no guarantee on how long it would hold up or for how many games, officials looked at other options, including the possibility of purchasing the original turf field from the Sky Dome in Toronto. But in the end the decision was made to use 133,000 square feet of custom turf from AstroTurf.

"We felt most comfortable with AstroTurf and their staff," said Gottsch, "and with their being the official turf supplier for MLB we knew we would have their blessing."

The field installed was an AstroTurf GameDay Grass 3D52 Diamond synthetic turf system, a third generation artificial playing surface. Once the turf was selected, a decision needed to be made on whether the turf would be laid on a pad, dirt, or the concrete floor alone, and how the dirt areas would be handled. With the help of Murray Cook, former president of the Sports Turf Managers Association and a MLB consultant, the decision was made to put a 3-4 inch thick dirt sub-base under the infield area and feather it down to the floor in the foul areas and starting beyond the 95-foot arc to the outfield.

Doing a one-of-a-kind install like this would be difficult under normal circumstances, but making this one even more complicated was the Alamodome's busy schedule. In addition to getting ready for this event, the Dome already had other events on the schedule; two home games for the San Antonio Talons of the Arena Football League, a 2-day running event, and a pay per view Total Nonstop Action wrestling event. Coordination among all the parties was key; if this was going to succeed, we all had to be on the same page.

Kevin Swank with Texas-based AstroBuilders handled the install of the turf. When the turf was delivered, his team began the process of cutting it and piecing it together to conform to the Dome floor and seating configuration.

Once that was done, the turf in the north half of the building was rolled up and moved south and stored so stadium staff could install the arena for the Talons home game. This also required the turf on the south side to be partially rolled up so seating could be moved.

As soon as the AFL game was over, that field was removed and seating moved back, and the installation of the dirt sub base began. Garrett Reddehase, field superintendent for the Round Rock Express, and his staff handled this portion of the project. Once home plate was set, wood frames for home plate, the pitchers mound and each of the three base pits were constructed and placed. Then, approximately 300 cubic yards of dirt was brought in to provide the base that the turf would be laid on. Reddehase and staff then laser graded everything, and once it was completed, the turf was laid back in place and finally preparation of the turf began. Total installation of the turf took 8 days, which is about one-third of the time a standard project takes.

Upon completion of the turf, the crew from Round Rock began finally prep of the base pits, home plate and the pitchers mound. Bullpen mounds were constructed in the tunnels leading from the loading docks to the stadium floor. Crews began hanging wall pads on the seating and temporary fencing was placed in the corners and from behind home plate down the 3rd base line to form one of the dugouts. Once the games were complete, the turf was rolled up and hauled off to a storage facility down the street from the Dome, along with the wall pads, fencing and other items used for the event, to be used for future games.

More than 75,000 people attended the 2-day event that saw the Texas Rangers take on the San Diego Padres. Overall the response to the event was good from the both players and fans. Recently, a 2-year agreement was signed that will bring Big League Weekend back to the Alamodome. In 2014, the Texas Rangers will take on the Houston Astros for two games. As with anything, some changes will be made to enhance the experience for players and fans. The bullpens will be moved out onto the field so fans can see them. Lighting will be added in the corners to help brighten up these areas up (Alamodome lighting is configured for football not baseball). In addition, home plate will be moved a few feet to make the viewing experience better for all fans. Officials for both the Alamodome and Ryan-Sanders Baseball hope that this event will be something that they can grow and continue to do for many years to come. ■

Thomas McAfee is the Facilities Operations Coordinator, Convention & Sports Facilities Department, for the City of San Antonio.

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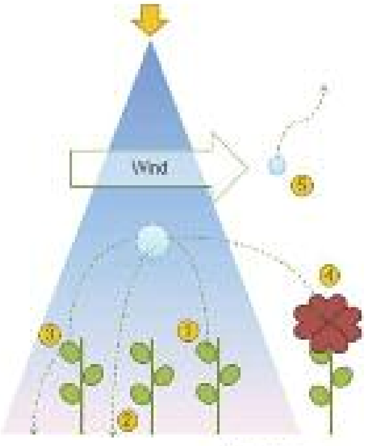
Maximizing pesticide performance

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. ■

Aaron Johnsen is the product manager and technical specialist for WinField's Professional Products Group.

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

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.