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Southern Turf Solutions

Your Guide to Healthy, Quality Turf

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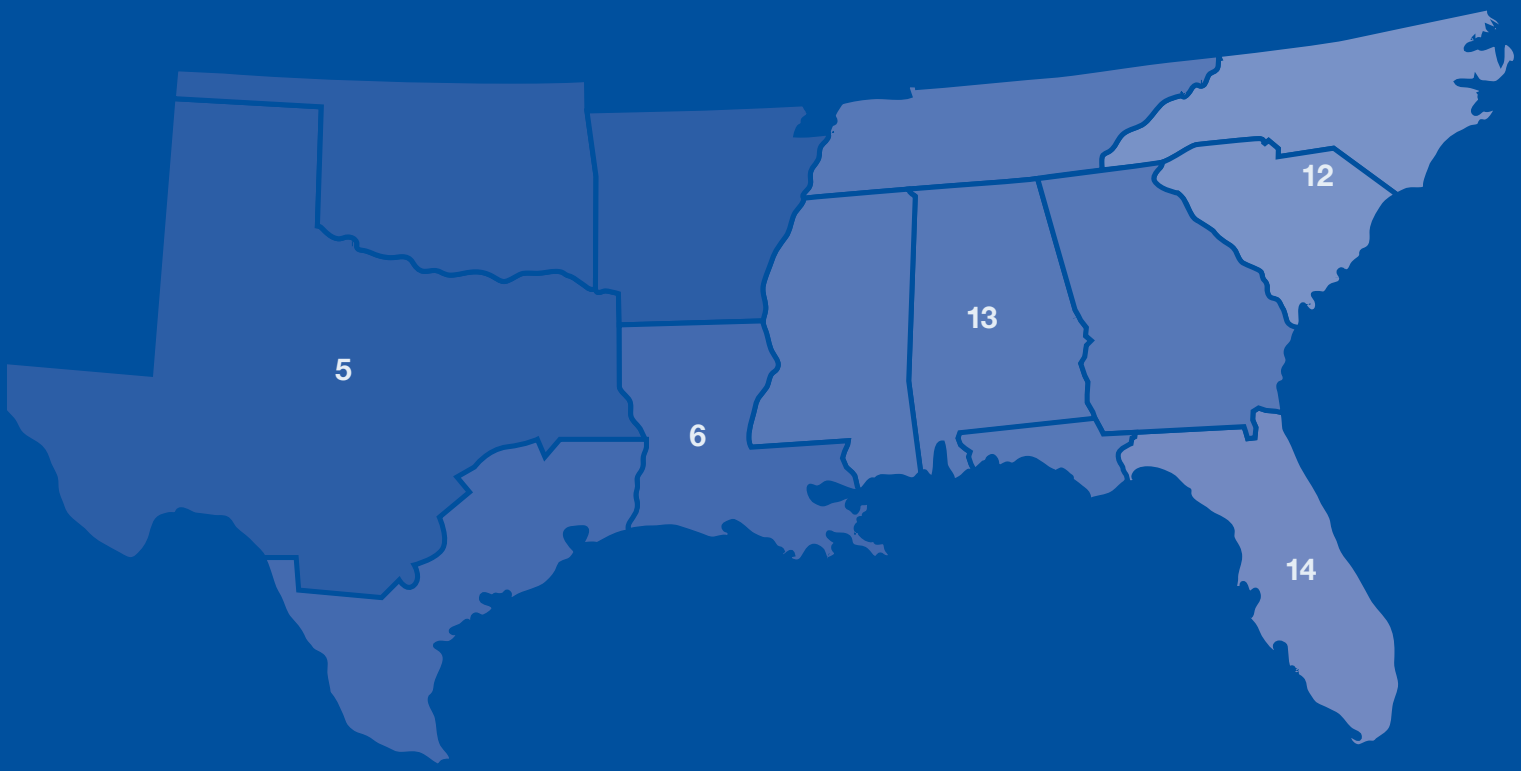

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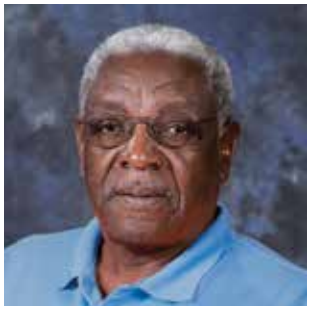

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Innovative Solutions That Meet Your Regional Needs

At BASF, we create chemistry that helps you grow resilient, healthy turf for optimal playing conditions. Our commitment is to provide you with innovative fungicides, herbicides and insecticides that complement your agronomic programs and help you achieve your turf management goals.

When you purchase BASF solutions, you have the confidence that comes from choosing high-quality products, backed by a dedicated team of experts that know your business and the challenges you face every day. Our Crop Protection Division invests $1 million per day on research and development, which has led to innovations like **Lexicon**® **Intrinsic**® brand fungicide and **Xzemplar**® fungicide. In the coming years, we will continue to develop innovative solutions that meet your needs.

This regional solutions guide includes recommended BASF products that are ideal for the control of primary diseases and weeds in your region as well as turf colorants that enhance the appearance of your course. Within this directory, you will also find a valuable overview of the biggest problems that affect the turf in your region, from key diseases to important weeds. Note that BASF fungicides control up to 27 diseases, and our herbicides control hundreds of problem weeds.

To discuss your specific needs, please contact your BASF sales representative, technical representative or distributor sales representative. You may also visit us online at betterturf.basf.us

We look forward to hearing from you.

Southern Turf Diseases

BASF fungicides provide rapid and long-lasting residual control of up to 27 turf diseases, the most problematic of which are shown and described here. On the following pages, you will find recommended spray programs that deliver preventive and/or curative control of these diseases and others, as well as a list of those diseases and the BASF products that control them.

Spring Dead Spot

Spring dead spot is considered by some to be the most problematic disease on bermudagrass and bermudagrass hybrid turfgrasses that go dormant and are established for at least three years. Circular, straw-colored patches characterize the infection when grasses begin to break dormancy in the spring. Disease development begins in late summer and early fall and grows rapidly in roots and stolons of turfgrass that have good moisture in moderate soil temperatures of 50°-68°F. Turfgrass under lower mowing heights, heavy thatch, and nutrient imbalances and compaction can increase disease severity. Turfgrass that is less susceptible to winterkill or that exhibits greater cold hardiness can be less affected by spring dead spot.

above:
Spring dead spot

Photo: Dr. Bruce Martin, Clemson University Field Day, 2015

The fungi associated with the cause of spring dead spot are *Ophiospharella korrae*, *O. herpotricha, O. narmari*, and sometimes *Gaeumannomyces graminis* in the Southern United States. *Ophiospharella korrae* is found mostly in the Eastern and Southern United States; *O. herpotricha* in the plains states (Oklahoma, Arkansas and Missouri); and *O. narmari* is found to be more common in California. It is known that a toxin from the fungus can remain in the soil, contributing to lack of turfgrass growth in these spots following infection.

at left:
Pythium spp.

Photo: N.C. State University

***Pythium* spp.**

Pythium spp. can cause foliar or crown and root rot, generally under different weather patterns, turfgrass susceptibility, and maintenance routines. The typical foliar *Pythium* blight (aka cotton web) appears during warm and humid weather patterns, develops rapidly, and can spread from round patches to streaks across greens and tees with water patterns. A foliar greasy surface appearance characterizes these larger areas. Cool-season turfgrass can be more susceptible.

Crown and root rots caused by *Pythium* spp. are slower to develop and can occur anytime that the cool and wet conditions associated with spring and autumn (winter in Florida) dominate.

Pythium root dysfunction caused by a complex of fungi dominated normally by *P. volulum* is problematic on bentgrass greens whereas other *Pythium* species have been associated with turf decline on warm season greens, especially bermudagrass hybrids. Patches can develop and become large areas of turfgrass decline that appear off color, from yellow to reddish brown, ultimately resulting in complete death of the turfgrass across the green. Root and crown *Pythiums* generally do not have foliar mycelia present and clinical diagnostics can best confirm these diseases.

above:
Pythium root dysfunction

Photo: Dr. Bruce Martin, Clemson University

top to bottom:
Brown patch; large patch; leaf and sheath spot

Brown patch photo: Dr. Henry Wetzel, Consultant

Large patch photo: Dr. Mike Richardson, University of Arkansas

Leaf and sheath spot photo: Jim Kerns, NC State University

Patch Diseases *(Rhizoctonia* spp.)

Brown patch of cool-season turfgrasses, large patch of warm-season turfgrasses caused by *Rhizoctonia solani,* and leaf and sheath spot diseases caused by *R. zeae* and *R. oryzae* infect both warm- and cool-season turfgrasses. Also, *R. cerealis*, or yellow patch, generally associated with bentgrass greens, has occurred in the winter months. In the Southern region, brown patch on bentgrass greens occurs as day temperatures along with humidity increase in summer. In the mountain regions, fairways of cool-season blends are also susceptible. Grayish to tan patches develop. Smoke rings are noticeable on close-cut turf greens.

Large patch caused by *Rhizoctonia solani* (AG2-2LP) infects warm-season turfgrasses. Zoysiagrass and seashore paspalum turfgrasses – used from greens and collars to bunker faces and fairways – are most susceptible to large patch development. Centipedegrass and St. Augustinegrass are sensitive as well.

As soil temperatures drop below 70°F in the early fall, these turfgrasses can become infected. Cool and wet conditions in the fall and spring favor disease development and extended infection. If spring remains cold and wet, the severity of disease can require multiple protective applications. When infected, plant sheaths become reddish-brown to bronze colored; when highly infected, the sheaths turn tan to black and turf dies out in large patches.

It is much harder to predict conditions that favor leaf and sheath spot* caused by *R. zeae*, and this disease can be very difficult to control. Laboratory diagnostics of *R. zeae* are key, as is timing of the protective fungicide before patches and rings can extend over large areas of the greens. In the South – excluding Florida – the disease is associated with mid-summer to mid-fall temperatures and moisture. Research is currently exploring which nutrients may help fungicides provide more effective overall control.

* *Leaf and sheath spot caused by Rhizoctonia zeae or Rhizoctonia oryzae (Waitea circinata var. zeae or W. circinata var. oryzae, Chrysorhiza zeae or Chrysorhiza oryzae)*

Fairy Ring

Fairy rings can occur through the growing season in any region of the country and in cool- and warm-season turfgrasses. A number of soil- and thatch-inhabiting fungi belonging to the "mushroom-forming" group basidiomycetes cause fairy rings of different types. The presence of a fungal growth under the turfgrass is indicated by any of the following: an irregular pattern of turfgrass death or a ring of dead turfgrass; a dark green stimulated ring of turfgrass; or a ring or an arrangement of mushrooms or puffballs with no other effects to the turfgrass.

Turfgrass under lower moisture and watering conditions as well as lower fertility and higher thatch production are more susceptible to fairy ring development. Sand-based greens can be more susceptible. Knowing whether you have developed hydrophobic conditions in your soil profile may dictate a routine wetting agent program to assist with moisture retention and breakdown of the organic layers. Applications of fungicides and wetting agents have provided relief but may not eradicate the possible ring formation.

below:
Fairy ring types

Photos: Dr. Mike Fidanza, Pennsylvania State University

Bipolaris Leaf Spot

In warm-season turfgrasses, bipolaris leaf spot is caused principally by *Bipolaris cynodontis, B. sorokiniana, B. spicfera,* and *Exserohilum* spp. Leaf spot infection occurs on leaves, stolons and rhizomes, first appearing tan to straw in color. Individual spots can coalesce and form irregular patches if not controlled. Overall thinning of the turfgrass may occur. If turfgrass is lost, then algae can be seen filling these canopy voids.

Bipolaris leaf spot occurs in warm-season turfgrass during wet and cooler weather, from late summer through autumn and spring. In bermudagrass that does not go dormant, the infection period could extend into winter months. Leaf spots occur in warm-season turfgrass during wet and cooler weather from late summer to autumn and then into spring. In bermudagrass that does not go dormant the infection period could extend into winter months. Lean fertility programs and low mowing heights can aggravate infection. Sometimes severe leaf spot can be mistaken for the occurrence of chronic nematode problems.

above:
Bipolaris leaf spot

Photo: Dr. Bruce Martin, Clemson University

Disease Spray Program Recommendations

Program 1: Fall Management of Non-Dormant Bermudagrass Greens and Tees

App #	Product	Timing	Rate/ 1,000 sq ft	Disease Target	Application Volume
1	**Lexicon® Intrinsic®** brand fungicide	End of summer through winter	0.47 fl oz	Bipolaris leaf spot	Application needs to target leaf spot and leave fungicide on foliage*
2a	Segway fungicide + 26GT fungicide + Mancozeb fungicide	Preventive or early curative	0.9 fl oz + 4 fl oz + 4 fl oz	Leaf spot and *Pythium*	Follow individual product label for target disease treatment
2b	**Xzemplar®** fungicide	Preventive or early curative	0.26 fl oz	Fairy ring and leaf spots	2 gal/1,000 sq ft – Fairy ring requires additional irrigation; leaf spots do not irrigate
3	**Honor® Intrinsic** brand fungicide	Late Oct. through Nov.	0.47 fl oz	Bipolaris leaf spot, fairy ring, Bermudagrass decline	2 gal/1,000 sq ft – Application needs to leave fungicide on foliage. See footnote for contact fungicide tank mix
4a	Prostar fungicide, Mirage Stressgard or Torque fungicide	Preventive or early curative	See product label	Fairy ring	2 gal/1,000 sq ft + ¼ inch of water following application
4b	Segway fungicide + 26GT fungicide + Mancozeb fungicide	Preventive or early curative	0.9 fl oz + 4 fl oz + 4 fl oz	Leaf spot and *Pythium*	Follow individual product label for target disease treatment

* *If cloudy, humid and wet conditions persist, the shorter length of control may be anticipated. Combine or rotate with contact like Daconil or Mancozeb fungicide to extend control. When controlling leaf spot, avoid applications of Plant Growth Regulators (PGRs) at the time of application to allow the turfgrass to grow.*

Program 2: Fall Management of Soil Diseases on Dormant Bermudagrass Greens and Tees

App #	Product	Timing	Rate/ 1,000 sq ft	Disease Target	Application Volume
1	**Lexicon Intrinsic** brand fungicide	Preventive Sept. 15 - Oct. 10	0.47 fl oz	Spring dead spot*†	2 gal/1,000 sq ft + additional turns on the head directly following the application
2a	Signature XTRA Stressguard fungicide + Daconil Action fungicide	Preventive or early curative	6 fl oz + 3.2 fl oz	*Pythium* and leaf spots	Follow individual product label for target disease treatment
2b	**Xzemplar** fungicide	Preventive or early curative	0.26 fl oz	Fairy ring †	2 gal/1,000 sq ft + ¼ inch of water following application
3a	**Lexicon Intrinsic** brand fungicide	Preventive Oct. 15 - Nov. 10	0.47 fl oz	Spring dead spot*†	2 gal/1,000 sq ft + additional turns on the head directly following the application
3b	Segway fungicide + 26GT fungicide + Mancozeb fungicide	Preventive or early curative	0.9 fl oz + 4 fl oz + 4 fl oz	Leaf spot and *Pythium*	Follow individual product label for target disease treatment
4	ProStar fungicide	Preventive or early curative	2.2 fl oz	Fairy ring	2 gal/1,000 sq ft + ¼ inch of water following application

* *The second application should be out at least one month prior to beginning of winter dormancy. Applications should be made to actively-growing turfgrass.*

† *Subject to BASF FIFRA Section 2(ee) Recommendation for spring dead spot and fairy ring. See www.CDMS.net for BASF Technical Information Bulletin.*

Program 3: Control of *Pythium* spp. on Bentgrass or Bermudagrass Greens and Tees

App #	Product	Timing	Rate/ 1,000 sq ft	Disease Target	Application Volume
1	Segway fungicide	Preventive or early curative when weather conditions favor disease development	0.9 fl oz	*Pythium* spp. - blight or root rot	2 gal/1,000 sq ft
2	**Lexicon® Intrinsic®** brand fungicide or **Honor® Intrinsic** brand fungicide	2 weeks following initial application; 10-14 day interval when weather conditions remain challenging	0.47 fl oz	*Pythium* spp. - blight or root rot	2 gal/1,000 sq ft*
3	Chipco Signature fungicide	2 weeks after last application	4-6 fl oz	*Pythium* spp.	2 gal/1,000 sq ft
4	**Lexicon Intrinsic** brand fungicide or **Honor Intrinsic** brand fungicide	2 weeks following initial application; 10-14 day interval when weather conditions remain challenging	0.47 fl oz	*Pythium* spp. - blight or root rot	2 gal/1,000 sq ft*

* *If treating Pythium root rot, make sure to provide additional irrigation directly following the application to move fungicide into the soil.*

* *Presence of Pythium can be both foliar blight and root and crown rot.* ***Lexicon Intrinsic*** *brand fungicide is best used as a preventive in a rotation with Pythium-specific fungicides. Segway fungicide, Banol fungicide and Koban fungicide are products of choice when making curative applications, followed by residual applications of* ***Lexicon Intrinsic*** *or* ***Honor Intrinsic*** *brand fungicides.*

Program 4: Control of *Rhizoctonia* spp. in Cool-Season Turfgrasses

App #	Product	Timing	Rate/ 1,000 sq ft	Disease Target	Application Volume
Brown Patch					
1	**Lexicon® Intrinsic®** brand fungicide **Honor® Intrinsic** brand fungicide	When conditions are present for brown patch summer - 2 week interval	0.47 fl oz 1.11 fl oz	Brown patch on bentgrass greens	2 gal/1,000 sq ft
2	Daconil fungicide	When conditions remain present for brown patch 7-10 day interval	3.2 fl oz	Brown patch on bentgrass greens	2 gal/1,000 sq ft
3	**Xzemplar®** fungicide	When conditions remain present for brown patch 2 week interval	0.26 fl oz	Brown patch on bentgrass greens	2 gal/1,000 sq ft
4	26 GT + Daconil fungicide	When conditions are present for brown patch 2 week interval	0.47 fl oz 3.2 fl oz	Brown patch on bentgrass greens	2 gal/1,000 sq ft

Program 5: Control of *Rhizoctonia* spp. in Warm-Season Turfgrasses

App #	Product	Timing	Rate/ 1,000 sq ft	Disease Target	Application Volume
Large Patch					
1	**Trinity®** fungicide	Early Sept. when conditions are present for large patch	1.5 fl oz	Large patch on warm-season greens or fairways	2 gal/1,000 sq ft
2	**Xzemplar** fungicide	Later in fall, prior to dormancy	0.26 fl oz	Large patch on warm-season greens or fairways	2 gal/1,000 sq ft*
3	**Xzemplar** fungicide	In spring, at the time of the first green-up. Repeat application within 21 days if weather remains cool and wet	0.26 fl oz	Large patch on warm-season greens or fairways	2 gal/1,000 sq ft

* *Please note that this application will also protect the turfgrass from dollar spot and leaf spots caused by Bipolaris spp. as the turf becomes dormant.*

Program 6: Control of *Rhizoctonia zeae* in Warm- or Cool-Season Turfgrass Greens

App #	Product	Timing	Rate/ 1,000 sq ft	Disease Target	Application Volume
1	**Lexicon® Intrinsic®** brand fungicide + Daconil fungicide	Early summer Control of this disease target should be with applications on 14-day interval	0.47 fl oz 3.2 fl oz	*Rhizoc. zeae* - warm-season turfgrass greens	2 gal/1,000 sq ft
2	Mirage Stressgard or Torque fungicide	Summer	See product label(s)	*Rhizoc. zeae* - warm-season turfgrass greens	2 gal/1,000 sq ft
3	**Xzemplar®** fungicide + Daconil fungicide	Summer	0.26 fl oz 3.2 fl oz	*Rhizoc. zeae* - warm-season turfgrass greens	2 gal/1,000 sq ft*
4	ProStar fungicide	Summer If symptoms persist continue to rotate products, referring back to top treatments (1-4), every 2 weeks into fall	See product label	*Rhizoc. zeae* - warm-season turfgrass greens	2 gal/1,000 sq ft

* *Please note that these applications will also provide preventive protection for fairy ring and bipolaris leaf spot during this time period if weather conditions become cloudy and wet for extended periods. Reference CDMS for BASF FIFRA 2(ee) Recommendations for* ***Xzemplar*** *fungicide.*

Turf Fungicide Solutions

Broad-Spectrum Plant Health Solutions

Lexicon® Intrinsic® brand fungicide

For the ideal plant health foundation, apply four times a year* for cool-season and warm-season greens. **Lexicon Intrinsic** brand fungicide controls 27 turfgrass diseases, providing resilient, healthy greens.

Honor® Intrinsic brand fungicide

Keep your fairways and tees in top-notch condition. Provides two modes of action, delivering superior control of top diseases plus proven plant health benefits.

Insignia® SC Intrinsic brand fungicide

This proven standard provides reliable, cost-effective disease control and plant health benefits for fairways and greens.

Pillar® G Intrinsic brand fungicide

A broad-spectrum granular fungicide for the control of patch diseases such as brown and large/zoysia patch, bermudagrass decline and others, for a total of 27 diseases.

Dollar Spot Solutions

Xzemplar® fungicide

Maximizing utility on greens and fairways for control of patch diseases, fairy ring and leaf spots. **Xzemplar** fungicide provides the ultimate control of dollar spot.

Emerald® fungicide

Provides 21- to 28-day preventive dollar spot control. Excellent for fairways, greens, and tees.

Trinity® fungicide

Delivers unbeatable value for controlling a broad spectrum of diseases, including dollar spot, anthracnose, and patch diseases. The ideal tank mix or rotation partner for **Intrinsic** brand fungicides to control your most troublesome turf problems. Best used in the spring and fall of the year in Southern turfgrass management.

* *Now labeled for 4 applications per year at the highest rate, which is 0.47 fl oz/1,000 sq ft.*

Technical Overview

	Lexicon Intrinsic brand fungicide	Honor Intrinsic brand fungicide	Insignia SC Intrinsic brand fungicide	Pillar G Intrinsic brand fungicide	Xzemplar fungicide	Emerald fungicide	Trinity fungicide
FRAC group(s)	7 + 11	7 + 11	11	3 + 11	7	7	3
Packaging	4x 21 fl oz	6x 3 lb 1x 36 lb	4x 30.5 fl oz 4x 122 fl oz 2x 2.5 gal	30 lb bag	2x 114 fl oz 4x 11.4 fl oz	10x 0.49 lb 50x 0.49 lb	2x 2.5 gal
Formulation	Suspension concentrate	Water-dispers-able granule	Suspension concentrate	Granule	Suspension concentrate	Water-dispers-able granule	Suspension concentrate
Length of control	Up to 28 days	Up to 28 days	Up to 28 days	Up to 28 days	Up to 28 days	Up to 28 days	14-21 days
Rate range	0.34 - 0.47 fl oz/ 1,000 sq ft	0.55 - 1.11 oz/ 1,000 sq ft	0.4 - 0.7 fl oz/ 1,000 sq ft	3 lbs/ 1,000 sq ft	0.16 - 0.26 fl oz/ 1,000 sq ft	0.13 - 0.16 oz/ 1,000 sq ft	1.0 - 2.0 fl oz/ 1,000 sq ft

Disease Spectrum Overview

Major diseases controlled	Lexicon® Intrinsic® brand fungicide	Honor® Intrinsic brand fungicide	Insignia® SC Intrinsic brand fungicide	Pillar® G Intrinsic brand fungicide	Xzemplar® fungicide	Emerald® fungicide	Trinity® fungicide
Algae (suppression)					■		■
Anthracnose	■	■	■	■			■
Bentgrass dead spot	■	■	■	■		■	
Bermudagrass decline	■	■	■	■			
Brown patch	■	■	■	■	■		■
Brown ring patch	■	■	■	■			■
Dollar spot	■	■	■	■	■	■	■
Fairy ring	■	■	■	■	■◊		■
Fusarium patch	■	■	■	■			■
Grey leaf spot	■	■	■	■			
Large patch	■	■	■	■	■		■
Leaf spot	■	■	■	■	■◊		
Melting out	■	■	■	■			
Necrotic ring spot (suppression)	■	■	■	■			■
Pink patch	■	■	■	■	■†		■
Powdery mildew	■	■	■	■			
Pythium blight	■	■	■	■			
Pythium root dysfunction	■	■	■	■			
Rapid blight	■	■	■	■			
Red thread	■	■	■	■			■
Rhizoctonia leaf or sheath spot	■	■	■	■	■◊		
Rust	■	■	■	■			■
Snow mold	■	■	■	■			■
Spring dead spot	■◊						
Summer patch	■	■	■	■	■		■
Take-all patch	■	■	■	■			■
Yellow tuft	■	■	■	■			
Zoyzia patch	■	■	■	■	■		■

◊ *Now subject to BASF FIFRA 2(ee) Recommendation for fairy ring, leaf spot, rhizoctonia leaf or sheath spot, spring dead spot in certain states. See www.CDMS.net for BASF Technical Information Bulletins.*

† *Tank mix suggested.*

Southern Weeds

BASF offers highly effective pre- and postemergent herbicides that control Southern turfgrass weeds. The five most prevalent Southern weeds are shown and described here. On the pages that follow, recommended weed control spray programs and a Weed Spectrum Overview detail how BASF products control these weeds.

above:
Annual bluegrass within turfgrass

Photo: Shawn Askew Virginia Polytechnic Institute and State University

Annual Bluegrass

Annual bluegrass *(Poa annua)* is a problematic, winter annual, grassy weed found infesting turfgrass stands around the globe. Although it has been cultivated on putting greens in the Northern U.S., annual bluegrass infestations on greens, fairways, roughs and lawns disrupt the aesthetics of the area, and in the case of athletic fields, its shallow root system can reduce athlete safety. Annual bluegrass has a light green color and produces copious numbers of seedheads in early spring. In summer, its lack of tolerance for drought, heat, and overall stress reduces stand numbers and produces an undesirable, voided appearance. This weed easily tolerates a broad range of cutting heights, from several inches to several millimeters.

Annual bluegrass can be identified by its light green color, tall, membraneous ligule, and folded vernation. Seeds are produced in a whitish-green pyramidal panicle.

Currently, there are few postemergent herbicides labeled for control of annual bluegrass in cool-season turfgrass, but herbicides in the sulfonylurea group will selectively control annual bluegrass (and other cool-season turfgrass species) in warm-season turfgrass. There are several options for controlling annual bluegrass preemergence, but consult labels for turfgrass restrictions. See specific labels for selectively postemergent control since products can severely damage cool-season grasses or can only be used on dormant turfgrass.

Crabgrass

Crabgrass is a summer annual grass commonly found infesting turfgrass stands. There are several species that are commonly found in the Southern region: smooth crabgrass *(Digitaria ischaemum),* large crabgrass *(Digitaria sanguinalis),* and Southern crabgrass *(Digitaria ciliaris).* Crabgrass germinates when soil temperatures exceed 57-64°F for extended periods of time in spring, and dies following decreased temperatures and the first killing frost in fall. Crabgrasses tiller aggressively if left unchecked, and are capable of rooting at tiller nodes. Crabgrass germinates readily in bare areas, so a strong, dense turfgrass sward is a good defense against infestation.

Smooth crabgrass has a smooth, membranous ligule (1.0-2.0 mm), with sparse hairs around the collar region, but no hairs are visible on the rest of the plant. Large crabgrass has an uneven, membranous ligule (1.0-2.0 mm) with dense hairs on the collar and overall leaf surface. Southern crabgrass has a frayed, membranous ligule (1.0-3.0 mm) with dense hairs on the sheath and collar, but sparse or absent hairs on leaf surfaces. All species have a rolled vernation.

There are several effective pre- and postemergent herbicides labeled for controlling crabgrass in cool- and warm-season turfgrass, which can be referenced in the Weed Spectrum Overview in this guide.

above and left:
Crabgrass in various turfgrasses

above:
Goosegrass; green kyllinga

Goosegrass photo:
Dr. Shawn Askew,
Virginia Polytechnic Institute
and State University

Goosegrass

Goosegrass *(Eleusine indica)* is another summer annual grass that is commonly found infesting turfgrass stands where the turfgrass is thinned from biotic or abiotic factors. Goosegrass also thrives in compacted areas such as driveways, cart paths, or other areas subject to high traffic. Plant growth is similar to crabgrass, but overall plant morphology is different.

Goosegrass has a fringed, membranous ligule (0.9 mm), and a prostrate growth habit. Often, the center of the tillers is whitish-silver. Seedheads are shaped loosely like bird's feet. Sheaths are typically hairy, with sparse hairs found elsewhere on the plant. Goosegrass has a folded vernation.

There are several effective pre- and postemergent herbicides labeled for controlling goosegrass in cool- and warm-season turfgrass, which can be referenced in the Weed Spectrum Overview in this guide.

Kyllinga and Sedges

Kyllinga and sedges are not grasses, but perennial grass-like plants commonly found infesting turfgrass stands that tend to remain wet. Green kyllinga *(Kyllinga brevifolia),* yellow nutsedge *(Cyperus esculentus),* and purple nutsedge *(Cyperus rotundus)* are most easily identified by their triangular stems. Kyllinga species typically grow about four to five inches in height, usually no taller than eight inches in height. Yellow nutsedge can be much taller, often exceeding 12 inches in height with finely pointed leaves; purple nutsedge has both tall and short spikes and boat-shaped leaf tips.

Kyllinga persists via mats of rhizomes, or underground stems, and reproduces by seed. Yellow nutsedge persists via mats of rhizomes and reproduces via small tubers, or nutlets. Purple nutsedge persists and reproduces via rhizomes connected together like chains. Yellow nutsedge is known for tubers that have a "sweet taste."

There are several BASF products shown in the Weed Spectrum Overview which control kyllinga and sedges, but reducing persistent, wet soil conditions can also reduce infestations of these weeds. Hand pulling does not typically reduce population levels, as most of the persistent structures are underground.

left:
Yellow nutsedge

Photo: Jose (Javi) Vargas,
Research Associate, University
of Tennessee

Doveweed

Doveweed *(Murdannia nudiflora)* is a summer annual broadleaf weed that is often confused for a grass, particularly when it infests large areas of turfgrass. Doveweed germinates at temperatures between 65º and 70°F. Similar to the sedge species, doveweed prefers moist areas but has been seen to infest taller cut grass around bunkers, fairway edges, and slope areas. The leaves have a thick, rubbery texture, and are borne on stolons. This plant reproduces by seed and via shredded stolons. Flowers are purple-blue and have three petals.

Utilizing pre- and postemergent herbicides in conjunction with improved cultural practices will eliminate weed problems in one to three years, depending on infestation severity. See the Weed Spectrum Overview in this guide for herbicides that control doveweed. Identifying where the doveweed has emerged – since it grows deep out of the turfgrass canopy – is the key to timing. The first application of the season should combine a preemergent herbicide with a postemergent herbicide.

above:
Doveweed in turfgrass

Photos: Dr. Lambert McCarty, Clemson University

left:
Closeup of doveweed in flower

Weed Spray Program Recommendations

Program 1: Control of Weeds in Fairways, Roughs or Lawn Care

App #	Product	Timing	Rate/AC	Turf Type	Weed Target	Application Volume
1	**Pendulum® AC** herbicide	Preemergence in early spring	4.2 pts	Cool and warm	Crabgrass and small-seeded broadleafs	40-80 gals per acre
2	**Tower®** herbicide	Preemergence in late spring	32 fl oz	Warm	Goosegrass, doveweed, and sedges/kyllinga	40-80 gals per acre
3a	**Pylex®** herbicide or **Pylex** herbicide + **Drive® XLR8** herbicide	Postemergence in late summer	1-1.5 fl oz 1 + 32 fl oz	Cool	Goosegrass and crabgrass in cool-season grasses	40-80 gals per acre
3b	**Pendulum® AC** herbicide + **Pylex** herbicide	Pre- and postemergence in early summer	4.2 pts 1-1.5 fl oz	Cool	Goosegrass and crabgrass in cool-season grasses	40-80 gals per acre
3c	**Pylex** herbicide + **Basagran® T&O** herbicide	Postemergence in early summer and fall	1-1.5 fl oz 2 pts	Cool	Crabgrass, goosegrass, and sedges	40-80 gals per acre
4a	**Tower** herbicide	Preemergence in mid summer	32 fl oz	Warm	Goosegrass, doveweed, and sedges/kyllinga	40-80 gals per acre
4b	**Tower** herbicide + **Drive XLR8** herbicide	Preemergence combined with postemergence	32 fl oz 32-64 fl oz	Warm	Goosegrass, doveweed, crabgrass, and sedges/kyllinga	40-80 gals per acre

Basagran T&O *herbicide has registration for use on cool- and warm-season grasses, and can be integrated into these programs for postemergent control of broadleaf weeds and sedges.*

Program 2: Control of Weeds in Naturalized Areas

App #	Product	Timing	Rate/AC	Turf Type	Weed Target	Application Volume
1	**Pendulum® AC** herbicide	Preemergence in early spring	4.2 pts	Cool- and warm-season ornamental grasses	Crabgrass and small-seeded broadleafs	40-80 gals per acre
2	**Pendulum AC** herbicide + **Pylex®** herbicide	Pre- and postemergence in early summer	4.2 pts 1-1.5 fl oz	Cool- and selective warm-season ornamental grasses*	Goosegrass and crabgrass/ clover in cool-season grasses	40-80 gals per acre
3	**Basagran T&O** herbicide + **Pylex** herbicide	Postemergence	2 pts + 1.5 fl oz	Cool- and selective warm-season ornamental grasses*	Sedges/kyllinga, goosegrass, crabgrass and selected broadleaf weeds	40-80 gals per acre

** Little bluestem, weeping lovegrass and fescues have shown a tolerance to **Pylex** herbicide. All other species used in naturalized areas need to be tested prior to large-scale application. **Segment** herbicide can be integrated into the program for control of grasses, including perennial grasses such as bermudagrass.*

Program 3: Control of Weeds in Ornamental Landscapes

App #	Product	Timing	Rate/AC	Woody, Annual or Perennial	Weed Target	Application Volume
Granular Application Options - Preemergence						
1	**FreeHand® 1.75G** herbicide	Preemergence in late spring (temps above 55ºF) 8 week application	200 lb	Consult label	Crabgrass, goosegrass, sedges and doveweed	Granular*
2	**FreeHand 1.75G** herbicide	Preemergence in early summer 8 week application	200 lb	Consult label	Crabgrass, goosegrass, sedges and doveweed	Granular*
Liquid Application Options - Preemergence						
1	**Tower®** herbicide	Preemergence in summer (temps above 55ºF) 8 week application	32 fl oz	Consult label	Crabgrass, goosegrass, sedges and doveweed	20-40 gals per acre
2	**Pendulum® AC** herbicide + **Tower** herbicide	Preemergence in summer 8 week application	4.2 pts 21-32 fl oz	Consult label	Crabgrass, goosegrass, sedges and doveweed	20-40 gals per acre
Liquid Application Options - Postemergence						
1	**Segment®** herbicide	Postemergence	2.25-3.75 pts	Consult label	Annual and perennial grasses	20-40 gals per acre
2	**Basagran T&O** herbicide	Postemergence	1.5-2 pts + crop oil	Consult label	Nutsedge, kyllinga, galinsoga, dayflower	40 gals per acre

** Calibrate spreader to ensure accurate rate application.*

Turf Herbicide Solutions

Preemergent Herbicide Solutions

Pendulum® AquaCap herbicide

A water-based formulation utilizing an ultra-thin microcapsule to deliver control of crabgrass and broadleaf weeds. It has virtually no odor, reduced staining potential, and offers handling, mixing and cleanup flexibility for even the most budget-conscious applications.

FreeHand® 1.75G herbicide

The only preemergent granular herbicide that controls sedges, annual grasses and hard-to-control broadleaf weeds like spurge and doveweed. It combines two active ingredients for a broader range of control with excellent residual control in warm-season turf and ornamental landscape beds.

Tower® herbicide

A broad-spectrum preemergent herbicide for use in golf course turfgrass and ornamental landscape management. Highly effective on many small-seeded broadleaf weeds, it also controls numerous grassy weeds, annual sedges and kyllinga.

Postemergent Herbicide Solutions

Pylex® herbicide

The standard for the control of bermudagrass and goosegrass in cool-season turf, providing unmatched performance on these difficult-to-manage weeds. It has also shown excellent control of nimblewill, crabgrass, clover, speedwell and others. Always include a crop oil concentrate or methylate seed oil with your application.

Drive® XLR8 herbicide

A proprietary water-based formulation that provides superior control of crabgrass, torpedograss, kikuyugrass, broadleaf weeds (including clover), and other troublesome weeds. It delivers quick plant uptake, providing fast and effective control, and is rainfast in less than one hour.

Basagran® T&O herbicide

Reliable, cost-effective postemergent control of yellow nutsedge, annual sedges and broadleaf weeds such as dayflower, purslane and lawn burweed in turf. Can also be used in and around ornamentals.

Segment® herbicide

Selective control of weeds in centipedegrass, annual bluegrass and established fine fescue and tall fescue. Turf professionals and commercial growers can enjoy control with no injury to labeled ornamental plants at any stage of growth including seedling and bud break stages.

Technical Overview

	Pendulum AquaCap herbicide	FreeHand 1.75G herbicide	Tower herbicide	Pylex herbicide	Drive XLR8 herbicide	Basagran T&O herbicide	Segment herbicide
HRAC group(s)	3	3 + 15	15	27	4	6	1
Active ingredient	Pendimethalin	Pendimethalin + Dimethena-mid - P	Dimethena-mid - P	Topramezone	Quinclorac	Sodium bentazon	Sethoxydim
Packaging	2x 2.5 gal 1x 15 gal 1x 110 gal 1x 220 gal	50 lb bag	2x 2.5 gal	4x 8 fl oz	4x 0.5 lb	2x 1 gal	4x 1 gal
Formulation	Capsule suspension	Clay granule	Emulsifiable concentrate	Suspension concentrate	Soluble liquid	Soluble liquid	Liquid (1 lb a.i. /gal of product)
Rate range	3.1 - 6.3 pints/ acre	100 - 200 lbs/ acre	21 - 32 fl oz/ acre	1 - 2 fl oz/ acre	32 - 64 fl oz/ acre	12 - 16 fl oz/ acre	0.8 - 1.4 fl oz/ 1,000 sq ft

Weed Spectrum Overview

Grass and Sedge Species	Pendulum® AquaCap herbicide	FreeHand® 1.75G herbicide	Tower® herbicide	Pylex® herbicide	Drive® XLR8 herbicide	Basagran® T&O herbicide	Segment® herbicide
Barnyardgrass	■	■	■	■	■		■
Bermudagrass				■			■
Bluegrass, Annual	■	■	■				■
Brome, Downy	■	■	■	■			■
Crabgrass, Large, Smooth	■	■	■	■	■		■
Cupgrass (Woolly, Southwestern)	■	■	■	■			■
Dallisgrass				■			■
Flatsedge, Rice	■	■	■				
Foxtail, Giant, Green, Yellow	■	■	■	■	■		
Goosegrass	■	■	■	■			■
Johnsongrass, Seedling	■	■	■	■	■		■
Kikuyugrass					■		
Kyllinga spp.		■	■				
Nimblewill				■			
Nutsedge, Yellow		■	■			■	
Panicum, Fall	■	■	■	■	■		■
Sandbur	■	■	■				■
Signalgrass, Broadleaf	■	■	■	■	■		■
Stiltgrass				■			
Torpedograss					■		

Broadleaf Species	Pendulum AquaCap herbicide	FreeHand 1.75G herbicide	Tower herbicide	Pylex herbicide	Drive XLR8 herbicide	Basagran T&O herbicide	Segment herbicide
Bittercress, Hairy	■	■	■	■			
Burweed, Lawn	■	■				■	
Carpetweed	■	■	■	■			
Chickweed, Common	■	■		■		■	
Clover spp.	■	■		■	■		
Daisy, English					■		
Dandelion, Common				■	■	■	
Doveweed		■	■				
Eclipta		■	■				
Galinsoga spp.		■	■	■		■	
Groundsel, Common		■	■			■	
Henbit		■					
Horseweed (Mare's Tail)				■	■		
Liverwort		■	■				
Purslane	■		■			■	
Shepherdspurse		■	■	■		■	
Spurge spp.	■	■	■				
Veronica (Speedwell)				■	■		
Willowherb, Northern		■	■				
Woodsorrel, Yellow (Oxalis)	■	■		■		■	

Note: *Many other weed species such as pigweed species, common lambsquarters, ragweed and Pennsylvania smartweed are listed on BASF labels above.*

Turf Colorant Spray Program Recommendations

Southern Dormant Greens, Tees or Fairways

App #	Product	Timing	Package Size	Rate/1,000 sq ft	Application Volume
1	**Transition™ HC** turf colorant	Prior to turfgrass dormancy	4x 1 gal	16-32 fl oz	45-55 gals per acre
2	**Transition HC** turf colorant	Prior to turfgrass dormancy	4x 1 gal	32 fl oz	45-55 gals per acre
3a	**Transition HC** turf colorant	Maintained	4x 1 gal	64 fl oz	45-55 gals per acre
3b	**GreenLawnger®** turf colorant	Maintained	12x 1 liter 4x 1 gal 2x 2 ½ gal 30 gal	3.3 gal	7-9 gals per acre
4a	**Transition HC** turf colorant	Maintained	4x 1 gal	64 fl oz	45-55 gals per acre
4b	**GreenLawnger** turf colorant	Maintained	12x 1 liter 4x 1 gal 2x 2 ½ gal 30 gal	6.2 gal	7-9 gals per acre
5*	**Transition HC** turf colorant	Maintained	4x 1 gal	16-32 fl oz	45-55 gals per acre

* *If you choose to maintain your turfgrass with a pigment only, then **Transition HC** turf colorant will be reapplied throughout the dormancy with graduated rates increasing. When turfgrass begins to green up, decrease rates. If you choose to use a **GreenLawnger** turf colorant, then the **Transition HC** turf colorant will be used initially to establish the desired color prior to dormancy, and again as the turfgrass comes out of dormancy. The rate will be variable depending on the turfgrass conditions.*

GreenLawnger turf colorant

GreenLawnger turf colorant with **ColorLock**™ technology restores the natural green color to turf during dormant periods, providing an excellent playing surface during the colder months. It is also used for touch up to turf areas damaged by chemicals, hydraulic oil and pests. **Green Lawnger** turf colorant is a long-lasting green pigment that provides color for 12-14 weeks.

Transition HC turf colorant

Transition HC high dark turf colorant with **ColorLock** technology adds a natural green color to turf and is most useful in delaying dormancy and promoting emergence from dormancy. **Transition HC** is a pigment product that will give your turf good short-term color.

Vision Pro HD turf colorant

Vision Pro HD high definition turf colorant with **ColorLock** technology adds a natural green color to all chemical applications. UV light-resistant **Vision Pro** is a pigment product used as an application aid that improves coverage and winter color.

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Always read and follow label directions.