

# Preemergence herbicide use on athletic fields

**S**PRING IS A TIME FOR ATHLETIC FIELD MANAGERS to focus on control of summer annual weeds such as crabgrass (*Digitaria* spp.) and goosegrass (*Eleusine indica*). These species complete their life cycle in 1 year, germinating from seed in spring, growing throughout summer, and finally setting seed in fall. If left uncontrolled, both crabgrass and goosegrass can reduce the aesthetic and functional quality of warm- and cool-season athletic field turf.

Research conducted at the University of Tennessee Center for Athletic Field Safety (CAFS) in 2012 illustrated that high-use areas of fields comprised of predominately crabgrass lose approximately 10% cover after each traffic event compared to only 1% for those containing predominantly Tifway hybrid bermudagrass (*C. dactylon* x *C. transvaalensis*). These losses in cover were associated with increases in surface hardness (measured as Gmax), a property linked with head injury incidence.

An effective means for controlling summer annual weeds is the use of preemergence herbicides. A list of preemergence herbicides labeled for use on warm- and cool-season turfgrasses commonly found on athletic fields is presented in Table 1.

Table 1. List of active ingredients labeled for preemergence control of annual grassy weeds in warm- and cool-season turfgrasses commonly used on athletic fields.

## KEYS TO SUCCESS

There are two keys to effectively controlling summer annual weeds with preemergence herbicides. First, be sure to apply these materials before weeds have emerged from soil (i.e., before they are visible). These herbicides do not prevent weed seed germination; rather they prevent germinated seedlings from developing into mature plants. Considering that the timeframe between germination and emergence can be quite short, it is often recommended that these herbicides be ap-

Active Ingredient	Trade Name <sup>†</sup>	Formulations <sup>‡,¶</sup>	Labeled Species
<b>prodiamine</b>	Barricade	FL, WG	Bermudagrass Seashore Paspalum Tall Fescue Kentucky Bluegrass Perennial Ryegrass
<b>dithiopyr</b>	Dimension	EW, WP	Bermudagrass Seashore Paspalum Tall Fescue Kentucky Bluegrass Perennial Ryegrass
<b>prodiamine + sulfentrazone</b>	Echelon	SC	Bermudagrass Seashore Paspalum Tall Fescue Kentucky Bluegrass Perennial Ryegrass
<b>pendimethalin</b>	Pendulum	FL, G, EC	Bermudagrass Seashore Paspalum Tall Fescue Kentucky Bluegrass Perennial Ryegrass
<b>pendimethalin + dimethenamid-P</b>	FreeHand	G	Bermudagrass Seashore Paspalum
<b>oxadiazon</b>	Ronstar	G, FL, WSP	Dormant Bermudagrass (FL, WSP only)  Bermudagrass (G only) Seashore Paspalum (G only) Tall Fescue (G only) Kentucky Bluegrass (G only) Perennial Ryegrass (G only)
<b>indaziflam</b>	Specticle	WSP, FL	Bermudagrass

<sup>†</sup> Active ingredients may be available under multiple trade names. Mention of trade names or commercial products in this publication is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the University of Tennessee Institute of Agriculture. The omission of a particular trade name is not intended to reflect adversely, or to show bias against, any product or trade name not mentioned.

<sup>‡</sup> FL = flowable; WG = water dispersible granular; EW = concentrated emulsion; WP = wettable powder; WSP = water soluble powder; SC = soluble concentrate; G = granular (not on fertilizer).

<sup>¶</sup> Many preemergence herbicides are sold on granular fertilizer carriers. Be sure to follow label instructions to ensure that the correct rates of active ingredient and nutrients are supplied to turf when using these materials.

Table 1

plied once soil temperatures are favorable for crabgrass seed germination. Athletic field managers should make their first pre-emergence herbicide application as soon as soil temperatures (at approximately 2 inches) measure  $\geq 55^{\circ}\text{F}$  for a minimum of three days in spring.

Ornamental forsythia plants can be a helpful indicator of when this benchmark soil temperature has been reached. Forsythia plants produce distinctive yellow blooms at soil temperatures similar to those that facilitate crabgrass seed germination. Thus, the presence of yellow petals on forsythia plants serves as an indicator of when pre-emergence herbicides for summer annual weed control should be applied in spring. Athletic field managers should be sure to apply pre-emergence herbicides before forsythia plants have completed flowering.

A second key to effectively controlling weeds with pre-emergence herbicides is to water them into the soil after application. Most labels require that 0.25 to 0.50 inches of irrigation or rainfall be applied within 24 to 48 hours after application. These herbicides are absorbed by germinating seedlings in the soil profile so moving them into the rootzone is critical. Failure to irrigate after application can also lead to material being lost due to volatilization. On fields without irrigation, try to time pre-emergence herbicide applications around a period of rainfall.

### SPLIT APPLICATIONS

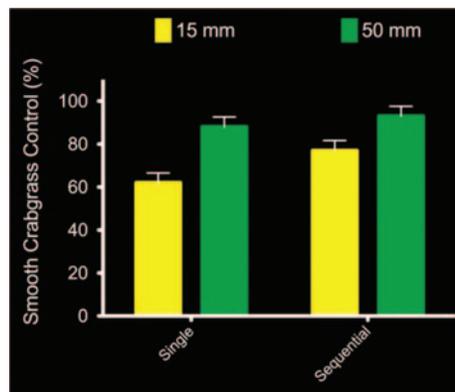
Split (also referred to as “sequential”) application programs of pre-emergence herbicides tend to provide more consistent control of summer annual weeds throughout a growing season. These programs typically apply the total amount of active ingredient for the season in two applications spaced 8 to 10 weeks apart. A single herbicide application in spring for pre-emergence control of crabgrass will slowly be broken down by soil microbial activity over the course of a summer often leading to crabgrass breakthrough by fall. Split application programs delivering active ingredient two times throughout a season tend to provide a longer period of control. Additionally, split application programs will control species germinating later in the year than crabgrass (e.g., goosegrass, etc.).

### MOWING HEIGHT

Research conducted at CAFS in 2012 evaluated the effects of mowing height on the efficacy of single and split applications of pre-emergence herbicides for crabgrass control. A total of six different herbicides were evaluated. At a 0.6 inch mowing height, split application regimes provided greater crabgrass control than single applications regardless of product. When mowing height was increased to 2 inches, no significant differences were detected between single and split application regimes regardless of product (Figure 1).

Five of the six herbicides tested provided greater crabgrass control when applied to turf maintained at 2 inches compared to 0.6 inches regardless of application regime. While this experiment will be repeated again in 2013, these preliminary results indicate that split application regimes provide better control than single applications at low (0.6 inch) heights of cut. Additionally, increasing mowing height can improve the efficacy of pre-emergence herbicides for crabgrass control. Increases to 2 inches may reduce the need for split application programs altogether; however, this height of cut may not be acceptable on all athletic fields.

Figure 1. Smooth crabgrass (*Digitaria ischaemum*) control 5 months after initial pre-emergence herbicide treatment at CAFS in Knoxville in 2012. Means from the 0.6 inch (15 mm) and 2 inch (50 mm) heights of cut were pooled across six different herbicide chemistries.



### CONCERNS OVER TRAFFIC TOLERANCE

It is well documented that many of the pre-emergence herbicides used to control an-

nual grassy weeds can inhibit bermudagrass root growth. Reductions in root growth in the uppermost portion of the soil profile could potentially compromise bermudagrass traffic tolerance and recovery; thus, rendering the benefits of effective weed control moot.

Research was conducted at CAFS during 2009 and 2010 evaluating the effects of four pre-emergence herbicides on Tifway hybrid bermudagrass traffic tolerance and recovery. Over the course of the 2-year study, no differences in smooth crabgrass (*Digitaria ischaemum*) control were detected among herbicide treatments after being subjected to athletic field traffic in spring; control measured 95 to 99% by 5 months after treatment. Moreover, no differences in Tifway traffic tolerance or recovery were reported in either year.

We hypothesized that this response was due to Tifway recovering predominately from below ground rhizomes rather than stolons. Follow-up research was initiated in 2012 evaluating the effects of pre-emergence herbicide applications in spring on Tifway traffic tolerance in fall. After the first year of the study, no differences in fall traffic tolerance were detected due to herbicide treatment in spring. To date, these findings illustrate that use of pre-emergence herbicides to control weeds on bermudagrass athletic fields does not affect traffic tolerance or recovery.

Numerous pre-emergence herbicides are available for controlling annual grassy weeds on athletic fields. Always refer to the product label for specific information on proper use, tank-mixing compatibility and turfgrass tolerance. Mention of trade names or commercial products in this publication is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the University of Tennessee’s Institute of Agriculture. For more information on turfgrass weed control, visit the University of Tennessee’s turfgrass weed science website at [www.tennessee-turfgrassweeds.org](http://www.tennessee-turfgrassweeds.org).

*J. T. Brosnan is assistant professor, turfgrass weed science; G.K. Breeden is an assistant specialist; J. C. Sorochan is associate professor, turfgrass science & management; and A. W. Thoms is research leader, all at the University of Tennessee.*



## Managing summer annual weeds on high traffic sports fields

**T**HERE IS AN OLD ADAGE that the best form of weed control is a healthy, dense stand of turfgrass. Is it any wonder that high traffic sports fields virtually absent of turf cover are often riddled with summer annual weeds? Solving these weed problems requires more than a phone call to schedule a contractor-performed herbicide application. A long-term seeding program that may involve strategically-timed herbicide applications, or perhaps even sodding, must be employed to fill-in the voids in turf cover caused by traffic.

### THE PROBLEM

Sports field locations that are heavily trafficked during fall and receive little to no overseeding during that period typically enter winter as bare soil. These voids in the turf cover are ideal conditions for summer annual weeds to germinate during the following spring months, mature in summer, and produce large quantities of seed in late summer. The weed seed is returned to the soil creating a seed bank that will replenish weed populations for years to come. As temperatures cool and mother nature brings the first frost during fall, summer annual weeds are reduced to fragile skeletons and continued field use quickly reverts the surface back to bare soil—an unsafe surface that can lack stability when wet (i.e. mud) and be hard-as-concrete when dry.

Crabgrass (*Digitaria* spp.), goosegrass, (*Eleusine indica* L.) and prostrate knotweed (*Polygonum aviculare*) are summer annual weeds that are routinely present on high traffic sports fields.

Crabgrass is among the most common summer annual grassy weeds that invade turf areas. It germinates when soil

temperatures have been 55 degrees F for 4 to 5 consecutive days, typically corresponding with early April to early May in the Northeast United States.

Goosegrass, sometimes referred to as silver crabgrass, is a grassy weed, has a recognizable zipper-like seedhead structure and germinates later in spring compared to crabgrass when soil temperatures in the upper ½-inch of soil are 60-65

» **HIGHLY TRAFFICKED** sports fields that receive little or no overseeding during fall and subsequent spring months may consist almost entirely of summer annual weeds such as prostrate knotweed in field centers during summer months. Photo by Brad Park.

degrees F for 12 to 15 consecutive days. Often observed in goal creases, field centers, and footpaths where pedestrians cut-across turfgrass sites, goosegrass tends to be more tolerant of compacted soil conditions compared to other grasses and broadleaf vegetation.

The earliest germinating summer annual weed that affects sports fields in the Northeast is prostrate knotweed, a weed in which seedlings have been observed in northern New Jersey in the first week of March. Prostrate knotweed seedlings are often misidentified as newly germinated turfgrass; however, prostrate knotweed is a broadleaf weed (i.e. dicot) and has two seed-leaves (i.e. cotyledons). In contrast, grass species (i.e. perennial ryegrass, crabgrass, etc.) are monocots and have a single initial seed-leaf. Similar to goosegrass, prostrate knotweed is a common problem on heavily trafficked sports fields constructed out of compaction-prone native soils.

While summer annual weed lifecycles and the season-specific timing of much sports field use presents an inherent challenge, an added dilemma is that some sports fields are routinely treated with conventional preemergence herbicides (i.e. pendimethalin, prodiamine, or dithiopyr) in March and April yet are predominantly bare soil in field centers and goal

Similar to goosegrass, prostrate knotweed is a common problem on heavily trafficked sports fields constructed out of compaction-prone native soils.

creases. This decision does not improve turf cover in these high traffic areas. The following sections will examine the choice of seeding bare soil locations in early spring, as soon as soil conditions allow, and applying postemergence herbicides for selective control of summer annual weeds.



>> **SUMMER ANNUAL WEEDS** die during fall and their location in the field is reduced to bare soil entering winter if no action is taken. Photo by Brad Park.



>> **Above: PROSTRATE KNOTWEED** is a broadleaf weed and the earliest germinating summer annual. New seedlings have been observed in early March in northern New Jersey and are often misidentified as seedling turfgrass or crabgrass. Photo by Brad Park.



>> **GROWTH BLANKETS** can be used to cover late fall- or spring-seeded locations of sports fields to accelerate the germination and establishment of desirable turfgrass when soil and air temperatures would otherwise significantly delay the formation of turf cover. Photo by Brad Park.

## SEEDING SOLUTIONS

**Seed selection.** In many school and municipal settings, the decision to seed high traffic fields as opposed to applying pre-emergence herbicide in the spring will require the Supervisor of School Buildings and Grounds, Department of Public Works Chief, or other manager with multidisciplinary facilities responsibilities to keep records of fields with histories of summer annual weed problems. Record keeping is an integral component of Integrated Pest Management (IPM), a strategy that seeks to reduce pesticide use through, in part, site

assessment and monitoring. These records can be used to direct pesticide application contractors to withhold applications of pre-emergence products from bare soil sports fields that should receive priority for spring seeding, thus reducing unnecessary pesticide inputs.

Blends of perennial ryegrass are the best cool-season turfgrass choice for this purpose, given the ability of this species to germinate and establish more readily in cooler soil temperatures prevalent in late fall and early spring compared to other cool-season species. While seed mixtures may be marketed for “high traffic” locations or “sports turf,” these products typically contain Kentucky bluegrass and/or tall fescue, two species better suited for late summer/early fall seeding timings and an allowance for ample grow-in.

Gray leaf spot resistant perennial ryegrass blends are a highly useful tool for sports field managers and should be seeded on fields in climatic/geographic regions that had a history of gray leaf spot problems. Gray leaf spot is particularly problematic in late summer and early fall, a time coinciding with the beginning of the fall sports season and a need for routine overseeding. The establishment of site-appropriate turfgrass species and disease resistant varieties will reduce the need for future pesticide inputs and is a building block of IPM in turfgrass.

**Seeding methods.** Controlling summer annual weeds with postemergence herbicides requires newly seeded perennial ryegrass to be mature enough to withstand such application. This maturity is typically described in pesticide labeling terms as two or three mowings or 28 days after emergence (Note: NOT 28 days after seeding). Efforts should be made to accelerate perennial ryegrass establishment in early spring, before the germination of summer annuals, so that perennial ryegrass is not adversely affected by an herbicide and summer annual weeds are still in an early growth stage, a period when they are most

susceptible to postemergence control.

Better perennial ryegrass establishment can be achieved by seeding at 8 to 10 lbs seed/1000 ft<sup>2</sup> and improving seed-to-soil contact through slit-seeding or using tractor-mounted machines that incorporate solid tine cultivation and seeding in one pass. Applying a starter fertilizer at the time of seeding and additional fertilizer 2 to 3 weeks following seedling emergence will hasten establishment. Using growth blankets immediately following seeding and starter fertilizer application is a highly effective method to improve turf establishment during periods when soil and air temperatures are not conducive for germination and establishment. This includes seeding projects that occur at the conclusion of the fall sports season. Routine monitoring of perennial ryegrass development under the blanket must occur so that mowing can commence as soon as possible.

Ultimately, an aggressive perennial ryegrass overseeding program must be employed during periods when fields are in use. Before games and practices, perennial ryegrass can be introduced to high traffic filed locations using a rotary spreader and allowing athletes to “cleat-in” the seed to achieve necessary seed-to-soil contact. Caution should be exercised if slit-seeders with vertically spinning blades or solid tine cultivation/seeding devices are used in the midst of in-season overseeding as these machines can potentially injure new seedlings resulting in previous overseeding efforts.

The goal of these seeding strategies is to maximize turf cover at all times. This is particularly important heading into winter when seed germination and turf growth is virtually nonexistent and a bumper crop of summer annuals is laying in the soil awaiting germination in the spring.

## HERBICIDE STRATEGIES

Herbicides such as mesotrione (e.g. Tenacity) and siduron (e.g. Tupersan) may be applied at the time of spring seeding to provide some preemergence control of crabgrass and not adversely affect the establishment of perennial ryegrass. Preemergence control of goosegrass and prostrate knotweed is not listed on the pesticide labels for either of these active ingredients. Additionally, mesotrione should not be ap-

plied at rates higher than 5.0 oz product/Acre to newly seeded perennial ryegrass. An early-to-mid March perennial ryegrass seeding timing may be more than a month prior to crabgrass germination; thus, an application of siduron or mesotrione in concert with seeding at this time is likely too early relative to crabgrass germination. Crabgrass emergence during late spring and early summer may follow. Addressing crabgrass and other summer weeds on a post-emergence basis is likely a better decision.

Newly germinated crabgrass or those plants up to one tiller are susceptible to postemergence applications of quinclorac (e.g. Drive XLR8). Per quinclorac labeling, goosegrass is not on the list of susceptible weeds. Perennial ryegrass may be seeded up

until the date of a quinclorac application; however, the application should be withheld for 28 days after emergence of perennial ryegrass. Quinclorac is a very unique herbicide active ingredient as it has postemergence activity on both grassy and broadleaf weeds common on sports fields including white clover, black medic and dandelion.

Fenoxaprop (e.g. Acclaim Extra) is labeled for control of young (1-leaf) to mature (5-tiller) crabgrass and goosegrass and can be applied to perennial ryegrass that is at least 28 days old. Not surprisingly, younger crabgrass and goosegrass plants are susceptible to relatively low fenoxaprop application rates, whereas four to five tiller grassy weeds require higher rates for effective control. Underscoring the need to thoroughly read and understand pesticide labels, as well as having the ability to identify both desirable turf species and targeted grassy weeds, Kentucky bluegrass is susceptible to injury when high rates of fenoxaprop are applied for control of grassy weeds that have eclipsed four tillers in growth.

Mesotrione is also labeled for postemergence control of crabgrass and goosegrass plants that are less than four tillers. Per pesticide label information, repeat applications with a nonionic surfactant are necessary and product rates should not exceed 5.0 oz/Acre on stands of perennial ryegrass. Newly seeded turf should be mowed two times or have emerged at least 28 days before (whichever is longer) before application of mesotrione.

Prostrate knotweed is most effectively controlled when the plant is young and has yet to form the thick spreading mat of vegetation associated with its name. Because it is a broadleaf weed, postemergence herbicides labeled for grassy weeds will not be effective for control.

Dicamba (e.g. Banvel) is the most effective broadleaf active ingredient for control of prostrate knotweed. To avoid herbi-

cide injury to new perennial ryegrass, the seedlings should be mowed a minimum of two times prior to dicamba application.

### SOD SOLUTIONS

While more expensive compared to seed, sod installation is a strategy that not only creates instant turf cover but also can also have the effect of suppressing weed emergence.

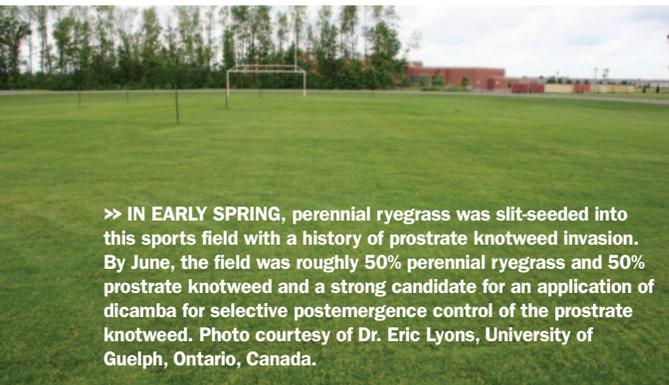
Modern turf milling equipment (e.g. Koro Field Topmaker, BLEC Combinator, etc.) can be used to remove the existing turf, thatch and 0.25 to 1.5-inch of soil before sodding. Fields with long-time summer annual weed problems would greatly benefit from this site-preparation strategy as a portion of the soil weed seed bank can be removed as part of this process.

Installation of high quality sod (free of annual bluegrass) that consists of improved varieties of Kentucky bluegrass or a mixture of tall fescue and Kentucky bluegrass will serve as new carpeting over bare, weed seed infested soil. Sodding is best performed at the end of the fall sports season; however, if spring sodding is to occur, sod should be installed as soon as it is available from growers and when soil conditions are dry enough to allow installation procedures without adversely compacting the soil. Ample time must be allowed for sod to establish before resumption of field use. Be sure to specify non-netted sod for sports fields.

Sports field managers are under increased pressure to reduce synthetic pesticide inputs. The problem of severe summer annual weed encroachment on sports fields cannot typically be addressed by herbicide applications alone. Establishment of turf cover using seeding or sodding methods must be integrated into the solution.

Additionally, recognize that a pesticide label is a legal document that contains information on product use, tank-mix compatibility, and turfgrass tolerance. The label must be thoroughly read and understood before applying a pesticide product. ■

*Brad Park is Sports Turf Research & Education Coordinator, Rutgers University, New Brunswick, NJ; a member of the Sports Field Managers Association of NJ Board of Directors; and a member of the STMA Editorial Communication Committee.*



>> IN EARLY SPRING, perennial ryegrass was slit-seeded into this sports field with a history of prostrate knotweed invasion. By June, the field was roughly 50% perennial ryegrass and 50% prostrate knotweed and a strong candidate for an application of dicamba for selective postemergence control of the prostrate knotweed. Photo courtesy of Dr. Eric Lyons, University of Guelph, Ontario, Canada.



>> IN ADVANCE of sod installation, milling equipment can be used to remove unwanted turf and weed cover as well as a portion of the weed seed bank in the soil. Photo by Brad Park.



>> Above: INSTALLING SOD can be a highly effective strategy to reduce summer annual weed populations. In this photo, goosegrass skeletons surround a weed-free sodded location in late November following the fall sports season. Photo by Brad Park.



&gt;&gt; Miami's Marlins Park.



&gt;&gt; ROOF POSITION to protect the press box until All-Star break.



&gt;&gt; WINTER SHADE line with lights out in use soccer mode.

## First-year turf review: Marlins Park in Miami

*Editor's note: We asked Chad Mulholland, the director of grounds for the Miami Marlins' new stadium that opened last spring, how his first year went working with the turf in the retractable roof park. Here is his response.*

**A**S WITH ALL RETRACTABLE ROOF STADIUMS we have had our share of good and bad surprises. You have expectations going in and then you realize it's not what you thought it would be like for some situations but it's better for others.

The Celebration bermudagrass was chosen before I was hired. Alan Sigwardt and his crew had some test plots they had used at Sun Life Stadium (in Miami); I believe they had a few different Bermuda varieties as well as a paspalum plot. Over the course of the summer the Celebration out-performed or was close to the best performer of the tested varieties. Being in Florida I think the comfort level of using Celebration was an easy decision. Jordan Treadway, who manages our spring training site in Jupiter, FL uses Celebration and it is in amazing shape year round. We had some moderate success with our Celebration but ran into some unknowns as well as some predictable issues.

The number one problem was natural sunlight. We either had zero or sometimes up to 3 hours per day depending on the area of the field and the time of year. The other big issue that I think affected us was the constant temperature change inside the building. We would go from an air temperature of 115-120 F in July to a temp of 68-72 F by the end of night games. Then we would open back up and it would be in the mid 90s all night. I have never seen a study of constant air temperature changes but I don't think it's healthy for a plant.

Areas where we had ample sunlight such as the center of our outfield I thought the grass performed well after we established a nutrient

base and put some organics into the soil. We are 100% sand and it took a while to keep our nutrients in our rootzone. I believe our sand has some sustainable nutrient base now and we should be better in the upcoming season.

Another issue that was unforeseen was our sod layer. We received some great-looking sod for the install and it was grown on sand, but it was a completely different composition from our rootzone. The sand was approved and appeared compatible, and it was until you added constant shade. The sand the sod was grown on had about 70% fine sands in it; our rootzone had around 17%. Where we had sufficient sun it was not a problem but where we had permanent or a majority of shade it stayed moist and wouldn't shoot any roots.

In those spots the Bermuda thinned out and tried to grow vertically. So we had to resod a significant amount before Opening Day and again in late May. By late May the sun is rising in a different spot and we had sunlight in right field. However, we have a carport type roof in left that blocks sun in left during the summer so our shade issue shifted from right to left. They have a huge window in left that retracts to let in sunlight so we get some early morning sunlight but it is minimal and it shifts quickly as the sun rises. We don't get completely out of shade in left field until about 1:30. We would close the roof about 4-4:30 if weather permitted so on a good game day we received around 3-4 hours of sunlight in left field.

### ROOF CLOSED MORE THAN ANTICIPATED

The roof was closed a lot more than initially anticipated and we never had full control

of the roof until around the All Star break. It was tested at different speeds and adjusted and re-adjusted and re-tested etc. It was a constant pain in our grow-in schedule. So even though it was 90 degrees outside and bright and sunny, we had the roof closed some days to test air conditioning, fix small roof leaks and seals, and to test the roof itself. The roof shuts in about 13 minutes but it isn't that easy; someone has to physically walk the tracks the roof rides on before any buttons are pushed. The whole process from the time I call for a closure until it's actually closed is usually about 30 minutes.

With our being in South Florida and that constant threat of rain, we have a tarp and it saved us a few times during the year. We have tried to use the roof to the best of our advantage. We have five different positions we refer to when closing or partially setting the roof. Even after commissioning we had other small issues to hammer out before we were comfortable with leaving the roof completely open on rain days when the team was on the road. We never installed windows on the press box and we kept the roof about 1/3 of the way closed for any rain threat until early July. If we left it open the press box would get flooded and it leaked to the luxury boxes underneath them. So the entire 1st base side of the skirts never got rain until July and it also robbed us of about 2-3 hours of sun a day as well basically the shade line ran from over top of the pitcher's mound when it was closed in that position.

Another thing we never anticipated was we could use the roof as a tarp if we had a threat of rain overnight we would close the roof till it

covered our dirt and leave centerfield and left field open to receive rainwater. With the threat of rain almost every night we saw it was beneficial to us by not having to tarp every night; our disease suppression was kept to a minimum and it helped on labor by not needing extra staff in early to yank off the tarp.

### WORKING THE SHADE AREAS

Some of the things we did to keep some of the areas playable were reducing our water in the shaded areas as well as treating them with specific product. We had trouble with rooting in the heavily shaded areas and had to be careful with any aeration so we relied heavily on spike aerating in those spots. If I had it to do all over again we would have overseeded to alleviate the appearance of the Bermuda in the shade as it thinned quickly.

We tried a few products that were meant to emulate sunshine or at least supply protein that sunshine would let the plant produce if it had sunshine. I am reserved on my opinion on them because I don't think they made a difference since we had no sunshine at all. But when we had any sunshine even in small amounts we did notice improved turf conditions. We tried to aerate as much as we could to rid the sod layer of the sand that came in with it and we had a pretty good stand of grass and started to see good rooting once the roof was under our control.

It really turned out to be a blessing that the roof was shut as much as it was in the early part of the year because management saw what a difference the roof made in quality of turf. Since this is our first winter in the building we are not real sure what we can do to improve the situation we are in. We will learn more as the winter time goes on.

When I took this position I knew we were an all-season venue. We have certainly lived up to that in our first season and we are still learning our stadium and what will and will not work and the changes we need to make. It leaves us with very little time for repair or rest. It isn't uncommon to have a dinner event followed up by a sporting event on back to back days or in the same week. What really hurts is that whether we have inclement weather or ideal weather the roof is often shut to accommodate our guests.

Our best tool for repair has become sodding. It isn't our first choice but due to no sunlight at all it is our best tool to guarantee a safe and playable field in our south end. We have tried to customize our maintenance schedule

as much as possible to accommodate for the shade but it's just impossible to grow grass without sunlight. We have altered our watering, our feeding and our agronomic practices but still have the same problem shade.

### GOING TO PASPALUM IN 2013

We will be changing grass variety and sod producer this coming up season in combination with a more suitable sand profile so we hope that eliminates some of our issues. We will have Platinum TE paspalum on our infield and sidelines and 419 Bermuda in our outfield. In 2014 we will be converted over to all Platinum TE. Dan Bergstrom of the Houston Astros made the switch a few years back and after consulting with him over the past 9 months we feel it is our best way to move forward. Houston's environment is probably the closest to Miami's of all the retractable roof stadiums.

The one thing I have learned is that even though we have retractable roofs we all have different problems due to weather or positioning of our stadiums. I have an even deeper respect for the guys who have been dealing with the roofs for years. In my mind I thought we would be fine due to our air temperature and our soil temperatures but I couldn't have been more wrong; the amount of light is everything.

Our infield material comes from Natural Sand in Pennsylvania. Grant McKnight has been a huge resource not only for his infield mix but his knowledge of soil gradations in general. We made the mistake of not getting the proper compaction for our exhibition games, and Grant came down the next day to help us with our problem. I had worked with the Natural Sand product in the past but never had to use the same compaction method as we did here. Once we had our ideal compaction it performed as expected. We just had to be careful of our watering schedule and the roof closures. If we have a 1 pm Sunday game and we close the roof at 10:30 am we have to have our base saturation already completed and the infield nailed up while we have sunlight.

If we don't get crusting with the nailed up material because we wait too long, the roof traps the moisture and it slows down the drying of the loose material. By closing the roof 10-15 minutes early it has cost us 2 hours of preparation time during the season. So we really have to be in constant communication with our front office. We will not make any changes to the dirt this year other than we now have expectations of how it will perform with the roof open or closed and our time table of when to

do certain maintenance practices. We really like our infield mix and have no intention of changing it. The only thing we might change is the color or the sizing of our conditioner.

We did not overseed the turf in 2012; it came from our sod supplier unseeded and very green. It looked fantastic. It only started to change colors when it got limited sunlight and consistent air temp changes from some of the AC testing. This year we will overseed but nothing too heavy. It adds to the visual appeal for our fans and management and also buys us some time with the shade issues. We know once we get sunlight our Bermuda will survive. So our thinking is we can keep the turf's appearance with the grow lights and delay the Bermuda decline somewhat in check with the lights as well. Once summer gets here we will just move the lights to left field and concentrate on the shaded areas affected by the sun's summer position. We think if push came to shove we could probably keep some ryegrass in the turf year round with the roof being closed as much as it is. We would just have to be very alert with the fungicide applications when the team is on the road and the roof is opened as much as possible.

We got mixed reaction from the players; some of them were curious on the decline of the conditions because they are not around during road trips and they assumed the roof is always open or unaware of events held on the field that affect the turf directly or the roof being closed as well as flooring on the turf. Once we educated some of the guys most of them knew we were doing our best but some just never understood the limitations we faced.

We got pretty good feedback as far as some of them knew there would be growing pains. We got compared to Arizona and Houston as they struggled the first few years as well. It was really good to hear some of our players as well as some of the visiting teams tell us of the improvement they saw as we gained more control of our growing environment. Late in the year Jeff Porter, the Braves trainer, told us he thought we looked better at the end of the year than any of the retractable roof stadiums had in their first year. We didn't get many compliments so we took it as a positive sign we were doing something right.

The one thing we realized is we have no wiggle room if we miss something. If we don't anticipate a prolonged roof closure or a week-long spell of bad weather it affects us more than most venues. We just simply don't have the same ability to recover as rapidly. ■