Insect Control *in* Commercial Turf

Mississippi State University Extension Service

Insect Control in Commercial Turf

Whether on golf courses, athletic fields, sod farms, or as part of the landscape, turfgrass is subject to attack by a number of different insect pests. Professional turf managers must be familiar with these pests to avoid damage and maintain high quality stands of grass. In addition to being able to identify the insects, it is important to understand their biology, know how to scout for them, understand the different management options that are available, and be familiar with the insecticides that control them.

Insect pests that attack turfgrass are managed in a variety of ways. "Integrated pest management" includes using economic thresholds, scouting, resistant varieties, cultural practices, and natural parasites, predators, and diseases, as well as pesticides. Insecticides certainly play a key role in managing turfgrass insects. However, relying on insecticides as the only way to manage insects can cause problems such as insect resistance, 'flaring' (increased numbers of target pests), secondary pest outbreaks, and environmental contamination.

When insecticides are used, proper application timing and, when necessary, adequate post-treatment irrigation are important to ensure effective results. For example, insecticides for white grub control work best when applied around egg hatch, and are adequately watered after treatment. Thatch, or the buildup of organic matter, may prevent an insecticide from reaching targeted pests in the soil.

Although the tolerance for insect damage in highly managed turf is low, not all insect infestations are severe enough to warrant treatment. Natural enemies such as spiders, predators, and parasites of pests are abundant even in high maintenance turf, and often help keep pests below damaging levels. However, when pest insect populations reach potentially damaging levels, it is important to treat them promptly with an effective insecticide. Many turf insect pests are easiest to control at a certain life stages, so proper timing of insecticide applications is an important part of turf insect management. Frequent monitoring and sampling can enable threatening infestations before damage occurs and can aid in proper timing of insecticide treatments.

Insecticide Selection for Different Turfgrass Sites

Not all turfgrass sites are created equal. It is important to read the label on the product before purchasing an insecticide for a particular site in turfgrass.

An insecticide may not be labeled for all turfgrass uses (e.g., lawns, athletic field, sod farms, or golf course). Some products are only labeled for use on golf courses or sod farms. For example, Dursban 50W (chlorpyrifos) is not labeled for use on residential or commercial lawns. Furthermore, Orthene (acephate) formulations are labeled for use against fire ants in residential and commercial lawns, but not other pests in lawns.

In some instances, manufacturers will add GC as part of the title to inform users that a product can be used on golf courses when other formulations of that product are not labeled for that site. For example, Allectus SC is not labeled for use on golf courses but Allectus GC SC is.

Labeling for sod farms will also follow similar rules. For example, Merit 0.5 G is not to be used on sod farms, but Merit 2 and Merit 75WP are labeled for use on sod farms.

If product restrictions are noted on the label, they may appear as a note next to the product names in this publication. For example, when you read, "landscape turf only" that product is not available for use on golf course or sod farms. When a product labeled for these other sites is available it is included but it may not have any restrictions noted. If no restrictions are noted, the product is likely labeled for general use on turfgrass or on all turfgrass sites.

The label on your individual product may vary from the online version of the manufacturers' labels, so abide by all restrictions on the product label if they differ from those presented in this guide.

Fire Ants

Although they do not directly attack grass, fire ants are the number one insect pest in Mississippi turfgrass. Their mounds are unsightly and can interfere with play and maintenance, but their stings and aggressive nature cause the greatest concern. It is unlikely we will eradicate this pest, but we can reduce fire ant populations to tolerable levels by using safe and effective control methods.

There are many available methods of fire ant control. The choice of method depends on the size and type of area being treated and the level of control required. Most control methods greatly reduce fire ant populations, but keeping an area practically free of fire ants usually requires persistence and a combination of control methods.

Baits - One of the most effective methods of fire ant control is the use of granular baits. When properly applied two to three times per year, baits can provide 80 to 90 percent control. Although baits can be applied as individual mound treatments, broadcast applications are much more effective. This is because, in addition to the large mounds you can easily see in an area, there are usually many small, hard-to-detect colonies. Individual mound treatments eliminate only the large mounds, and these are quickly replaced by smaller colonies that thrive in the absence of foraging competition from the larger colonies.

Broadcast bait treatments target all colonies in an area, regardless of size. Early spring is one of the best times to use granular baits because recently developed queens are controlled before they leave on their flights and establish new colonies. Follow-up granular bait applications usually are necessary in midsummer and again in the fall.

Apply baits when the ground is dry (with no forecast of rain) and when ground temperatures are between 70 and 90 °F. Avoid irrigating for 1 or 2 days after applying fire ant baits. The insecticides used in granular baits are slow-acting for a reason: Foraging ants pick up the baits, carry them back to the colony, and pass them among the ants in the colony, eventually reaching and killing the queen. Depending on the specific bait used, maximum control of the colony takes 2 to 6 weeks.

Mound treatments - In small areas, fire ant control can be improved by combining granular baits with spot treatment of any individual mounds that escaped the bait treatments. However, it is best to wait several days after applying a bait treatment before treating individual mounds. This gives foraging worker ants time to carry the baits into the colonies, improving the odds of killing the queen(s).

Several different types of individual mound treatments are available. These include mound drenches, granular treatments, and dry powders. Insecticides used for individual mound treatments are fast-acting contact insecticides. **When treating individual mounds with any insecticide, do not disturb mounds before treating.** If you do, the colony may take the queen or queens to safety, either by moving them deeper in the mound or by moving them to the side to set up other mounds.

Broadcast insecticide treatments - In highly sensitive areas, such as athletic fields, the tolerance level for fire ants is essentially zero. Reaching and keeping this high level of control requires a high level of management that involves several methods of control. Broadcast bait treatments can serve as the backbone of an intensive fire ant control program. But to achieve and maintain high levels of control, you may have to supplement bait treatments with broadcast insecticide treatments and, when necessary, with individual mound treatments.

Broadcast insecticide treatments differ from baits in that they are fast-acting contact insecticides intended to control foraging workers and newly settled queens. Although many broadcast insecticide treatments are applied as granules, these granules are not attractive to the ants (they are not baits). The granules only serve as carriers for the insecticide. To be most effective, most broadcast insecticides must be applied every 4 to 8 weeks during the growing season. Some broadcast insecticide treatments indicate one application will provide season-long control, but in areas where tolerance for fire ants is very low, the wise turf manager will be prepared to supplement these treatments when necessary.

Many of the insecticides used as broadcast treatments for fire ants also act against other turf pests, such as mole crickets and white grubs. Turf managers can take advantage of this by knowing the range of pests the various insecticides control and choosing treatments and application methods that will be most effective against the complex of pests you want to control.

Fire ant control is never-ending because managed turf areas are continually reinfested by swarming queens that emerge from mounds in nearby unmanaged areas. When swarming queens try to establish mounds in areas already heavily infested with other fire ants, the ants already there often prey on the queens. When swarming queens attempt to establish colonies in areas without other fire ants, their chances of success are much higher because of the absence of competition. Thus, fire ant control programs are most effective when every turf manager in an area treats for fire ants.

Baits for Fire Ant Control*

Brand Name (Insecticide)	Rate/mound	Rate/acre
Advion Bait (indoxacarb)	4 tablespoons	1.5 lb
Amdro Bait (hydromethylnon)	5 tablespoons	1 – 1.5 lb
Award Bait (fenoxycarb)	1 to 3 tablespoons	1 – 1.5 lb
Chipco FireStar (fipronil)	5 tablespoons	1.5 – 15 lb

** Avoid applying baits just before or after irrigation or rain. Baits may require 4 to 8 weeks for best results.*

Mound Drench Treatments for Fire Ant Control*

Insecticide	Brand Name	Rate
acephate	Orthene TTO 75WP	1 oz per 5 gal
	Orthene TTO 97	0.75 oz per 5 gal
bifenthrin	Talstar GC Flowable	1 teaspoon per gal
carbaryl	Sevin SL	0.75 fl oz per gal
chlorpyrifos	Dursban 50W	0.24 oz per gal
Restricted-use insecticide	(golf course and sod production only)	
	Dursban Pro (golf course only)	1 fl oz per 2 gal
lambda-cyhalothrin	Scimitar CS	0.5 fl oz per 2.5 gal
Restricted-use insecticide	(landscape turf only)	
	Scimitar GC	
deltamethrin	DeltaGard GC 5SC	1.5 fl oz per gal
Restricted-use insecticide		
imidacloprid + bifenthrin	Allectus GC SC	0.33 fl oz per gal
Restricted-use insecticide	(golf course and sod farms)	
	Allectus SC (landscape turf only)	
permethrin	Astro (landscape turf only)	1.6 fl oz per gal
spinosad	Conserve	0.1 fl oz per gal
thiamethoxam	Meridian 25WG	0.1–0.3 oz per gal

** Generally, it takes 1 to 2 gallons of water to drench a fire ant mound effectively.* ***Do not disturb mounds before drenching.***

Dry Mound Treatments for Fire Ant Control*

Insecticide	Brand Name	Rate/mound
acephate	Orthene TTO 75WP	1–2 teaspoon per mound
cyfluthrin	Bayer Fire Ant Killer	1 teaspoon
deltamethrin	Bengal Ultra Dust Fire Ant Killer (0.05%)	1 tablespoon
	Terro Fire Ant Killer (0.05%)	
	DeltaGard G (landscape turf only)	2 tablespoons per mound[a]
		Restricted-use insecticide
imidacloprid + bifenthrin	Allectus GC (golf course and sod farms)	4 oz per mound[a]
Restricted-use insecticide	Allectus G (landscape turf only)	

** Sprinkle dry product over and around mound as directed on label.*
** Do not disturb the mound before or after treatment.*
[a] Follow application with 1 to 2 gallons of water for best results.

Broadcast Treatments for Fire Ant Control*

Insecticide	Brand Name	Rate
fipronil **	Chipco Topchoice	2 lbs per 1000 sq ft
	or Gardentech Over'n Out!	**or** 87 lb per acre
bifenthrin	Talstar EZ Golf Granular	2.3–4.6 lbs per 1000 sq ft
Restricted-use insecticide	Talstar GC Flowable	0.5 fl oz per 1000 sq ft
carbaryl	Sevin SL	3 fl oz per 1000 sq ft
chlorpyrifos	Dursban 50W (sod production and golf course)	16 lb per acre
Restricted-use insecticide	Dursban Pro	1.5 fl oz per 1000 sq ft
cyfluthrin	Tempo SC Ultra (landscape turf only)	8 ml per 1000 sq ft
Restricted-use insecticide	Tempo WP Ultra (landscape turf only)	5–10 grams (1–2 scoops) per 1000 sq ft
	Tempo WP GC (for use on golf courses)	1 packet per 7,800 sq ft
deltamethrin	DeltaGard GC 5SC	1.5 fl oz per gal
Restricted-use insecticide	DeltaGard T&O 5 SC (landscape turf only)	
	DeltaGard G (landscape turf only)	2–3 lb per 1000 sqft
imidacloprid + bifenthrin	Allectus GC SC	1.32–1.65 fl oz per 1000 sq ft
Restricted-use insecticide	Allectus SC (landscape turf only)	
	Allectus GC	1.7–2.9 lb per 1000 sq ft
	Allectus G (landscape turf only)	
lambda cyhalothrin	Scimitar CS (landscape turf only)	3.4–7 ml per 1000 sq ft
Restricted-use insecticide		Apply 4–10 gal. of spray per 1,000 sq ft
	Scimitar GC	

**Except for fipronil treatments (Topchoice or Over'n Out), apply broadcast treatments every 4 to 8 weeks as a supplement to broadcast baits.*

***The labels of the fipronil treatments (Topchoice and Over'n Out) indicate that a single spring application will provide season-long control.*

Chinch Bugs

Chinch bugs are the most common pests of St. Augustine grass, but they can occasionally cause damage to other grasses, such as zoysia, Bermuda, and centipede. Adult chinch bugs are about one-fifth of an inch long and are black with white wings folded over their backs.

Nymphs are yellow upon hatching, but they soon turn red and have a light-colored band across their abdomens. With each molt, nymphs more closely resemble the adults. Both the adults and nymphs cause damage by sucking plant juices through their piercing-sucking mouthparts. As the chinch bug sucks the plant juices, it releases a toxin that kills the grass and causes yellowish or brownish patches in turf.

This pest is a sunshine-loving insect and seldom attacks grass in dense, shady areas. Expanding patches of discolored turf located in full sun are characteristic of a chinch bug infestation.

Scout turf on sunny days by parting the stems and looking for the small, reddish or black nymphs and/or adults in the crown region or running across the exposed soil. You can also check for chinch bugs by using a large coffee can or gallon can with both ends removed. Press one end of the can into the soil, fill with water, and keep full for at least 5 minutes. If chinch bugs are present, they will float to the surface.

When sampling for chinch bugs, be sure to sample the area on the outer edge of the damage in the green, apparently uninfested grass.

Several short-residual insecticides are available to control chinch bugs. Be sure to follow label directions for watering both before and after treatment. Treat the entire area evenly and thoroughly. Where chinch bug infestations are heavy, re-treat the area in 2 weeks to kill recently hatched insects.

Populations of chinch bugs have shown resistance to certain pyrethroids, organophosphates, and carbamate insecticides, so selecting products with different chemistries or modes of action would reduce the likelihood of resistance. For example, pyrethroids such as Talstar have a different mode of action from Merit, a neonicotinoid insecticide.

Cinch Bug Control

Insecticide	Brand Name*	Rate	Comments
acephate	Orthene TTO 75 WP	1.2 – 2.4 oz per 1000 sq ft	Irrigate before application only. (Golf course or sod farms use only.)
	Orthene TTO 97	0.9 – 1.8 oz per 1000 sq ft	
bifenthrin	Talstar EZ Golf Granular	2.3 – 4.6 lbs per 1000 sq ft	Irrigate immediately after application with a minimum of ¼ inch of water. **Restricted-use insecticide**
	Talstar GC Flowable	0.25 – 0.5 fl oz per 1000 sq ft	Irrigate before treatment. Higher application rate may be required to control heavy infestations. **Restricted-use insecticide**
carbaryl	Sevin 80 WSP	7.5 – 10 lb per acre	Irrigate before application then no irrigation for 24 hours.
	Sevin SL	6 – 8 fl oz per 1000 sq ft	Irrigate before application then no irrigation for 24 hours.
clothianidin	Arena 50WDG	10.67 oz per acre	Irrigate immediately after application.
	Arena 0.5G	66.67 lb per acre	(suppression)
cyfluthrin	Tempo SC Ultra (landscape turf only)	8 ml per 1000 sq ft	Irrigate before and after application. **Restricted-use insecticide**
	Tempo WP Ultra (landscape turf only)	7.7–15.4 oz per acre	Irrigate before and after application. **Restricted-use insecticide**
	Tempo 20 WP (golf course only)	1 packet per 7,800 sq ft	Irrigate before and after application. **Restricted-use insecticide**
deltamethrin	DeltaGard T&O 5SC (landscape turf only) DeltaGard GC 5SC	0.6 – 0.9 fl oz per 1000 sq ft	**Restricted-use insecticide**
	DeltaGard G (landscape turf only) DeltaGard T&O Granular	2 – 3 lbs per 1000 sq ft	**Restricted-use insecticide**
imidacloprid + bifenthrin	Allectus SC (landscape turf only)	0.4 – 1.65 fl oz per 1000 sq ft	Irrigate before and after application.
	Allectus GC	1.7 – 2.9 lb per 1000 sq ft	**Restricted-use insecticide**
lambdacyhalothrin	Scimitar CS (landscape turf only) Scimitar GC	0.47 fl oz (14 ml) per 1,000 sq ft	Apply using 2–10 gal spray per 1000 sq ft. Water in following application ¼ to ½ inch. **Restricted-use insecticide**
thiamethoxam	Meridian 0.33G	7.1–9.4 lbs per 5,000 sq ft	Irrigate granular formulatio after treatment. Use 1.5–5 gal. of spray per 1000 sq ft for 25WG formulation. (suppression only)
	Meridian 25WG	1.5–1.95 oz per 1,000 sq ft	
trichlorofon	Dylox 80	3.75 oz per 1000 sq ft	Water immediately after application.

** See back page for explanation of abbreviations.*

Mole Crickets

Mole crickets are a prominent turf pest in the southern portion of Mississippi, especially in the coastal area, but they are rarely a problem north of I–20 in Mississippi. Mole crickets are most damaging in highly managed turf areas, such as golf greens, but they can occur in other commercial turf areas as well.

These insects damage turf by burrowing in the soil and feeding on roots and stems of grasses, and their tunnels can interfere with play on golf greens. They are especially fond of light, sandy soils. Mole crickets directly damage plants by feeding on the roots, and they indirectly damage plants by extensive tunneling, which destroys roots and disrupts root development. Mole crickets usually feed at night, tunneling several feet per night.

Two species of mole crickets, southern and tawny, damage turf in Mississippi. Southern mole crickets are primarily predators on other animals living in the soil, but still cause damage by tunneling. Tawny mole crickets cause damage both by tunneling and feeding on the roots. Although the appearance and habits of these two species are different, their general biology is similar.

Mole crickets overwinter as nymphs (immatures) in the soil, become active in early spring, and mature by mid to late spring. The most severe damage usually occurs in the spring as a result of the heavy tunneling and feeding of these large nymphs and adults. New adults emerge and begin mating flights in mid-March to mid-May (mating flights of tawny mole crickets are generally a bit earlier than those of southern mole cricket). Exact timing of mating flights can vary considerably, depending on weather and location in the state (flights occur earlier on the Gulf Coast than in the central portion of the state). Eggs, which are deposited in the soil in clusters of 35 to 40 eggs, hatch in 10 to 40 days, depending on temperature. At first the damage caused by the newly hatched nymphs is minimal and nearly impossible to detect. However, this is the stage that is most vulnerable to insecticides. There is only one generation per year.

Because damage is usually greatest in the spring, it is often necessary to treat at this time. But these large nymphs and adults can be very difficult to control. Mole cricket treatments are most effective when targeted toward the young nymphs in June and July. Because the grass has recovered from spring damage, and the damage caused by newly hatched nymphs is not obvious, it is sometimes difficult to realize the need to treat then. But if mole crickets were present in the spring, they will be present in June and July. This is the best time of the year to apply treatments on turf areas that have a history of mole cricket infestation.

Mole crickets can be persistent and difficult pests to control and it may be necessary to make several applications per season to reduce or prevent damage. But the treatment targeted to control young, newly hatched nymphs is the most important. Treatments containing fipronil have proven to be highly effective against mole crickets when applied at this time and also provide long-term control of fire ants.

Check for mole crickets by mixing 1 to 2 fluid ounces of dishwashing liquid per gallon of water and pouring it over a small area of turf. This is best done early in the morning when crickets are most likely to be near the surface. The soapy water flushes any crickets to the surface. This sample will provide an approximate number and age of the mole crickets present, as well as how near they are to the soil surface. If crickets appear promptly after the soap solution is applied, they are near the surface.

Before treating for mole crickets, be sure that the turf is well watered because mole crickets tend to burrow deeper in dry soil, where they can escape an insecticide treatment. With most mole cricket treatments, it is also important to water immediately following treatment in order to leach the treatment into the soil where it can contact the mole crickets.

Mole Cricket Control

Insecticide	Brand Name*	Rate	Comments
acephate	Orthene TTO 75WP	1 – 1.9 oz per 1000 sq ft	Irrigate before application, but not following application. Golf course and sod farm use only.
	Orthene TTO 97	0.8 – 1.4 oz per 1000 sq ft	
bifenthrin	Talstar GC Flowable	0.25 – 0.5 fl oz per 1000 sq ft	Irrigate before and after application with a minimum of 0.5 inch of water. Apply during peak egg hatch.
	Talstar GC Granular	2.3 – 4.6 lb per 1000 sq ft	
carbaryl	Mole Cricket Bait	0.75 – 0.9 lb per 1000 sq ft	This is a bait. Do not water following treatment. Baits are used primarily for control of large nymphs and adults.
clothianidin (suppression)	Arena 50WDG	10.67 oz per acre	Irrigate before and after application. Apply during peak egg hatch.
	Arena 0.5G	66.67 lb per acre	
cyfluthrin	Tempo WP Ultra	7.7 – 15.4 oz per acre	Irrigate after application. Landscape turf only. Apply during peak egg hatch period.
	Tempo SC Ultra	8 ml per 1000 sq ft. **or** 12 fl oz per acre	
deltamethrin	DeltaGard GC 5SC	0.6 – 0.9 fl oz per 1000 sq ft	Water in following application ¼ to ½ inch. Landscape turf only. **Restricted-use insecticide**
	DeltaGard T&O Granular (landscape turf only)	2 – 3 lbs per 1000 sq ft	
fipronil	Chipco Topchoice	2 lb per 1000 sq ft	Apply when eggs and small nymphs are present. Water in after treatment.
imidacloprid	Merit 75 WSP	1.6 oz per 8250 sq ft	Apply during peak egg hatch period. Irrigate within 24 hours after application.
	Merit 0.5 G	1.8 lb per 1000 sq ft	Apply during peak egg hatch period. Irrigate within 24 hours after application. Not for use on sod farms.
imidacloprid + bifenthrin	Allectus SC (landscape turf only)	1.32 – 1.65 fl oz per1000 sq ft	Irrigate before and after application. **Restricted-use insecticide**
	Allectus GC	2.9 lb per 1000 sq ft **or** 4.6 – 5.7 lb per 1000 sq ft	
indoxacarb	Advion Mole cricket bait	1.15–4.6 lbs per 1,000 sq ft	Rates at or above 2.3 lbs per 1,000 sq ft may be needed against heavier infestations. Do not irrigate after application. Crickets may die on surface for 1–5 days after treatment.
lambda-cyhalothrin	Scimitar CS (landscape turf only)	Nymphs: 7 ml per 1000 sq ft	Apply 4–10 gal. spray per 1000 sq ft. Irrigate before and after application. **Restricted-use insecticide**
	Scimitar GC	Adult: 14 ml per 1000 sq ft	
permethrin	Astro (landscape turf only)	1.6 fl oz per gal	Water in following application ¼ to ½ inch.
thiamethoxam	Meridian 0.33G	7.1–9.4 lbs per 5,000 sq ft	Irrigate granular formulation after treatment. Use 1.5–5 gal. of spray per 1000 sq ft for 25WG formulation. (suppression only)
	Meridian 25WG	1.5–1.95 oz per 1,000 sq ft	
trichlorofon	Dylox 80	3.75 oz per 1000 sq ft	Irrigate before and after application.
	Dylox 6.2G	3 lb per 1000 sq ft	

** See back page for explanation of abbreviations.*

White Grubs

White grubs are larvae of several species beetles, including May beetles, June beetles and chafers. When fully grown, grubs are whitish or grayish in color, are about 1½ inch long, have a distinct brownish head, three pairs of legs (which distinguishes them from the larvae or billbugs), and characteristically rest in a C-shaped position.

Most grubs spend about 10 months in the soil, but some require 2 to 3 years to develop into beetles. White grubs feed on grass roots and organic matter in the upper 3 inches of soil. Turf with severe white grub damage has dead patches the rollback like a loose carpet when pulled. Periods of drought with water stressed grass accentuate this damage. Grub damage is often most noticeable in the spring, when severely grub damaged areas failed to 'green up", but damage also can occur in summer and fall. Grubs are easiest to control in mid-summer, when larvae are the smallest.

Well-watered and maintained can harbor lots of white grubs without showing signs of damage. In such cases vertebrate predators, such as skunks, moles, or armadillos, may do more damage to the turf than the grubs themselves. Controlling in grubs may eliminate or reduce the damage caused by these in need predators.

When scouting for grubs in the spring or summer, cut several 1- to 2-foot square samples 2 to 3 inches deep, lift out or roll back the turf square, and examine for grubs. If you find an average of 3 to 5 grubs per square foot, you may need to treat.

Water grass before treatment if soil is dry (this causes grubs to move nearer the soil surface), and thoroughly water again after treatment (this leaches the insecticide into the soil where the grubs are feeding).

Insecticides labeled for use against white grubs should be applied at or before egg hatch. Imidacloprid, halofenozide, clothianidin, thiamethoxam, or Allectus (a combination of imidacloprid and bifenthrin) applied at that time can provide greater than 90% control of the annual grub species. However, only trichlorfon or carbaryl will control large grubs.

White Grub Control

Insecticide	Brand Name*	Rate	Comments
acarbaryl	Sevin SL	6 fl oz per 1000 sq ft **or** 8 qt per acre	Irrigate turfgrass soon after treatment.
	Sevin 80 WSP	10 lb per acre	Irrigate turfgrass soon after treatment.
clothianidin	Arena 50WDG	8 oz per acre	Irrigate within 24 hours after treatment.
	Arena 0.5G	50 lb per acre	
halofenozide	Mach 2 1.5 G	133 lb per acre	Irrigate within 24 h after treatment. May cause short-term discoloration of Tifdwarf bermudagrass. For sod farms, allow at least 7 days to elapse between application and harvest of sod.
	Mach 2 SC	2.9 fl oz per 1000 sq ft	
imidacloprid	Merit 75 WSP	8.6 oz per acre	Irrigate within 24 hours after treatment
	Merit 0.5 G	1.4 lb per 1000 sq ft **or** 60 lb per acre	Irrigate within 24 hours after treatment
imidacloprid + bifenthrin	Allectus SC (landscape turf only)	1.32 – 1.65 fl oz per 1000 sq ft	Irrigate within 24 hours after treatment. **Restricted-use insecticide**
	Allectus GC	2.3 – 2.9 lb per 1000 sq ft	
thiamethoxam	Meridian 0.33G	7.1–9.4 lbs per 5,000 sq ft	Irrigate granular formulation after treatment. Use 1.5–5 gal. of spray per 1000 sq ft for 25WG formulation.
	Meridian 25WG	1.5–1.95 oz per 1,000 sq ft	
trichlorfon	Dylox 80 T&O	3.75 oz per 1000 sq ft or 10.2 lb per acre	Irrigate following application.
	Dylox 6.2 G	3 lb per 1000 sq ft **or** 130 lb per acre	Irrigate following application.

** See back page for explanation of abbreviations.*

Billbugs

Billbugs are weevils that sometimes damage turfgrass. They are most common in zoysia and hybrid Bermudas, but also occur centipede and St Augustine. Several species of billbugs occur in Mississippi. Hunting billbugs are the most common. Adults are shiny, dark-colored weevils with long bodies and distinct snouts. They are about ¼ to ⅜ inch long. The larvae are small, legless grubs, normally found in the crown area.

Billbug damage first appears as isolated, hand-sized patches of dying, discolored turf, but these patches may overlap when populations are heavy. Damage is often most obvious in the fall, but it can be difficult to detect when turf is also browning because of drought. Although the adults feed on the runners and stolons, larvae cause the most damage. They feed heavily in crowns and stolons. Check for billbug damage by the tug test: turf infested with billbug larvae will break at the crown when tugged. Often, you can locate larvae or their frass by digging in the crown and root area.

Billbug infestations on sod farms can interfere with turf harvesting by causing sod to break apart when lifted. Two strategies can be used to target billbugs in turf.

First, target adults with pyrethroids. Several insecticides are listed for use against adults. The objective is to kill the gravid female before she lays eggs in the turf. Second, target the larval stage. Young larvae will feed inside the stem protected from surface applied insecticides. When the larvae gets too large for the stem it emerges from the stem and burrows into the soil where it feeds on roots.

Soil applied, contact insecticides (for example, Dylox, Dursban, or Sevin) can be successful when targeting the larger larvae, but most of the damage will be done to the turf by then. Systemic insecticides, such Merit, Arena, or Mach2, can be applied to the soil and translocated into the stems.

Targeting young larvae while feeding inside the stem can potentially reduce the overall damage to the grass.

Billbug Control

Insecticide	Brand Name*	Rate	Comments
bifenthrin	Talstar EZ Golf Granular	1.15 – 2.3 lb per 1,000 sq ft	Apply when adults are first observed. **Restricted-use insecticide**
	Talstar GC flowable	0.25 – 0.5 fl oz per1,000 sq ft	
carbaryl	Sevin SL	6 fl oz per 1000 sq ft **or** 8 qt per acre	Irrigate turfgrass soon after treatment
	Sevin 80 WSP	10 lb per acre	Irrigate turfgrass soon after treatment
chlorpyrifos	Dursban 50W	2 – 4 lb per acre	**Sod production only** Apply when adults are first observed. **Restricted-use insecticide**
clothianidin	Arena 50WDG	8 oz per acre	Irrigate within 24 hours after treatment
	Arena 0.5G	50 lb per acre	
deltamethrin	DeltaGard GC 5SC	0.6 – 0.9 fl oz per 1000 sq ft	Water in following application ¼ to ½ inch. Sprays targeting adults before egg lay. **Restricted-use insecticide**
	DeltaGard T&O granular (landscape turf only)	2 – 3 lbs per 1000 sq ft	
halofenozide	Mach 2 1.5 G	133 lb per acre	Irrigate within 24 hours after treatment. May cause short-term discoloration of Tifdwarf bermudagrass. For sod farms, allow at least 7 days to elapse between application and harvest of sod.
	Mach 2 SC	2.9 fl oz per 1000 sq ft	
imidacloprid	Merit 75 WSP	1.6 oz per 8250 sq ft **or** 8.6 oz per acre	Irrigate within 24 hours after treatment.
	Merit 0.5 G	1.4 lb per 1000 sq ft **or** 60 lb per acre	Irrigate within 24 hours after application.
imidacloprid + bifenthrin	Allectus GC SC	.4 – 1.65 fl oz per 1000 sq ft	Irrigate within 24 hours after treatment. Time applications when adults are active. **Restricted-use insecticide**
	Allectus GC	01.7 – 2.9 lb per 1000 sq ft	
thiamethoxam	Meridian 0.33G	7.1–9.4 lbs per 5,000 sq ft	Irrigate granular formulation after treatment. Use 1.5–5 gal. of spray per 1000 sq ft for 25WG formulation.
	Meridian 25WG	1.5–1.95 oz per 1,000 sq ft	
trichlorfon	Dylox 80 T&O	3.75 oz per 1000 sq ft **or** 10.2 lb per acre	Irrigate following application.
	Dylox 6.2 G	3 lb per 1000 sq ft **or** 130 lb per acre	

** See back page for explanation of abbreviations.*

Two–lined Spittlebugs

Spittlebugs occur in all parts of Mississippi and throughout the eastern United States. The most noticeable signs of spittlebugs in lawns are the adults flying when the grass is being mowed or when children are playing.

Adults are wedge shaped, about ¼ to ⅜ inch long and black with two orange stripes running perpendicular across their back. Adults and nymphs are sucking pests feeding directly on the grass. Adults also feed on hollies (Japanese and American holly) planted in the adjacent landscape.

Adult spittlebugs feed openly on the turf foliage and stems and can cause significant damage. Nymphs often feed closer to the thatch or even below the thatch inside a frothy mass called spittle. When populations are high, the grass may be described by a client as being 'squishy'.

Nymphs produce the spittle which they use for protection. If you take the spittle mass and gently rub it between your fingers, one or more wingless, lightly-colored nymphs with brown head, will emerge.

Damage to centipede is apparent when a stand of grass appears to be yellowing or 'burned'. Individual grass blades will have a purplish-stripe or streak due to the salivary toxin that is injected during feeding then translocated through the parallel veins.

All warm season turfgrass species can be attacked but centipede is the most common host. Spittlebug damage to St. Augustinegrass may be mistaken for chinch bug injury. If the damage is in full sun it is likely caused by chinch bugs, but brown areas in the shade should be inspected for spittlebugs.

Damage is often worse in years where there is above average spring and summer rainfall or when the turf is well irrigated. Lawns with heavy thatch can also be more susceptible to spittlebug damage. This is, in part, because females deposit eggs into hollow grass stems and other debris. Eggs are less than one-sixteenth of an inch long, bright yellow to orange, and present all winter long. They hatch into nymphs in the spring (March and April) and nymphs immediately begin to feed. They take about one month to develop into adults. There will be 2–3 generations per year with peak adult activity from the first generation occurring around June.

There are no known parasites of spittlebugs and the most common turfgrass predators of spittlebug eggs and adults are fire ants and predaceous beetles. To reduce or prevention outbreaks of spittlebugs, reduce thatch and manage irrigation practices carefully so as not to over irrigate.

Because of the spittle mass, adults are easier targets for insecticides than the nymphs. Liquid formulations of insecticides usually work better than granular ones, and these should be timed around July, and made late in the day. If possible, mow and irrigate the turf the night before or morning of the application.

Spittlebug Control

Insecticide	Brand Name*	Rate	Comments
acephate	Orthene TTO 75WP	1 – 1.9 oz per 1000 sq ft	Make application in the late afternoon or evening. Do not irrigate within 24 hours of application.
	Orthene TTO 97	0.8 – 1.4 oz per 10000 sq ft	
bifenthrin	Onyx	0.07 – 0.15 fl oz per 1000 sq ft	Do not irrigate within 24 hours after application. **Restricted-use insecticide**
carbaryl	Sevin SL	1.5 – 3 fl oz per 1000 sq ft **or** 2 - 4 qt per acre	Do not irrigate within 24 hours after application.
	Sevin 80 WSP	2.5 – 5 lb per acre	
deltamethrin	DeltaGard GC 5SC	0.2 – 0.4 fl oz per 1000 sq ft	Do not irrigate within 24 hours after application. **Restricted-use insecticide**
	DeltaGard T&O 5 SC (landscape turf only)	**or** 8.75 – 17.5 fl oz per acre	

** See back page for explanation of abbreviations.*

Turf Caterpillars

There are several species of caterpillars that occasionally damage turfgrass. These include fall armyworms, cutworms, and sod webworms.

Fall armyworms often migrate in large numbers and attack turf in late summer and fall. They feed anytime, day or night, and can destroy or severely retarding the growth of grasses. Because of their large numbers, damage can happen quickly.

Cutworms are a related group of caterpillars that feed on stems and leaves of turf. Although there are many species of cutworms, the black cutworm is most common especially on creeping bentgrass greens and tees. This species is most often associated with pockmarks and damage to putting greens, which interferes with ball roll. Cutworms are active at night and hide in the day but may become active on cloudy days.

Adult moths begin to appear in March and may produce four generations per year. They lay eggs on the tips of grass blades so close cutting of putting greens removes most eggs before they hatch. However, cutworms that develop in the rough often migrate into greens as larger larvae.

Sod webworms cut off blades of grass above the thatch line and pull them into their burrows to feed. Infested areas may appear as small brown patches. If infestation is heavy, patches may run together to form larger irregular brown areas.

Adult moths are small, frail, and 'snouted', and are often seen hovering over the turf at dusk. There may be two or three generations per year.

In residential and commercial lawns especially, outbreaks of caterpillar pests are buffered by the presence of natural enemies such as ants, spiders, or parasites. These natural enemies commonly attack exposed eggs or small larvae reducing the number of larger caterpillars later. Certain insecticides may significantly reduce these natural enemies if not used properly.

Insecticides with target-selective modes of action reduce the negative impacts on these natural enemies. If possible, try to incorporate biorational products such as spinosad or halofenozide into your chemical control program for these pests.

Turf caterpillars are primarily controlled using foliar sprays; but careful, frequent scouting is necessary to detect a developing infestation before it causes damage. Because there are several different species of turf-infesting caterpillars, and because there may be several overlapping generations per year, several applications may be necessary in a growing season.

Turf Caterpillar Control

Insecticide	Brand Name*	Rate	Comments
acephate	Orthene TTO 75WP	0.5 – 1.2 oz per 1000 sq ft	Irrigate before application. Delay watering or mowing for 24 hours following application.
	Orthene TTO 97	0.4 – 0.9 oz per 1000 sq ft	
bifenthrin	Talstar GC Flowable	0.25 fl oz per 1000 sq ft **or** 10 fl oz per acre	Delay watering or mowing for 24 hours following application.
carbaryl	Sevin SL	1.5 – 3 fl oz per 1000 sq ft **or** 2 - 4 qt per acre	Do not irrigate following insecticide application. Use 6 qt of Sevin SL/acre for sod webworm control.
	Sevin 80 WSP	2.5 – 5 lb per acre	Do not irrigate following insecticide application. Use 7.5 lb Sevin 80 WSP/acre for sod webworm control.
chlorpyrifos	Dursban 50W	2 lb per acre	Sod production and golf course only. **Restricted-use insecticide**
cyfluthrin	Tempo SC Ultra (landscape turf only)	4 – 8 ml per 1000 sq ft **or** 6 - 12 fl oz per acre	Delay watering or mowing for 24 hours following application.
	Tempo 20 WP (includes golf course uses)	55 grams per 7,800 – 11,000 sq ft	
deltamethrin	DeltaGard GC 5SC	0.2 – 0.4 fl oz per 1000 sq ft **or** 8.75 – 17.5 fl oz per acre	**Restricted-use pesticide**
halofenozide	Mach2 SC	1.5 fl oz per 1,000 sq ft **or** 2 qt per acre	May cause short-term discoloration to Tifdwarf bermudagrass. For sod farms, allow at least 7 days between application and harvest.
indoxacarb	Provaunt	2–4 oz per acre **or** 0.0046–0.092 oz per 1,000 sq ft	Delay mowing and irrigation for 24 hours after application. If applied to turf maintained at >1 inch, use 4 oz application rate.
lambda-cyhalothrin	Scimitar CS (landscape turf only)	3.4 – 7 ml per 1000 sq ft **or** 5 – 10 fl oz per acre	Apply 2–5 gal of spray per 1,000 sq ft. Delay watering or mowing for 24 hours. Landscape turf only. **Restricted-use insecticide**
trichlorfon	Dylox 80 T&O	2.5 – 3.75 oz per 1000 sq ft or 6.8 – 10.2 lb per acre	For sod webworm and cutworm. Do not irrigate following application.
spinosad	Conserve 1SC	0.25 – 0.8 fl oz per 1000 sq ft **or** 10 – 35 fl oz per acre	Lower rate is effective against small fall armyworms and sod webworm, but high rate is required against cutworms. Delay watering or mowing for 24 hours following application.
halofenozide	Mach 2 2SC	1.5 fl oz per 1000 sq ft **or** 2 quarts per acre	May cause short-term discoloration of Tifdwarf bermudagrass. For sod farms, allow at least 7 days between application and harvest of sod.

** See back page for explanation of abbreviations.*

Mites in turfgrass

Mites in turfgrass are different from those that attack ornamentals. You will need a hand lens to see any of these mites, but the **Eriophyid mites** are the smaller of the two types of mites we find in southern turfgrass. Eriophyid mites (zoysiagrass and bermudagrass mites) are extremely small, much smaller than spider mites and too small to see with the naked eye. When viewed under magnification, they appear elongated, shaped like the upper part of an exclamation point, with two pairs of legs near the head. Feeding by these mites can bring abnormal growth in their host plants. Eriophyid mites are host specific to the grasses they infest, and damage may include stunting, a witches broom (tufting of the grass), or distortion of infested grass blades. Lower mowing heights, more frequent mowing, and removal of clippings will remove mites and reduce populations. Close mowing and clipping removal, combined with insecticide sprays, are the best strategies to manage these pests. Because of the short generation time, you may have to make a second insecticide application in 5 to 10 days to target mites that matured after the initial treatment.

Bermudagrass mites, also called **Bermudagrass Stunt Mites**, have been fairly common in drought conditions in Mississippi. The mites appear as yellow to white elongated individuals in high numbers on the stems and inside the leaf sheath, but it takes careful examination under high magnification to see them. There are multiple generations per year, since they need only 5 to10 days to complete a generation. Also, different life stages may be present at the same time. Bermudagrass mites can be found on most varieties of bermudagrass. Studies have shown these pests rarely attack Tifgreen Tiffine, Tifdwarf, Texturf 1F, Texturf 10, FloraTex, Midiron, Royal Cape, and Everglades, but they often attack Tiflawn, Ormond, St. Lucie, and NoMow. As a rule of thumb, Bermudagrass varieties that are finer textured are generally less susceptible than those with a coarser texture. Everglades and Tifway were rated as both susceptible and resistant in two separate studies. Studies may differ in ratings because cultural practices change susceptibility. Adequate moisture and fertility may enable grasses with low populations of mites to outgrow the damage. Likewise, mowing height, mowing frequency, and clipping removal can also influence populations. Lower mowing heights, more frequent mowing, and removal of clippings will remove mites and reduce populations.

Zoysiagrass Mites can damage zoysiagrass. Infested turf looks unhealthy because the leaf blades streak yellow. Closer examination reveals that one side of the leaf blade is rolled longitudinally and yellowed. Often the tip of the terminal leaf blade becomes caught in this roll at the base of the subterminal leaf, creating a curl or hooked appearance. Lawn maintenance personnel sometimes refer to this as the pin-stripe and bowtie effect. Zoysiagrass mites have a similar appearance to bermudagrass mites. The life cycle of this mite is unclear but is assumed to be similar in generation time (5 to10 days) to bermudagrass mite. Cultivar evaluations indicate that Royal and Emerald are resistant. Crown, Palisades, and El Torro have intermediate resistance, but Korean Common, Meyer, Belair, Cavalier, and Sunburst are the most susceptible.

Other Mites in Turf

Banks Grass mites are reported to attack zoysiagrass, Bermudagrass, and St. Augustine grass but rarely damage turfgrass in Mississippi. These mites look like typical spider mites and often have two dark spots on their backs. Adults are small and greenish-yellow, which makes them harder to detect in the grass. Webbing may be present at the base of the grass plant and on the underside of the leaf blade. Eggs are laid on the foliage and require 8 to 25 days to mature into adults. There are multiple generations per year, and hot, dry weather favors their reproduction and development. Damage appears as stippling or chlorotic spots on the grass blade, resulting from mites' feeding on the contents of leaf cells. Damage is more evident in water-stressed turf and rarely occurs in irrigated turf. Evaluations of zoysiagrass cultivars suggest Meyer, Midwest, and Emerald can be severely damaged.

As their name suggests, **Winter Grain** mites are more common during the cooler months, especially late winter to early spring. Another common name for this mite is the red-legged earth mite, which characterizes the dark body and reddish-orange legs of the adult mite. These mites may damage ryegrass overseeded into stands of warmseason grasses in pastures or managed turfgrass. Eggs are present at the base of the grass plant on stems or roots, or on the thatch. Immatures and adults are present on the leaf blades feeding mostly at night. Mites spend the day in the thatch or soil just under the foliage. There are two generations per year both occurring from December through April.

Damage to ryegrass by winter grain mites appears as dead tissue at the blade tip, not as stippling. The location of the damage on the plant at that time of year often leads to misdiagnosis of mite injury as cold or freeze injury in overseeded ryegrass. In Mississippi, damage to ryegrass can be extensive by early January.

Mite Control

Insecticide	Brand Name*	Rate	Comments
azadirachtin	Azatrol EC	1.3 fl oz per 1,000 sq ft	Apply 1–2 gal. of spray per 1,000 sq ft.
bifenthrin	Talstar	0.25–0.5 fl oz per 1,000 sq ft	Apply using a surfactant. A second application may be required after 5–10 days.
chlorpyrifos	Dursban 50W Dursban Pro	2 lb per acre	**Sod production and golf course only** **Restricted-use insecticide**
deltamethrin	DeltaGard GC 5SC	0.6 – 0.9 fl oz per 1000 sq ft **or** 8.75 – 17.5 fl oz per acre	Do not irrigate SC formulation within 24 hours after application. Suppression only.
	DeltaGard T&O 5 SC (landscape turf only)		**Restricted-use insecticide**
	DeltaGard GC granular	2–3 lbs per 1,000 sq ft	Granular treatments should be watered after application to activate.
dicofol	Dicofol 4-E	10.5–16 fl oz per acre	Not for use in residential turfgrass.
	Kelthane WSP	0.5–1 lb per 100 gal.	Do not apply with lime or sulfur.
lambda-cyhalothrin	Scimitar CS (landscape turf only)	3.4 – 7 ml per 1000 sq ft **or** 5 – 10 fl oz per acre	Apply 2–5 gal of spray per 1,000 sq ft. Delay watering or mowing for 24 hours. Landscape turf only. **Restricted-use insecticide**

** See back page for explanation of abbreviations.*

Active ingredients for use against insect and mite pests of turfgrass

Active ingredient	Examples of product names
Acephate	Orthene Tree, Turf, and Ornamental Spray 97, Acephate 75
Azadirachtin	Azatrol
Bacillus thuringensis (all strains)	Biobit HP insecticide, CryMax, Dipel Pro
Bifenthrin	Talstar formulations, Menace GC
Carbaryl	Sevin, Carbaryl
Chlorpyrifos	Chlorpyrifos, Dursban
Clothianidin	Arena formulations
Cyfluthrin	Tempo formulations
Deltamethrin	Deltagard formuations
Dicofol	Dicofol, Kelthane[a]
Entomopathogenic nematodes	Nematac S (for mole crickets)
Essential oils (peppermint and rosemary oils)	Ecotrol
Fenoxycarb	Award fire ant bait
Fipronil	Chipco Choice, Top Choice, Chipco Firestar fire ant bait
Halofenozide	Mach 2 formulations
Hydramethylnon	Amdro fire ant bait
Imidacloprid	Merit formulations, Mallet, Allectus (with bifenthrin)
Indoxacarb	Provaunt, Advion brand baits
lambda-cyhalothrin	Scimitar*
Methoprene	Extinguish
Permethrin	Perm-Up, Astro*
Pyrethrins: piperonyl butoxide	Pyganic, Evergreen EC
Potassium salts of fatty acids (insecticidal soap)	M–PEDE
Pyriproxyfen	Distance fire ant bait
Spinosad	Conserve
Sulfur	Sulfur 6L (plant nutrient used as an inorganic pesticide)
Thiamethoxam	Meridian formulations
Trichlorofon	Dylox formulations

[a] Manufacturer has terminated production so availability is limited to existing stock

** Current registration expires 12/31/2007*

Abbreviations

DG = Dry Flowable
E = Emulsifiable
G = Granular
S = Soluble
SP = Soluble Powder
TI = Turf Insecticide
W = Wettable
WSP = Water-Soluble Package

Safety Precautions

- Read the label before buying the insecticide.
- Store insecticides in a safe place, especially away from children.
- Read the label before applying the insecticide.
- Wear proper protective clothing while applying insecticides.
- Follow all instructions and restrictions on the label.
- If you spill any insecticide on your body, wash with soapy water immediately. Wash all exposed skin after dusting or spraying.

Conversion Factors

1 acre = 43,560 sq ft	1 fl oz = 29.6 mL	1 oz = 28.4 g
1 gal = 128 fl oz	1 qt = 32 fl oz	1 lb = 16 oz

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