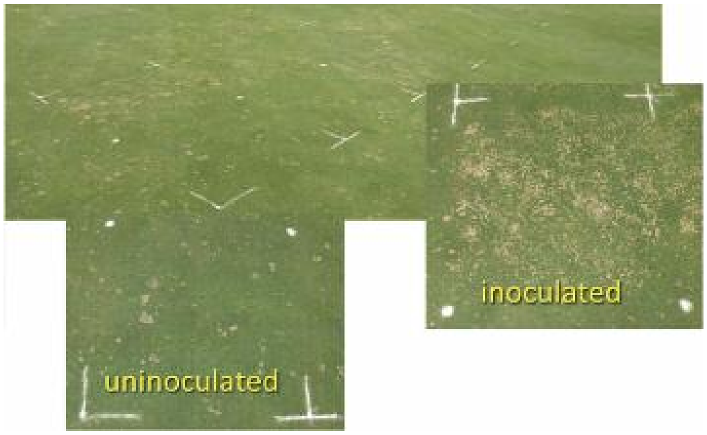
Figure 10. Localized dry spot in bentgrass turf; some plots are treated with wetting agents.

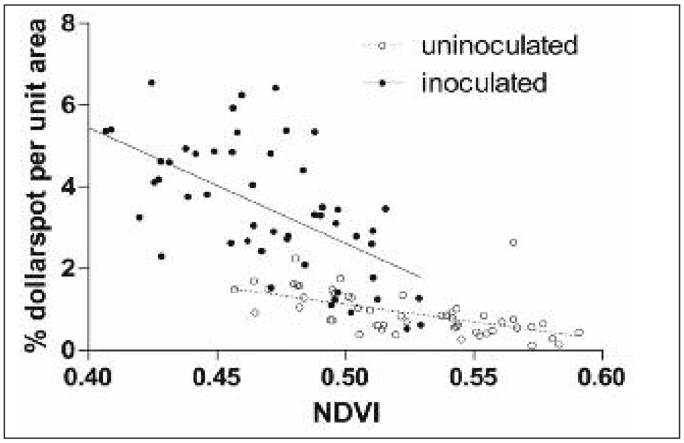
young technique outside of research applications.

Calibration. The sensitivity of the tool to so many factors means that in order to isolate effects of interest, we need to learn to calibrate to remove extraneous noise (we use untreated control plots in research, and similar techniques can be used in management).

History. The more the tools are used on a particular turf area, the better the information. The advantage of these tools is that they automatically record and time-stamp the information, and if so-

▼ **Figure 13. Left:** Dollar spot disease on inoculated and uninoculated plots. ▼ **Figure 14. Right:** Association between canopy reflectance and dollar spot disease levels in trial plots.





equipped will even record GPS information.

More computer tools. Recording, analyzing, and interpreting canopy reflectance data is dependent on computer software and training. At the moment the tools are research tools; widespread use of the techniques in industry will require computer tools that assist in the analysis and interpretation.

The tools and techniques are powerful, the equipment is easy to use and becoming more and more affordable all the time (currently low four figures for the equipment we use in research), and worth keeping an eye on if you're a turfgrass manager. Someday in the not too distant future you may be sending your crew out to take routine canopy reflectance readings of your turf, and using the data to make your job easier. ■

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50 Years:

Willie Leak maintains TifGrand bermudagrass at RFK Stadium

The iconic Robert F. Kennedy Stadium, affectionately known as RFK, was built in 1961, and was then called District of Columbia Stadium. In 1969, a year after the assassination of Senator Kennedy, the stadium was renamed in his honor. By that time, Willie Leak, head groundskeeper at the stadium, had already been working at the Washington, D.C., facility for 4 years. This year, Leak celebrates half a century of service at RFK. "Something here just draws me," Leak says, "and makes me come here everyday."


▲ **IN 1994**, RFK hosted the FIFA World Cup; this game featured the USA v. Germany. Kea Taylor, Imagine Photography.

Leak began his career at RFK as a part-time member of the grounds crew. **In 1969**, he was hired to the full-time crew. **In 1997**, he was promoted to head groundskeeper.

"Something here just draws me," Leak says, "and makes me come here everyday."


◀ **WILLIE LEAK**, head groundskeeper, RFK Stadium. Photo credit Nick Woodall, Mike B Photography.

Leak began his career at RFK as a part-time member of the grounds crew. In 1969, he was hired to the full-time crew. In 1997, he was promoted to head groundskeeper. He's held the position ever since. "I haven't missed any games. I've been here for quite a few things," Leak says.

Those few things include 35 years as the home of the Washington Redskins NFL football team and nine years as the home of the Washington Senators Major League Baseball team. Since 2011, RFK has been the venue for the NCAA AT&T Nation's Football Classic, featuring teams from the traditionally black universities Howard University and Morehouse College.

The 45,423-seat stadium was the site of concerts by the Beatles in 1966; Bruce Springsteen and the E Street Band in 1985; the Jackson Five in1974 and 1984; and U2 in 1987, 1992 and 1997. RFK has hosted many religious, memorial and charitable functions. Of note are the 2009 National Day of Service for Our Military when more than 12,000 volunteers joined First Lady Michelle Obama to create 85,000 care packages for troops serving overseas; and United We Stand, a 2001 benefit concert spearheaded by Michael Jackson to benefit victims of the September 11th attacks.

In recent years, RFK has been a Mecca for soccer-related events. In 1994, RFK hosted the FIFA World Cup. In 1996, the stadium hosted nine soccer games over six days during the Summer Olympic Games. And since 1996, RFK has been the home field of the DC United MLS soccer team.

Field prep these days focuses on soccer for DC United, a 40-game soccer festival for AESA-ONE (the All Ethiopian Sports Association), and football for the Howard vs. Morehouse game. The main difference in maintenance between the two sports the field must service, Leak says, is the height of cut. For soccer, the turf is mowed at ¾-inch. For football, it's mowed at 1.5-inches.

Two years ago, Leak says the decision was made to regrass the existing Tifway 419 bermudagrass field with a new shade-tolerant turf variety called TifGrand bermudagrass.

"One of the main reasons why we switched over was the shade tolerance that this particular grass provided," says Mike Mohamed, RFK building manager. "We have an overhang that goes around the entire stadium and it creates quite a bit of shade, even in the summer months on the field. The nearside of the field and the corner will be in shade almost year round. We had a lot of issues trying to bring that turf back after play and getting it to recover because it didn't get enough sunlight. So we wanted to use this turf just to test it out to see how the recovery would be since it is a shade tolerant grass. So far, the nearside near the tunnel where we've had a lot of shade issues in the past, it's been a lot better this year. It gets a lot of traffic there. The teams warm up there so it gets a lot of wear. The field as a whole has been able to recover very well. TifGrand has been markedly better than the turf we used before."

Dr. Wayne Hanna, who developed TifGrand bermudagrass at the University of Georgia, attributes the shade tolerance and fast recovery of the grass to its thick, vigorous rhizome structure.

"TifGrand has a good rhizome system right below the surface so even if the tops get damaged, or if it doesn't get a lot of sun, it has a lot of reserve energy right below the ground to keep the grass moving," Hanna says.

Leak says he has noticed an increase in wear tolerance with the TifGrand over the old 419 field. "The divots in the grass grow back really fast," Leak says.

Even though TifGrand is quite durable, every grass has its limits. Each July since 2011, RFK has hosted the AESA-ONE soccer festival. The event consists of 40 semi-pro soccer matches played in just one week's time. Three weeks later, DC United is scheduled to play a league game in the stadium.

"With the amount of games we played, basically from the goal mouth to the goal mouth, if you'd take the 18-yard box and just extend it all the way down, in between those areas got so torn up that there really wasn't any grass left in those spots because of the amount of games that were played. You've got to remember, it's a semi pro league, so the wear and tear, the sliding that they put on the field is a bit more than the professionals do. There's just nothing to bring back. To have

JFK FIELD CREW (L-R): Pablo Blanco, Michael Mohamed, Willie Leak, Jeff Hunter, Anthony Jones. Photo credit Nick Woodall, Mike B Photography.

DC United come back and play a league game on the field would be a disservice. So, we decided to resod the field," Mohamed says.

Leak adds, "In order for the whole thing to look the same, we just decided to resod the whole field. We figured that would be the best way to go. We only have X-amount of time to recover and we didn't think we had enough time to make it come back in time for soccer."

After the tournament, the field is stripped of sod, laser graded and resodded, "everything as if we were installing a new field," Leak says.

Charles Harris is the president of Buy Sod, Inc., the licensed sod producer that grew and installed the original TifGrand field at RFK. Buy Sod is licensed to produce TifGrand through The Turfgrass Group. Buy Sod has come back each July after the weeklong tournament and replaced the grass, providing the stadium with a brand new playing surface every year. Because he knows the replacement sod will be needed each summer, Harris and his team plan ahead.

"We select the sod field the grass will come from the year before and hold out the grass to be sure it's at least two growing seasons old so the sod is very mature and will hold together very well. We grow the turf in sand and the rhizomes on the back of the pad are very uniform," Harris says. "I think that's the critical component, the quality of the sod and the way you're maintaining it so it's ready for play when you put it down … The TifGrand is extremely dense. There are just more plants per square foot and the density makes it really wear tolerant. We take the mowing height down to ¾-inch in the farm field. It gets dense and tight and uniform so it plays very well and holds up to traffic."

The TifGrand sod is grown on sandy soil in North Carolina and some 95,000 square feet of sod is shipped as 42-inch big rolls to the stadium site.

"Now it's almost routine," Mohamed says. "Once we have the event in July, we know we're tearing up the field. It only takes about a week to get the old field up and the new field down."

Resodding an entire field every year is an expensive proposition but Mohamed says, "fortunately the event in July helps take care of some of those costs."

Erik Moses is senior vice president of sports & entertainment for Events DC, the entity that operates the stadium for the city. Moses explains his position as the "person responsible for attracting events to our campus." He says that his clients, including college coaches and event promoters, continuously offer enthusiastic compliments regarding the condition of the field. "We get those kinds of accolades because of the hard work that Willie and all of the other guys do to preserve and maintain that surface. They make my job easier for me. I would be remiss if I didn't explain how maintaining the field and the playing conditions in a particular way really impacts our business, the bottom line and how we service our customers. These guys really play a big role in that."

The stadium "does function as a living monument to Robert Kennedy," Moses says. "It means so much to the city. That is why we try so hard to maintain it. Fifty-two years and counting."

Mohamed says he, like Leak and so many others, has a love for the stadium.

"I've been coming here since I was 7-years-old. I was a big Redskins fan. It has a lot of history to it. So much has happened here. The Rolling Stones, Michael Jackson, The Grateful Dead. So many people have been in and out of this building," Mohamed says. "We have a saying around here that RFK's got you. You'll be here forever. You just don't know how long forever is going to be." ■

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