# 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 properly watered in 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 certain life stages, so proper timing of insecticide applications is an important part of turf insect management. Frequent monitoring and sampling can help you detect threatening infestations before damage occurs and can aid in proper timing of insecticide treatments.

### Insecticide Selection for Different Turfgrass Sites

All turfgrass sites are not equal. In particular, the potential for human exposure to pesticide residues is much greater in some turf situations than in others. Home lawns and commercial landscape turf may be frequented by barefoot toddlers, and athletes, ranging from preschool soccer players to high school football players, often end up lying on sports turf. The potential for such intimate contact with turfgrass is considerably lower on golf courses, and with the exception of harvest, is even lower on commercial sod farms.

This is one reason an insecticide may not be labeled for all turfgrass uses (e.g., home lawns, commercial landscapes, athletic fields, golf courses, and sod farms). Some products are only labeled for particular turfgrass sites, and some insecticides are only labeled for use against certain pests or certain types of application. For example, acephate (Orthene) is labeled for spot treatment of fire ant mounds in home lawns, but acephate may not be applied as a broadcast treatment or used to treat other pests in home lawns. However, some formulations of acephate are labeled for use as broadcast treatments on golf courses and sod farms.

In some cases, manufacturers will have products that are specifically labeled for certain types of turf while other products with similar active ingredients are not labeled. For example, Allectus SC is not labeled for use on golf courses, but Allectus GC SC is. The product name does not usually indicate where the product can be used. You have to read the product label carefully to find out. For example, Merit 0.5 G is not labeled for use on sod farms, but Merit 2 and Merit 75WP are labeled for use on sod farms.

Before you buy any insecticide, read the label carefully to be sure the product is labeled for the particular site you plan to treat and to be sure the product will control the pest(s) you need to control. Read the label again just before mixing the insecticide to be sure you understand all directions for application and how to safely mix and apply the appropriate rate.

### 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 this pest will be eradicated, but you 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 one or two 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 two to six 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. 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 four to eight 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.

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| Baits for Fire Ant Control\* |
| Brand Name (Insecticide) | Rate/mound | Rate/acre |
| Advion Bait (indoxacarb) | 4 Tbsp | 1.5 lb |
| Amdro Bait (hydramethylnon) | 5 Tbsp | 1–1.5  |
| Ascend (abamectin)Award II | 5–7 Tbsp  | 1 lb |
| Award (fenoxycarb) | 1–3 Tbsp | 1–1.5 lb |
| Distance (pyriproxyfen) | 1–4 Tbsp  | 1.5 lb |
| Extinguish (s-methoprene) | 3–5 Tbsp | 1.5 lb |
| Extinguish Plus (hydramethylnon + s-methoprene) | 2–5 Tbsp  | 1.5 lb |
| Siesta Insecticide Fire Ant Bait (metaflumizone) | 2–4 Tbsp | 1.5 lb |
| \*Avoid applying baits just before or after irrigation or rain. Baits may require four to eight weeks for best results.Broadcast applications are much more effective than individual mound treatments. |

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| Mound Drench Treatments for Fire Ant Control\* |
| Insecticide | Brand Name | Rate |
| acephate | Orthene TTO 97 | 0.75 oz per 5 gal |
| bifenthrin | Talstar Select | 1 teaspoon per gal |
| Talstar Professional | 1 fl oz per gal |
| carbaryl | Sevin SL | 0.75 fl oz per gal |
| lambda-cyhalothrin  | Scimitar CS (landscape turf only) | 0.5 fl oz per 2.5 gal Restricted-use insecticide |
| Scimitar GC |
| deltamethrin | DeltaGard GC 5SC | 1.5 fl oz per gal Restricted-use insecticide |
| imidacloprid + bifenthrin  | Allectus GC SC (golf courses and sod farms) | 0.66 fl oz per gal Restricted-use insecticide |
| 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 one to two gallons of water to drench a fire ant mound effectively. Do not disturb mounds before drenching. |

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| Dry Mound Treatments for Fire Ant Control\* |
| Insecticide | Brand Name | Rate/mound |
| acephate | Orthene Fire Ant Treatment | 1 Tbsp |
| bifenthrin + zeta-cypermethrin | Talstar XTRA GC Granular Insecticide | 1/2 cup Restricted-use insecticide |
| cyfluthrin | Bayer Fire Ant Killer | 1 tsp |
| deltamethrin | Bengal Ultra Dust Fire Ant Killer (0.05%) | 1 Tbsp |
| Terro Fire Ant Killer (0.05%) |
| DeltaGard G (landscape turf only) | 2 Tbspa Restricted-use insecticide |
| \*Sprinkle dry product over and around mound as directed on label. Do not disturb the mound before or after treatment.aFollow application with one to two gallons of water for best results. |

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| Broadcast Treatments for Fire Ant Control\* |
| Insecticide | Brand Name | Rate |
| fipronil\*\*Restricted-use insecticide | Topchoice | 2 lb per 1000 sq ft |
| bifenthrin Restricted-use insecticide | Talstar GC Granular | 2.3–4.6 lb per 1000 sq ft |
| Talstar Select | 1 fl oz per 1000 sq ft |
| Talstar Professional | 1 fl oz per 1000 sq ft |
| bifenthrin + zeta-cypermethrinRestricted-use insecticide | Talstar XTRA GC Granular Insecticide | 2.3–4.6 lb per 1000 sq ft |
| carbaryl | Sevin SL | 3 fl oz per 1000 sq ft |
| cyfluthrinRestricted-use insecticide | Tempo SC Ultra (landscape turf only) | 8 ml per 1000 sq ft |
| Tempo WP Ultra (landscape turf only) | 5–10 g (1–2 scoops) per 1000 sq ft |
| Tempo WP GC (for use on golf courses) | 1 packet per 7800 sq ft |
| deltamethrinRestricted-use insecticide | DeltaGard GC 5SC  | 0.6 fl oz per 1000 sq ft |
| DeltaGard T&O Granular (landscape turf only) | 2–3 lb per 1000 sq ft |
| lambda cyhalothrin Restricted-use insecticide | Scimitar CS (landscape turf only) | 3.4–7 ml per 1000 sq ftApply 4–10 gal of spray per 1000 sq ft |
| Scimitar GC |
| \*Except for fipronil (Topchoice), apply broadcast treatments every four to eight weeks as a supplement to broadcast baits. \*\*The label for Topchoice indicates 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 and fill with water. If chinch bugs are present, they will float to the surface. Look closely; chinch bugs are small.

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 two 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.

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| Chinch Bug Control |
| Insecticide | Brand Name\* | Rate | Comments |
| acephate | Orthene TTO 97(golf course or sod farm use only) | 0.9–1.1 oz per 1000 sq ft | Irrigate before application only.  |
| bifenthrin | Talstar EZ Golf Granular | 2.3–4.6 lb per 1000 sq ft | Irrigate immediately after application with a minimum of ¼ inch of water. Restricted-use insecticide |
| Talstar Professional | 0.5–1 fl oz per 1000 sq ft | Irrigate before treatment. Higher application rate may be required to control heavy infestations. Restricted-use insecticide |
| Talstar Select | 0.5 fl oz per 1000 sq ft |
| carbaryl | Sevin SL | 6–8 fl oz per 1000 sq ft | Irrigate before application, then no irrigation for 24 hours. |
| clothianidin | Arena 50WDG | 12.8 oz per acre | Irrigate immediately after application. |
| cyfluthrin | Tempo SC Ultra (landscape turf only) | 8 ml per 1000 sq ft | Irrigate before and after application. Restricted-use insecticide |
| Tempo WP Ultra | 7.7–15.4 oz per acre  |
| Tempo 20 WP (golf course only) | 1 packet per 7800 sq ft |
| deltamethrin | DeltaGard GC 5SC | 0.6–0.9 fl oz per 1000 sq ft | Restricted-use insecticide |
| DeltaGard T&O Granular (landscape turf only) | 2–3 lb per 1000 sq ft |
| imidacloprid + bifenthrin | Allectus SC (landscape turf only) | 0.9–1.65 fl oz per 1000 sq ft | Irrigate before and after application. Restricted-use insecticide |
| Allectus GC | 1.7–2.9 lb per 1000 sq ft |
| lambda-cyhalothrin | Scimitar CS (landscape turf only) | 7 ml per 1000 sq ft | Apply using 2–10 gal spray per 1000 sq ft.Water in following application ¼ to ½ inch. Restricted-use insecticide |
| Scimitar GC | 7 ml per 1000 sq ft |
| trichlorofon | Dylox 80 | 3.75 oz per 1000 sq ft |  |
| \*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 less often a problem north of I–20 in Mississippi and are rarely encountered north of Highway 82. 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 crickets). 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 one to two 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.

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| Mole Cricket Control |
| Insecticide | Brand Name\* | Rate | Comments |
| acephate | Orthene TTO 97 | 0.8–1.4 oz per 1000 sq ft | Irrigate before application, but not following application. Golf course and sod farm use only. |
| bifenthrin | Talstar Select | 1 fl oz per 1000 sq ft | Irrigate before and after application with a minimum of 1⁄2 inch of water. Apply during peak egg hatch. Restricted-use insecticide |
| Talstar Professional | 1 fl oz per 1000 sq ft |
| 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. |
| cyfluthrin | Tempo WP Ultra | 7.7–15.4 oz per acre  | Irrigate after application. Landscape turf only. Apply during peak egg hatch period. Restricted-use insecticide |
| 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 lb per 1000 sq ft |
| fipronil | Topchoice | 2 lb per 1000 sq ft | Apply when eggs and small nymphs are present. Water in after treatment. Restricted-use insecticide |
| 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 per 1000 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 Insect Granules (This is a bait.) | 1.15–4.6 lb per 1000 sq ft or 50–200 lb per acre | Rates at or above 2.3 lb 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) | 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 |
| 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 the larvae of several species of 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, have 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 two to three years to develop into beetles. White grubs feed on grass roots and organic matter in the upper three inches of soil. Turf with severe white grub damage has dead patches that roll back 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 fail 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 turf 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 the grubs may eliminate or reduce the damage caused by these predators.

When scouting for grubs in the spring or summer, cut several one- to two-foot square samples two to three inches deep, lift out or roll back the turf square, and examine for grubs. If you find an average of three to five 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, clothianidin, thiamethoxam, or Allectus (a combination of imidacloprid and bifenthrin) applied at that time can provide greater than 90 percent control of the annual grub species. However, only trichlorfon or carbaryl will control large grubs.

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| White Grub Control |
| Insecticide | Brand Name\* | Rate | Comments |
| carbaryl | Sevin SL | 6 fl oz per 1000 sq ft or 8 qt per acre | Irrigate turfgrass soon after treatment. |
| chlorantraniliprole | Acelepryn 1.67 | 8–16 fl oz per acre | Irrigate following application. |
| Acelepryn Granular Insecticide | 50–100 lb per acre |
| clothianidin | Arena 50WDG | 8–12.8 oz per acre | Irrigate within 24 hours after treatment. |
| Arena 0.25G | 100–160 lb per acre |
| cyantraniliprole | Ference 1.67 | 8–16 fl oz per acre | Irrigate immediately after application. |
| 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 |
| 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 Granular | 2.3–2.9 lb per 1000 sq ft |
| thiamethoxam | Meridian 0.33G | 7–9 lb per 5000 sq ft | Irrigate granular formulation after treatment. Use 1.5–5 gal of spray per 1000 sq ft for 25WG formulation.  |
| Meridian 25WG | 12.7–17 oz per acre |
| 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. |

### Billbugs

Billbugs are weevils that sometimes damage turfgrass. They are most common in zoysia and hybrid Bermudas, but they also occur in 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 one-fourth to three-eighths 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 get too large for the stem, they emerge and burrow into the soil where they feed on roots.

Soil-applied, contact insecticides (e.g., Dylox 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 as Merit or Arena, can be applied to the soil and translocated into the stems.

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

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| Billbug Control |
| Insecticide | Brand Name\* | Rate | Comments |
| bifenthrin | Talstar GC Granular | 1.15–2.3 lb per 1000 sq ft | Apply when adults are first observed.Restricted-use insecticide |
| Talstar Select | 0.25–0.5 fl oz per1000 sq ft |
| Talstar Professional |
| carbaryl | Sevin SL | 6 fl oz per 1000 sq ft or 8 qt per acre | Irrigate turfgrass soon after treatment. |
| chlorantraniliprole | Acelepryn 1.67 | 8–20 fl oz per acre | Irrigate following application. |
| clothianidin | Arena 50WDG | 8–12.8 oz per acre | Irrigate within 24 hours after treatment. |
| Arena 0.25G | 100–160 lb per acre |
| cyantraniliprole | Ference 1.67 | 8–16 fl oz per acre | Irrigate immediately after application. |
| deltamethrin | DeltaGard GC 5SC | 0.6–0.9 fl oz per 1000 sq ft | Water in following application, ¼ to ½ inch. Target adults before egg lay. Restricted-use insecticide |
| DeltaGard T&O 5SC |
| imidacloprid | Merit 75 WSP | 1.6 oz per 8250 sq ft or 8.6 oz per acre | Irrigate within 24 hours after application. |
| Merit 0.5 G | 1.4 lb per 1000 sq ft or 60 lb per acre |
| imidacloprid + bifenthrin | Allectus GC SC | 0.67–1.65 fl oz per 1000 sq ft | Irrigate within 24 hours after treatment. Time applications when adults are active. Restricted-use insecticide |
| Allectus GC | 1.7–2.9 lb per 1000 sq ft  |
| thiamethoxam | Meridian 0.33G | 7–9 lb per 5000 sq ft | Irrigate granular formulation after treatment. Use 1.5–5 gal of spray per 1000 sq ft for 25WG formulation. |
| Meridian 25WG | 12.7–17 oz per acre |
| 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 one-fourth to three-eighths inch long and black with two orange stripes running perpendicular across their backs. Adults and nymphs are sucking pests that feed 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 as being “squishy.”

Nymphs produce the spittle that 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 heads 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 immediately begin to feed. They take about one month to develop into adults. There will be two to three 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 prevent outbreaks of spittlebugs, reduce thatch and manage irrigation practices carefully so as not to overirrigate.

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.

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| Spittlebug Control |
| Insecticide | Brand Name\* | Rate | Comments |
| acephate | Orthene TTO 97 | 0.8–1.4 oz per 1000 sq ft | Make application in the late afternoon or evening. Do not irrigate within 24 hours of application. Golf course and sod farm use only. |
| bifenthrin | Onyx Pro | 0.08–0.16 fl oz per 1000 sq ft | Do not irrigate within 24 hours after application. Restricted-use insecticide |
| Talstar Professional | 0.25–0.5 fl oz per 1000 sq ft |
| 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. |
| deltamethrin | DeltaGard GC 5SC | 0.2–0.4 fl oz per 1000 sq ft or 8.75–17.5 fl oz per acre | Do not irrigate within 24 hours after application. Restricted-use insecticide |
| DeltaGard T&O 5SC |
| \*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 are the most important insect pests of bermudagrass turf. Because they do not normally overwinter in Mississippi, moths must migrate in from more southern locations each year, and populations vary greatly from year to year. In years of heavy outbreaks, fall armyworms cause significant short-term damage to turfgrass, as well as bermudagrass hay fields. The gray, night-flying moths often go unnoticed, but heavy infestations of large caterpillars are difficult to overlook. Mature caterpillars are about 1¼ inch long and vary in color from green to tan to dark brown.

Depending on the situation, large numbers of caterpillars crawling around in the turf and on adjacent sidewalks and other paved areas can cause as much concern as the damage they do to the grass. Heavy infestations can cause severe defoliation in what appears to be a very short period of time—only a day or two. Actually, it takes these caterpillars around 14 days to complete the caterpillar period of their life cycle, but they become most noticeable—and do most of their damage—in the last two or three days before they pupate. To prevent excessive damage, as well as the presence of large caterpillars, it is important to detect and treat developing infestations when caterpillars are small. Watch for tiny, white “windowpanes” on grass blades or subtle white “frosting” or “frizzing” of blade tips. These are signs of feeding by small, recently hatched caterpillars. Check to be sure small caterpillars really are what is causing the signs you have observed, and treat promptly to prevent damage. Experienced turf managers learn to keep in contact with local cattle and hay producers. If local farmers are having to spray bermudagrass hay fields for fall armyworms, it’s time to pay closer attention to bermudagrass turf, as well.

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.

Tropical sod webworm moths look much different than the moths of other sod webworms. Adult moths are about ½ inch long and carry their wings in a more triangular, jet-like shape. Moths are often noticed before damage is observed, with large numbers of low-flying, small, brown moths being flushed up from the lawn and surrounding ornamental shrubs, or being attracted to lights at night. Because these insects do not survive freezing weather, they are more common in the coastal counties. Heavy outbreaks are sporadic, but occasionally occur as far north as I-20. Mature caterpillars are green, covered with darker spots, and approximately ¾-inch long. Heavy outbreaks can cause severe short-term damage, with turf having a dead, ragged appearance, and with trails of webbing present among the grass blades. Tropical sod webworms will damage all types of turf grass but especially favor St. Augustine, Bermuda, and centipede.

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. Many insecticides will significantly reduce these natural enemies.

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 into your chemical control program.

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. When applied at the caterpillar rates, Acelepryn and Ference tend to provide somewhat longer residual control than most other treatments. When applied at the higher rates used for white grub control, Acelepryn and Ference will provide extended residual control of fall armyworms and other caterpillar pests, often lasting many weeks. However, because control will eventually decline, turf should be scouted regularly in case supplemental treatments are needed later in the season.

Although turf caterpillars are capable of causing severe short-term damage to lawns and other turf areas, and the presence of large numbers of caterpillars can be distressing to people using the turf, healthy turf that is properly maintained will usually recover fully within a few weeks. In this respect, the long-term adverse effect of defoliation by caterpillar pests is much less damaging that that caused by heavy infestations of most other turf insects.

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| Turf Caterpillar Control |
| Insecticide | Brand Name\* | Rate | Comments |
| acephate | Orthene TTO 97 | 0.4–0.9 oz per 1000 sq ft | Irrigate before application. Delay watering or mowing for 24 hours following application. Golf course and sod farm use only. |
| bifenthrin | Talstar Select | 0.25 fl oz per 1000 sq ft or 10 fl oz per acre | Delay watering or mowing for 24 hours following application. Restricted-use insecticide |
| Talstar Professional |
| 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. Not for use on athletic fields. Broadcast applications permitted only on golf courses, sod farms, cemeteries, and commercial landscapes (see label). |
| chlorantraniliprole | Acelepryn 1.67 | 2–4 fl oz per acre | Delay watering for 24 hours after application. |
| chlorpyrifos | Dursban 50W | 2 lb per acre | Sod production only. Restricted-use insecticide |
| cyantraniliprole | Ference 1.67 | 2–16 fl oz per acre | Delay watering or mowing for 24 hours. |
| ­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.Restricted-use insecticide |
| Tempo 20 WP (includes golf course uses) | 55 g per 7800–11000 sq ft |
| deltamethrin | DeltaGard GC 5SC | 0.2–0.4 fl oz per 1000 sq ftor 8.75–17.5 fl oz per acre | Restricted-use pesticide |
| DeltaGard T&O 5SC |
| indoxacarb | Provaunt 30 WDG | 2–4 oz per acre or 0.0046–0.092 oz per 1000 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 1000 sq ft. Delay watering or mowing for 24 hours. Landscape turf only. Restricted-use insecticide |
| 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 webworms, but high rate is required against cutworms. Delay watering or mowing for 24 hours following application. |
| 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 control. Do not irrigate following application. |
| \*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 found 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 witch’s 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 five to ten 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 five to ten 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 curled or hooked appearance. Lawn maintenance personnel sometimes refer to this as the pinstripe and bow tie 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 (five to ten days) to bermudagrass mites. 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 warm-season 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.

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| Mite Control |
| Insecticide | Brand Name\* | Rate | Comments |
| azadirachtin | Azatrol EC | 1.3 fl oz per 1000 sq ft | Apply 1–2 gal of spray per 1000 sq ft. |
| bifenthrin | Talstar Professional | 0.5 fl oz per 1000 sq ft | Apply using a surfactant. A second application may be required after 5–10 days. Restricted-use insecticide |
| Talstar Select |
| \*See back page for explanation of abbreviations. |

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| Active ingredients for use against insect and mite pests of turfgrass |
| Active ingredient | Examples of product names |
| Abamectin | Ascend, Award II Fire Ant Bait |
| Acephate | Orthene Tree, Turf, and Ornamental Spray 97  |
| Azadirachtin | Azatrol |
| Bacillus thuringensis (all strains) | Biobit HP insecticide, CryMax, Dipel Pro |
| Bifenthrin | Talstar formulations, Menace GC |
| Carbaryl | Sevin, Carbaryl  |
| Chlorantraniliprole | Acelepryn |
| Clothianidin | Arena formulations |
| Cyantraniliprole | Ference |
| Cyfluthrin | Tempo formulations |
| Deltamethrin | DeltaGard formulations |
| Entomopathogenic nematodes | Nematac S (for mole crickets) |
| Essential oils (peppermint and rosemary oils)  | Ecotrol |
| Fenoxycarb  | Award Fire Ant Bait |
| Fipronil | Top Choice |
| Hydramethylnon | Amdro fire ant bait |
| Imidacloprid | Merit formulations, Mallet, Allectus (with bifenthrin) |
| Imidacloprid + bifenthrin | Allectus formulations |
| Imidacloprid + bifenthrin + zeta-cypermethrin | Triple Crown formulations |
| 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 |

### 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 = 43560 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

1 fl oz = 2 Tbsp

1 Tbsp = 3 tsp

1 tsp = 5 mL

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