

## INSECT CONTROL

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Contrary to most common beliefs, most insects that occur on turfgrass are not pests. Some, such as parasitic wasps and ground beetles, are in fact beneficial insects that feed on the pests and reduce pest population and damage. Therefore, it is important to identify insects found on turfgrass correctly. An effective integrated pest management (IPM) program takes into consideration the biology, ecology, environment impacts, and all available treatment options. An IPM system is not difficult to adopt. Unbeknown to most turfgrass professionals, they are already utilizing some of these elements in making pest management decisions.

Insecticide efficacy can be reduced by many environmental and biological factors. Water pH outside the suitable range can quickly degrade insecticides. Some insecticides may persist longer in clay than in sandy loam. Some insecticides may need irrigation after application to penetrate the soil and kill the insects that live underground. Insects may also develop resistance to one group of insecticides if the same group is applied to the same insect population repeatedly. In order to delay the development of insecticide resistance, avoid using insecticides from same mode of action or IRAC group number repeatedly. To assist in the decision to rotate insecticides, an IRAC table is included in this guide.

**Ants (nuisance ants and red imported fire ants):** A large number of ant mounds can interfere with the play on the greens. RIFA is also a medical concern because of their stings.

*Monitoring:* The small mounds made by the nuisance ants on the greens and the large mounds made by the RIFA along the periphery are the tell-tale signs.

*Treatment:* Most ants can be treated by one of the three methods: individual mound treatment, broadcast granules of baits or long-residual toxicants, and a combination of the two methods.

**Billbug:** Adults feed on the leaf blades and deposit eggs in the stem. The larvae, resembles legless white grubs, first bore into the stem and then feed on the rhizomes, roots and crown as they mature.

*Monitoring:* Adults can often be found crawling on pavement in the spring. Larvae can be found by digging into the yellowing and thinning turf. Grasses fed by the larvae can be easily pulled out from the ground because the roots are consumed. Fine, whitish, saw dust materials often come out of the hollowed stems.

*Treatment:* Recent research indicates that management should target both adults and grubs. Apply insecticides in last spring (May) and fall (September) when adults are observed.

**Caterpillars (cutworm, fall armyworm and sod webworm):** Fall armyworm begins to appear in June while cutworms and sod webworms often begin to appear in the spring.

*Monitoring:* Conduct soap flush (1-2 fl oz detergent per gallon water) to determine the species and size. Frequent congregations of birds and paper wasps also can indicate infestations.

*Treatments* are most effective against small caterpillars; therefore, it is crucial to determine size through soap flush. Treat when needed. Do not irrigate within 24 hours after application.

**Chinch bug:** Southern chinch bug is the major pest of St. Augustinegrass, often create yellowing or dead patches in the hot, dry days. Thick thatch often accentuates infestations.

*Monitoring:* Two floatation methods can be used to monitor chinch bug population: 1) insert a large PVC pipe or cut-out coffee can deep into the turf and pour in tap water, or 2) cut a piece of sod and flood it inside a container with tap water. Chinch bugs will float to the top and can be counted.

*Treatment:* Established treatment threshold is 25-30 chinch bugs per sq ft. A high volume spray (minimum of 50 gal/acre) will be needed to deliver the chemicals into the thatch for control.

**Earthworm:** Although usually considered beneficial, earthworm can still interfere with play by pushing a large number of castings onto the greens. No control is recommended.

**Mole cricket:** Tawny and southern mole crickets create tunnels and expose the grass roots to desiccation. Adult flight occurs in April to June. Egg hatch occurs from June through July.

*Monitoring:* Check for tunnels. Soap flush (1-2 fl oz lemon scented detergent per gallon water) in areas large numbers of tunnels can capture the mole crickets and determine body sizes.

*Treatment:* Treatment of young nymphs in June and July is more effective than treatment of adults in spring and larger nymphs in the fall. When contact insecticides are used, irrigate after application can help to push the insecticides into the soil.

**White grubs:** White grubs feed on the roots of turfgrass. Infested turf turns yellow and wilt. Severe infested turf feels spongy under foot and often fall apart when cut or lifted.

*Monitoring:* Remove sod from the ground and carefully inspect root zone for the grubs. Treat when more than 7-10 grubs are found in 1 sq ft of sod.

*Treatment:* Preventive treatment of young white grubs in May to June using long residual insecticides (such as neonicotinoids and diamides) is more effective than curative treatment of larger grubs in July and August (using organophosphate insecticides). Because the grubs live deep underground, the insecticides have to be irrigated in after application.

Biology and management information of the above mentioned and other pests of turfgrass are listed in the table.

**Common Turf Insecticides Listed by IRAC Classification, Chemical Classes and MOA**

IRAC Group	Mode of Action	Chemical Classes	Active Ingredient	Trade Name <sup>1</sup>
1A	Acetylcholine esterase inhibitors	Carbamates	carbaryl	Sevin
1B		Organophosphates	acephate	Orthene
			chlorpyrifos	Dursban
			trichlorfon	Dylox
2B	GABA-gated chloride channel antagonists	Fipronil	fipronil	TopChoice, Taurus
3	Sodium channel modulators	Pyrethroids	bifenthrin	Allectus <sup>2</sup> , Aloft <sup>2</sup> , Onyx, Talstar, Bifen, etc.
			cyfluthrin	Tempo
			cypermethrin	Demon, Triple Crown T&O
			deltamethrin	Deltagard
			lambda-cyhalothrin	Lambda, Battle, Demand, Scimitar, Tandem <sup>2</sup>
			permethrin	Astro
4A	Nicotinic acetylcholine receptor agonists/antagonists	Neonicotinoids	clothianidin	Arena, Aloft <sup>2</sup>
			dinotefuran	Zylam
			imidacloprid	Allectus <sup>2</sup> , Imidacloprid, Merit, Mallet, etc.
			thiamethoxam	Meridian, Tandem <sup>2</sup>
5	Nicotinic acetylcholine allosteric activator	Spinosyns	spinosad	Conserve
6	Chloride channel activators	Avermectins	abamectin	Avid, Award II fire ant bait
7A	Juvenile hormone mimics	Junevile hormone analogues	s-methoprene	Firestrike <sup>2</sup> , Extinguish, Extinguish Plus <sup>2</sup>
7C		Pyriproxyfen	pyriproxyfen	Distance Fire Ant Bait
11A	Microbial disruptors of insect midgut membranes	<i>Bacillus thuringiensis</i>	<i>B.t. subsp. aizawai</i>	Xentari
			<i>B.t. subsp. galleriae</i>	grubGONE! G
			<i>B.t. subsp. kurstaki</i>	Biobit, Crymax, Dipel, Juvelin, Lepinox
18A	Ecdysone agonists.molting disruptors	Diacylhydrazines	halofenozide	Mach 2
20	Mitochondrial complex III electron transport inhibitors	Hydramethylnon	hydramethylnon	Amdro Firestrike <sup>2</sup> , Extinguish Plus <sup>2</sup> , SiegePro
22	Voltage-dependent sodium channel blockers	Indoxacarb	indoxacarb	Advion fire ant bait, Provaunt
		Metaflumizone	metaflumizone	Siesta fire ant bait
28	Ryanodine receptor modulator	Diamides	chlorantraniliprole	Acelypryn
			cyantraniliprole	Ference
un	Unknown MOA	Azadirachtin	azadirachtin	Azatin O, Azatrol, Molt-X, Ornazin
		Dicofol	dicofol	Dicofol 4E
uc	Unclassified: Pathogens	Bacteria	<i>Bacillus popillae</i>	Milky spore powder
			<i>Chromobacterium subtsugae</i>	Grandevo PTO
		Nematodes	<i>Steinernema</i> and <i>Heterorhabditis</i> spp.	Millenium, BioVector, NemaShield
		Fungi	<i>Beauveria bassiana</i>	Botanigard, Naturalis
			<i>Metaehizium anisopliae</i>	Met52, Tick-Ex

<sup>1</sup>Trade names are provided as examples only. No endorsement of products is intended, nor is criticism of unnamed products implied.

<sup>2</sup>Allectus = imidacloprid + bifenthrin; Aloft = clothianidin + bifenthrin; Tandem = thiamethoxam + lambda-cyhalothrin; Triple Crown T&O = zeta-cypermethrin + bifenthrin + imidacloprid; Amdro Firestrike and Extinguished Plus = s-methoprene + hydramethylnon.

**Read pesticide labels and follow label instructions and precautions when handling, mixing, applying and storing pesticides.**

## INSECT PEST CONTROL

Pest	Pesticide Common Name	Pesticide Trade Name and Formulation <sup>1</sup>	Rate / 1,000 sq. ft.	Pest Biology, Symptoms, Cultural Practices, and Comments
Ants, Nuisance	acephate	Orthene TT&O 75 and 97	1.2 to 1.6 oz/gal, see label	<p>In most cases ants serve as predators of turfgrass pests and competitors to red imported fire ants. Ants become a nuisance when they build up to a high number, invade buildings and equipments, and build mounds that interfere with the smoothness of the greens. Species identification and an understanding of ant biology are critical in deciding where to treat and what to treat with, especially when baits are used. Ants are very susceptible to insecticide treatments, but relief of the problem seldom occurs unless the colony itself is eliminated. Sap-sucking insects (such as aphids, mealybugs, scale insects and leafhoppers) on nearby vegetations or landscape ornamentals should be controlled to reduce their attraction to the honeydew-seeking ants.</p> <p>Check labels of Sevin products for site restrictions.</p> <p>Dursban PRO is for uses on golf courses, road medians, and industrial plants sites only. Dursban 50W can also be used on sod farms and seed productions.</p> <p>Use GC formulation of Aloft for golf course and sod farms. Use LC formulation of Aloft for residential and commercial lawns, parks, recreational areas, and athletic fields.</p> <p>Check label for site restrictions.</p> <p>Demon is for lawn and landscape uses.</p> <p>DeltaGard is for lawns, recreational areas and athletic fields. Use GC formulation for golf courses and sod farms.</p> <p>Broadcast or slit applications. Provide 3 months control. Not for pasture and grazing lands. Check label for buffer zone and yearly application limit requirements.</p> <p>For fire ants, big-headed ants, and harvester ants.</p> <p>Use GC formulation of Allectus on golf courses and sod farms.</p> <p>For fire ants, big-headed ants, and pavement ants.</p> <p>Demand and Scimitar for use on lawns, recreational areas and athletic fields. GC formulation also for gold course and sod farm uses.</p> <p>For fire ants, native ants, big-headed ants, harvester ants, and Argentine ants.</p>
	bifenthrin <sup>2</sup>	Onyx	0.07 to 0.15 fl oz	
		OnyxPro	0.16 to 0.32 fl oz	
		Talstar EZ Golf , GC Gran, PL	2.3 to 4.6 lbs	
		Talstar GC Flowable, Talstar One	0.25 to 1.0 fl oz	
	bifenthrin + zeta-	Triple Crown T&O	0.46-0.80 fl oz	
	cypermethrin+imidacloprid	Sevin 5 Bait	11 oz	
	carbaryl	Sevin 10G	1.4 to 1.9 lbs	
		Sevin 80 WSP	2.5 to 5.0 lb/acre	
		Sevin SL	1.5 to 3 fl oz	
	chlorpyrifos	Dursban 50W	2 lb/acre	
		Dursban PRO	1.5 fl oz	
	clothianidin	Arena .25G	1.84 to 3.67 lbs	
		Arena .5G	1.0 to 1.8 lbs	
	clothinidin + bifenthrin	Aloft GC SC, LC SC	11.65 to 23.3 fl oz, see label	
		Aloft GC G, LC G	80 to 160 lbs, see label	
	cyfluthrin	Tempo (various formulations)	See label	
	cypermethrin	Demon Max	0.5 fl oz/gal	
		Demon WP	0.33 oz/gal	
	deltamethrin	DeltaGard GC, DeltaGard T&O	0.4 to 0.6 fl oz	
		DeltaGard G, DeltaGard GC Gran	2 to 3 lbs	
	fipronil	Chipco TopChoice	2 lbs	
		Chipco Choice	4.6 oz	
	hydramethylnon (bait)	Amdro Pro, SiegePro	1 to 1.5 lbs/acre	
		Maxforce G	1 to 2 lbs	
	imidacloprid + bifenthrin	Allectus G, Allectus GC Gran	1.7 to 2.9 lbs	
		Allectus SC, Allectus GC SC	1.32 to 1.65 fl oz	
	indoxacarb (bait)	Advion Fire Ant Bait	1.5 lb/acre	
lambda-cyhalothrin	Demand EZ	13.6 to 28 ml		
	Demand G	2 to 3 lbs		
	Demand CS, Scimitar GC and CS	3.4 to 7 ml		
methoprene +	Extinguish Plus	1.5 lbs/acre		
hydramethylnon (bait)				

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Ants, Nuisance	permethrin pyriproxyfen (bait)	Astro Distance Fire Ant Bait	0.4 to 0.8 fl oz 1 to 1.5 lbs/acre	Astro is for use on lawns, recreational areas and athletic fields. For fire ants and big-headed ants.
Ants, Red Imported Fire	<b>Mound treatment and Broadcast insecticide</b>			<p>The Red Imported Fire Ant (RIFA) found in South Carolina is an invasive species. Movement of soil and plant materials is regulated by a federal quarantine. If shipment of soil, sods or plant crops outside of the quarantine area is intended see <a href="http://www.aphis.usda.gov/oa/pubs/ifapub.pdf">http://www.aphis.usda.gov/oa/pubs/ifapub.pdf</a> for regulations on the specific treatments required by USDA-APHIS, or consult with the SC Department of Plant Industry.</p> <p>Chemicals for RIFA management can be broken into three categories: Individual mound treatments, broadcast bait treatments and broadcast insecticide treatments. Individual mound treatments (e.g., liquid drenches or granules) are fairly fast acting, but only work to kill the mounds that are directly treated. They are most appropriate for eliminating individual mounds that present a hazard or as clean-up treatments. They are not effective as a management strategy for reducing the RIFA population in an area.</p> <p>Broadcast bait treatments are more effective in reducing the population in a given area. The speed at which the baits reduce mound numbers differs by products. Some are slower acting and no results will be noticed for three or four weeks. More recently introduced products act faster. Baits will most likely need to be applied in the spring and fall. Most baits are applied at a rate of 1 to 1.5 lbs per acre. The key to success with RIFA bait products is to broadcast the material when the ants are foraging since most of the products breakdown quickly in sunlight and water. Foraging activity is regulated by surface soil temperatures. RIFA forage when soil temperature reaches above 65°F. The best way to determine if ants are actively foraging is to place a small amount of test bait in the area to be treated. If RIFA hit the bait within 30 minutes then it is a good time to use the baits.</p> <p>Broadcast insecticide treatments are recommended for high use areas with zero tolerance for RIFA. Most of these applications are relatively expensive and therefore cost prohibitive in large areas. The advantage of the broadcast granular products is the high level of control that can be achieved. They are also relatively easy to use and can go out at any time of the year. Most of the products can give up to twelve months of control. To achieve good control, the product should be applied evenly and thoroughly to cover all areas to be treated.</p> <p>Combinations of IMT, bait, and/or granular broadcast treatments based upon the needs of the site are likely to produce better results than the use of a single chemical or strategy alone. The 'two-step' program is a combination of both broadcast bait and individual mound treatments, which is suitable for large and medium-sized area at a moderate cost. First step involves broadcasting slow-acting baits in the spring and/or fall, when the RIFA is actively foraging. Then individual RIFA mounds can be treated individually with a fast-acting contact insecticide in step two. This shortcoming of this treatment program is the relatively long time required before an overall reduction in the RIFA population and mounds will be observed.</p> <p>Check label of individual insecticide for information on site uses, application method, yearly application limit and buffer zone restrictions.</p>
acephate	Orthene TT&O 75	Drench: 0.2 oz/gal/mound Dry: 1-2 teaspoons/mound		
bifenthrin <sup>2</sup>	Orthene TT&O 97 Onyx Pro Talstar EZ Golf, Talstar GC Gran Talstar GC Flowable, Talstar One Talstar F	Drench: 0.15 oz/gal/mound Broadcast: 0.16 to 0.32 fl oz Broadcast: 2.3 to 4.6 lbs Broadcast: 0.5 to 1.0 fl oz Drench: 1 teaspoon/gal/mound Broadcast: 1.0 fl oz Drench: 1 teaspoon/gal/mound		
bifenthrin + zeta-cypermethrin+imidacloprid	Triple Crown T&O	Broadcast: 0.46-0.80 fl oz		
carbaryl	Sevin 10G	Broadcast: 1 to 1.9 oz/mound		
chlorpyrifos	Dursban 50W  Dursban PRO	Broadcast: 2 lbs/acre Sod Broadcast: 16 lbs/acre Drench: 0.05 lb/gal/mound Broadcast: 1.5 fl oz Drench: 0.5 fl oz/gal/mound		
cyfluthrin	Tempo Ultra SC, Tempo Ultra GC Tempo 20 WP, Tempo Ultra WP Tempo 20 WP GC, Power Pak Tempo 20 WSP	Broadcast: 0.27 fl oz Broadcast: 10 grams 1 packet/7,800 sq. ft. 1 packet/5,000 sq. ft.		
deltamethrin	DeltaGard GC, DeltaGard T&O DeltaGard G, DeltaGard GC Gran	Drench: 1.5 fl oz/gal/mound Broadcast: 2 to 3 lbs		
fipronil	Chipeo TopChoice Chipeo Choice	Broadcast: 2 lbs Broadcast: 4.6 oz		
imidacloprid + bifenthrin	Allectus G, Allectus GC Gran  Allectus SC, Allectus GC SC	Broadcast: 2.9 to 5.7 lbs Dry: 0.5 cup/mound Broadcast: 1.32 to 1.65 fl oz SC Drench: 1/3 fl oz/gal/mound GC Drench: 2/3 fl oz/gal/mound		
lambda-cyhalothrin	Demand EZ Demand CS, Scimitar CS	Broadcast: 13.6 to 28 ml Broadcast: 3.4 to 7 ml		
permethrin	Astro	Broadcast: 0.4 to 0.8 fl oz		

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<b>Ants, Red Imported Fire</b>	spinosad	Conserve SC	Drench: 0.1 fl oz/gal/mound	
	thiamethoxam	Meridian 25WG	Drench: 1 to 3 oz/100 gal 2-3 gal//mound	
	thiamethoxam + lambda-cyhalothrin	Tandem	Broadcast: 14-28 fl oz/acre	
<b>Broadcast baits</b>				
	abamectin	Award II Fire Ant Bait	Broadcast: 1 lb/acre	Many baits also control other nuisance ant, such as harvester ants and big-headed ants. Check label for specific instructions. Do not exceed 4 applications per year.
	fipronil	Varsity Fire Ant Bait Maxforce FC	Mound: 5 to 7 tbsp/mound Broadcast: 1.5 to 5 lbs/acre	
	hydamethylnon	Amdro Pro Fire Ant Bait SiegePro Fire Ant Bait Maxforce G	Mound: 2 to 5 tbsp/mound Broadcast: 1 to 1.5 lbs/acre	Not for use on sod farms. Do not exceed 4 applications per year.
	indoxacarb	Advion Fire Ant Bait	Mound: 2 to 5 tbsp/mound Broadcast: 1 to 2 lbs/acre	
	methoprene	Extinguish	Mound: 2 to 5 tbsp/mound Broadcast: 1.5 lb/acre	Mix with other baits.
	methoprene + hydamethylnon	Extinguish Plus	Mound: 4 tablespoons/mound Broadcast: 1 to 1.5 lbs/acre	
	pyriproxyfen	Distance Fire Ant Bait	Mound: 3 to 5 tbsp/mound Broadcast: 1-2 oz/mound	
	spinosad	Justice Fire Ant Bait	Broadcast: 1-1.5 lbs/acre Mound: 2 to 5 tbsp/mound	
	pyriproxyfen	Distance Fire Ant Bait	Broadcast: 1 to 1.5 lbs/acre Mound: 1 to 4 tbsp/mound	
	spinosad	Justice Fire Ant Bait	Broadcast: 2.5 to 5 lbs/acre Mound: 4-6 tbsp/mound	
<b>Billbugs (adults)</b>	bifenthrin <sup>2</sup>	Onyx, OnyxPro Talstar EZ Golf, GC Gran, PL Talstar GC Flowable, One, F	0.07 to 0.16 fl oz, see labels 1.15 to 2.3 lbs 0.25 to 0.5 fl oz	Billbug adults and larvae feed on the roots and stems of various turfgrasses, with bermudagrass, zoysiagrass and seashore paspalum being the most susceptible. Symptoms are often misdiagnosed as drought stress or disease. Symptoms first appear as scattered dead stems and later enlarge to small patch turning from yellow to brown. Straw-color dead grasses are easily pulled out with the hollowed stem break away from the crown. Fine, sawdust-like frass can be seen at the base. The affected turf, which appears drought-stressed, does not recover with watering. Damage usually shows up in mid- to late-summer (worst in August) during extended drought period. Soil remains firm, not spongy underfoot as with white grub or mole cricket infestations.  Adults can be forced from the grass with a detergent or captured with a pitfall trap. Adults can be found from March to November in SC; the peak activity occurs in May and September. Treat for grubs soon after adult peak activity. Detection and treatment for larvae are similar to white grubs. Treat when adults and/or larvae are found and
	bifenthrin + zeta-cypermethrin+imidacloprid carbaryl	Triple Crown T&O Sevin 10G	0.23-0.46 fl oz 1.4 to 1.9 lbs	
	chlorpyrifos	Dursban 50W Dursban PRO	2 to 4 lbs/acre 1.5 fl oz	
	clothianidin + bifenthrin	Aloft GC SC, LC SC Aloft GC G, LC G	11.65 to 23.3 fl oz, see label 80 to 160 lbs, see label	
	cyfluthrin	Tempo (various SC formulation)	see label	

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<b>Billbugs (adults)</b>	cyfluthrin	Tempo 20 WSP, Power Pak	1 packet/5,000 to 7,800 sq. ft.	damage is apparent. Most materials, particularly those against the grubs, should be watered-in with 2-inch immediately after application.  Check label of individual insecticide for information on site uses, application method, yearly application limit and buffer zone restrictions.  Labeled for bluegrass billbug.
	deltamethrin	DeltaGard GC, DeltaGard T&O	0.6 to 0.9 fl oz	
	imidacloprid + bifenthrin	DeltaGard GC Gran, DeltaGard G	2 to 3 lbs	
		Allectus G, Allectus GC Gran	1.7 to 2.9 lbs	
		Allectus SC	0.4 to 1.65 fl oz	
	lambda-cyhalothrin	Allectus GC SC	0.9 to 1.65 fl oz	
Demand EZ		28 ml		
Demand G		3 to 4 lbs		
thiamethoxam + lambda-cyhalothrin	Demand CS, Scimitar GC and CS	7 ml		
<b>Billbugs (grubs)</b>	carbaryl	Sevin 80 WSP	10 lb/acre	Begin preventive treatment against larvae soon after the adults become active in the spring (usually in late April and May; monitor with pitfall traps). Larger grubs can also be controlled curatively (although less effectively) in early summer (when the grubs are in the soil) with methods similar to the white grubs.  0.5G is not for use on sod farms.  1 packet = 1.6 oz  2SC is not for uses in residential lawns.
		Sevin SL	6 fl oz	
	chlorpyrifos	Dursban 50W	2 to 4 lbs/acre	
		chlorantraniliprole	Acelepryn	
	Acelepryn granule		1.15 to 2.3 lb	
	clothianidin	Arena .25G	1.84 to 3.67 lbs	
		Arena .5G	1.0 to 1.8 lbs	
		Arena 50 WDG	6.4 to 12.8 oz	
	clothianidin + bifenthrin	Aloft GC SC	11.65 to 19 fl oz	
		Aloft GC G	80 to 132 lbs	
		Aloft LC SC	11.65 to 23.3 fl oz	
		Aloft LC G	80 to 160 lbs	
	cyantraniliprole	Ference	0.184-0.367 fl oz	
	dinotefuran	Zylam 20SG	1 oz	
	imidacloprid <sup>2</sup>	Merit 0.5 G	1.4 to 1.8 lbs	
		Merit 2 F	0.46 to 0.6 fl oz	
		Merit 75 WP	3 to 4 teaspoons	
		Merit WSP	1 packet/8,250-11,000 sq. ft.	
	imidacloprid + bifenthrin	Allectus G, Allectus GC Gran	1.7 to 2.9 lbs	
		Allectus SC	0.4 to 1.65 fl oz	
Allectus GC SC		0.9 to 1.65 fl oz		
halofenozide	Mach 2 2SC	2.9 fl oz		

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Billbugs (grubs)	halofenozide	Mach 2 1.5G	3 lbs	Allow 7 days before treatment and harvest of sods when using Mach 2.  Dylox is not for uses in sod farms, seed productions and research.
	thiamethoxam	Meridian 0.33G	1.42 to 1.88 lbs	
		Meridian 25WG	0.3 to 0.39 oz	
	thiamethoxam + lambda-cyhalothrin	Tandem	0.32-0.64 fl oz	
	trichlorfon	Dylox 6.2G	3 lbs	
		Dylox 80 T&O	3.75 fl oz/100 gal	
Caterpillars (Armyworms, Cutworms, Sod Webworms)	acephate	Orthene TT&O 75, 97	see label	Fall armyworm, cutworm and sod webworm are the major pest caterpillar species of turfgrass. All lawn caterpillars feed on grass blades.  True armyworms feed in groups, creating circular patches of bare grounds. Fall armyworms are less gregarious, so the damage often occurs as thinning of grasses in a broad area. Fall armyworm migrates from FL and southern GA each year. Damage begins to appear in June but at this time the caterpillars have become too big and difficult to control. Symptoms of care grounds often appear near building, trees, posts, poles and other erected structures as adult moths often lay eggs on these structures.  Cutworms dig a burrow in the thatch or soil and eat the grass around the burrow at night, resulting in small patches of dead greens and sunken areas; thus reducing the smoothness and uniformity of putting surface. Frequent mowing and clipping removal help to reduce population but not enough to achieve control.  There are several generations of sod webworm in a year. The damage begins to appear in spring and becomes progressively severe with the season. Damage begins as general thinning, followed by small patches of brown, closely-cropped grass; later coalesces into large irregular patches with severe infestations. Adult sod webworm or lawn moths, which have characteristic snout-like projections in front of their heads, are active flyers over turfgrass in the evening.  The presence of birds feeding on the caterpillar should also be an indicator. All caterpillar species can be monitored with detergent flush.  Treated areas (with most contact insecticides) <b>should not be irrigated within 24 hours</b> of treatment so that the caterpillars will come in contact with the residues.  Caterpillars are often attacked by natural enemies; therefore, conserve these natural enemies with less frequent sprays or compatible insecticides whenever possible.  Use higher rates of Sevin for cutworm control.
	azadirachtin	Azatrol	Up to 57 fl oz/acre	
	<i>Bacillus thuringiensis (Bt)</i>	Biobit, Crymax, Deliver, Dipel, Javelin, Lepinox, XenTari	0.5 to 3 lbs/acre, see label	
	bifenthrin <sup>2</sup>	Onyx	0.07 to 0.15 fl oz	
		OnyxPro	0.05 to 0.08 fl oz	
		Talstar EZ Golf, GC Gran, PL	1.15 lbs	
		Talstar GC Flowable, One, F	0.18 to 0.25 fl oz	
	bifenthrin + zeta-cypermethrin+imidacloprid	Triple Crown T&O	0.23-0.34 fl oz	
	carbaryl	Sevin 10G	1.4 to 1.9 oz, see label	
		Sevin 80 WSP	2.5 to 10 lb/acre, see label	
		Sevin SL	1.5 to 6 fl oz, see label	
	chlorpyrifos	Dursban 50W	2 lbs/acre	
		Dursban PRO	1.5 fl oz	
	chlordaniliprole	Acelypryn	0.046 to 0.092 fl oz	
		Acelepryn granule	1.15 to 2.3 lbs	
	<i>Chromobacterium subtsugae</i>	Grandevo PTO	0.75-1.5 oz	
	clothianidin	Arena .25G	1.84 to 3.67 lbs	
		Arena .5G	1.0 to 1.8 lbs	
		Arena 50 WDG	12.8 oz	
	clothianidin + bifenthrin	Aloft GC SC, LC SC	11.65 to 23.3 fl oz; see label	
	Aloft GC G	80 to 132 lbs		
	Aloft LC G	80 to 160 lbs		
cyantraniliprole	Ference	0.046-0.367 fl oz		
cyfluthrin	Tempo Ultra SC, Tempo Ultra GC	0.135 to 0.27 fl oz		
	Tempo 20 WP, Tempo Ultra WP	5 to 10 grams		

## INSECT PEST CONTROL

Pest	Pesticide Common Name	Pesticide Trade Name and Formulation <sup>1</sup>	Rate / 1,000 sq. ft.	Pest Biology, Symptoms, Cultural Practices, and Comments
<b>Caterpillars (Armyworms, Cutworms, and Sod Webworms)</b>	cyfluthrin	Tempo 20 WP GC, Power Pak	1 packet/7,500-11,000 sq. ft.	<p>Zylam is registered for use on cutworm and sod webworm.</p> <p>Only effective against small caterpillars.</p> <p>Mach 2 for use in commercial sites only. Both formulations are more effective against younger caterpillars. They are preventive rather than curative in nature.</p> <p>Merit is for cutworm only. Must be applied against early stages. May only achieve suppression of the population.</p> <p>1 packet = 1.6 oz.</p> <p>Not for use on sod farms.</p>
		Tempo 20 WSP	1 packet/5,000-10,000 sq. ft.	
	deltamethrin	DeltaGard T&O, DeltaGard GC	0.2 to 0.4 fl oz	
		DeltaGard G, DeltaGard GC Gran	2 to 3 lbs	
	dinotefuran	Zylam 20SG	1 oz	
	nametodes <sup>2</sup>	Various products	See label	
	halofenozide	Mach 2 2SC	1.5 fl oz	
		Mach 2 1.5G	1.55 lbs	
	imidacloprid <sup>2</sup>	Merit 0.5 G	1.4 to 1.8 lbs	
		Merit 2 F	0.46 to 0.6 fl oz	
		Merit 75 WP	3 to 4 teaspoons	
		Merit 75 WSP	1 packet/8,250-11,000 sq. ft.	
	imidacloprid + bifenthrin	Allectus G, Allectus GC Gran	1.2 to 2.9 lbs	
		Allectus GC SC	0.67 to 1.65 fl oz	
		Allectus SC	0.4 to 1.65 fl oz	
	indoxacarb	Provaunt	0.046 to 0.092 oz	
	lambda-cyhalothrin	Demand EZ	13.6 to 28 ml	
		Demand G	2 to 3 lbs	
	Demand CS, Scimitar GC, CS	3.4 to 7 ml		
permethrin	Astro	0.4 to 0.8 fl oz		
spinosad	Conserve SC	0.25 to 1.2 fl oz, see label		
thiamethoxam + lambda-cyhalothrin	Tandem	0.32-0.64 fl oz		
trichlorfon	Dylox 80 T&O	2.5 to 3.75 fl oz/100 gal		
	Dylox 6.2G	2 lbs		
<b>Chinch Bugs</b>	acephate	Orthene TT&O 75 and 97	0.9 to 2.4 oz; see label	<p>Chinch bugs are a major problem of St. Augustinegrass. Hot, dry weather, deep thatch, and high fertility favor chinch bug development. Infested turfgrass first appear yellow and stunted. As the infestation progresses, the grass wilt and dead, creating small dead patches which will expand as the infestation continues and the damage worsens.</p> <p>Sampling for chinch bugs is conducted using the floating method. Plugs of turf and soil can be placed in a 5-gallon bucket filled with clean water or an open ended cylinder (metal can or PIV pipe) driven into the ground and filled with clean water. Adults and nymphs will float to the surface within 10 minutes. Do not use soapy water. For best result sample along the edge of the damage. If chinch bugs are suspected and floating yields no results, visual examination of the stolons in the thatch layer may yield results.</p>
<i>Beauveria bassiana</i>	Botanigard	0.5 to 2 qts/100 gal		
bifenthrin <sup>2</sup>	Onyx, OnyxPro	See label		
	Talstar EZ Golf, GC Granular, PL	2.3 to 4.6 lbs		
	Talstar GC Flowable, One, F	0.25 to 0.5 fl oz		
bifenthrin + zeta-cypermethrin+imidacloprid	Triple Crown T&O	0.46-0.80 fl oz		
<i>Chromobacterium subtsugae</i>	Grandevo PTO	2-4 lbs/acre		



## INSECT PEST CONTROL

Pest	Pesticide Common Name	Pesticide Trade Name and Formulation <sup>1</sup>	Rate / 1,000 sq. ft.	Pest Biology, Symptoms, Cultural Practices, and Comments	
Chinch Bugs	carbaryl	Sevin 10G	1.4 to 1.9 lbs	Treatments should be applied if 25 to 30 insects are found per square foot. Chinch bugs are often found in the thatch layer. Thus higher volume is critical in delivering the insecticides through the thatch layer and to successful insecticide treatments. See insecticide label for specifics. In general, <b>use a minimum spray volume of 50 gallons/acre (1.2 gallons/1000 sq. ft.)</b> .	
		Sevin 80 WSP	7.5 to 10 lb/acre		
		Sevin SL	4.5 to 6 fl oz		
	chlorpyrifos	Dursban 50W	2 lbs/acre	St. Augustinegrass varieties 'Floratom', 'Floralawn' and 'Captiva' are resistant to chinch bugs. Cultural controls include less N, using water insoluble (slow release) N, using a sharp mower blade, mowing at 3" in sun areas, 4" in shaded areas, and controlling thatch. Irrigate with ¾-inch when grass begins to wilt. Minimize the use of atrazine on St. Augustinegrass during summer. Monitor turf regularly. To preserve beneficial arthropods, limit treatment to the damaged area and 5 to 10 feet beyond. Recheck in 2-3 days. Spot treat again, if needed.	
		Dursban PRO	1.5 fl oz		
	chlorantraniliprole	Acelypryn	0.184 to 0.46 fl oz		
		Acelepryn granule	1.15 to 2.3 lbs		
	clothianidin	Arena .25G and .5G	1.5 to 3.67 lbs, see label		
		Arena 50 WDG	12.8 oz		
	clothianidin + bifenthrin	Aloft GC SC	11.65 to 19 fl oz		
		Aloft GC G	80 to 132 lbs		
		Aloft LC SC	11.65 to 23.3 fl oz		
		Aloft LC G	80 to 160 lbs		
	cyantraniliprole	Ference	0.184-0.459 fl oz	Acelypryn and Ference provide suppression only.	
	cyfluthrin	Tempo (various formulations)	See label		
	cypermethrin	Demon Max	0.33 to 0.65 fl oz		
	deltamethrin	DeltaGard GC, DeltaGard T&O SC	0.6 to 0.9 fl oz		
		DeltaGard G, GC Gran, T&O Gran	2 to 3 lbs		
	dinotefuran	Zylam 20SG	1 oz		Zylam only achieves suppression.
	imidacloprid <sup>2</sup>	Merit 0.5 G	1.8 lbs		Merit only achieves suppression.
		Merit 2 F	0.6 fl oz		
		Merit 75 WP	4 teaspoons		
	imidacloprid + bifenthrin	Allectus G, Allectus GC Gran	1.7 to 2.9 lbs		Meridian may only provide suppression.
		Allectus SC, Allectus GC SC	1.65 fl oz		
lambda-cyhalothrin	Demand EZ	56 ml			
	Demand G	3 to 4 lbs			
	Demand CS, Scimitar GC, CS	14 ml			
permethrin	Astro	0.4 to 0.8 fl oz			
thiamethoxam	Meridian 0.33G	1.42 to 1.88 lbs			
	Meridian 25WG	0.3 to 0.39 oz			
thiamethoxam + lambda-cyhalothrin	Tandem	0.32 to 0.64 fl oz			
trichlorfon	Dylox 80 T&O	3.75 fl oz/100 gal			

## INSECT PEST CONTROL

Pest	Pesticide Common Name	Pesticide Trade Name and Formulation <sup>1</sup>	Rate / 1,000 sq. ft.	Pest Biology, Symptoms, Cultural Practices, and Comments
Chiggers and Ticks	azadirachtin	Azatrol	Up to 57 fl oz/acre	Chiggers (red bugs) and ticks may be present in turfgrass areas. Although they do not damage turfgrass, they are however significant health risks. Insecticide treatments are often ineffective. Only DeltaGard, Demand, Demon, Dursban, Scimitar, Sevin and Tempo are labeled at higher rates for chigger control. Keep grass mowed short to discourage chiggers and ticks. Avoid contact by applying repellents and wearing protective clothing.  Broadcast application. 1 month control for ticks.
	bifenthrin <sup>2</sup>	OnyxPro	0.16 to 0.32 fl oz	
		Talstar EZ Golf, GC Gran, PL	2.3 to 4.6 lbs	
		Talstar GC Flowable, One, F	0.5 fl oz	
	bifenthrin + zeta-cypermethrin+imidacloprid carbaryl	Triple Crown T&O	0.46-0.80 fl oz	
		Sevin 10G	1.4 to 1.9 lbs	
		Sevin 80 WSP	2.5 to 5 lb/acre	
		Sevin SL	1.5 to 3 fl oz	
	chlorpyrifos	Dursban 50W	2 lbs/acre	
		Dursban PRO	1.5 fl oz	
	cyfluthrin	Tempo Ultra SC, Tempo Ultra GC	0.135 to 0.27 fl oz	
		Tempo 20 WP, Tempo Ultra WP	5 to 10 grams	
	cyfluthrin	Tempo 20 WP GC, Power Pak	1 packet/7,500-11,000 sq. ft.	
		Tempo 20 WSP	1 packet/5,000-10,000 sq. ft.	
	deltamethrin	DeltaGard T&O, DeltaGard GC	0.4 to 0.6 fl oz	
		DeltaGard G, DeltaGard GC Gran	2 to 3 lbs	
fipronil	Chipco TopChoice	2 lbs		
	Chipco Choice	4.6 oz		
imidacloprid + bifenthrin	Allectus G, Allectus GC Gran	2.9 lbs		
	Allectus GC SC, Allectus SC	1.32 to 1.65 fl oz		
lambda-cyhalothrin	Demand EZ	13.6 to 28 ml		
	Demand CS, Scimitar GC, CS	3.4 to 7 ml		
<i>Metarhizium anisopliae</i>	Met52, Tick-EX	1-3 lbs		
permethrin	Astro	0.4 to 0.8 fl oz		
thiamethoxam + lambda-cyhalothrin	Tandem	0.24 fl oz		
Earthworms	No control is recommended.		Earthworms are considered beneficial organisms as they help aerate soil and decompose organic materials (such as thatch). However, when a large number of dirt and castings are pushed up to the putting greens, they will interfere with the play. At this time, no control is recommended. Earthworm castings may be managed with applications of saponin-containing products, such as the organic fertilizer Early Bird 3-0-1.	
Fleas	acephate	Orthene TT&O 75	1.2 to 2.4 oz	
		Orthene TT&O 97	0.9 to 1.8 oz	

## INSECT PEST CONTROL

Pest	Pesticide Common Name	Pesticide Trade Name and Formulation <sup>1</sup>	Rate / 1,000 sq. ft.	Pest Biology, Symptoms, Cultural Practices, and Comments
Fleas	bifenthrin	Onyx, OnyxPro	0.07 to 0.32 fl oz, see labels	Flea bites result in severe irritation and discomfort for human and pets. Pet owners can prevent infestation by treating the pets with a long-lasting insecticide or with flea collars. When curative treatment is needed, both infested area and pets need to be treated. Mowing the lawn before treatment may increase effectiveness. Use higher rates of bifenthrin for larval control, see label.
		Talstar EZ Golf , GC Gran, PL	2.3 to 4.6 lbs	
		Talstar GC Flowable, One, F	0.25 to 0.5 fl oz	
	bifenthrin + zeta-cypermethrin+imidacloprid carbaryl	Triple Crown T&O	0.23-0.46 fl oz	
		Sevin 10G	1.4 to 1.9 lbs	
		Sevin 80 WSP	10 lb/acre	
		Sevin SL	6 fl oz	
	chlorpyrifos	Dursban 50W	2 lbs/acre	
		Dursban PRO	1.5 fl oz	
	cyfluthrin	Tempo Ultra SC, Tempo Ultra GC	0.27 fl oz	
		Tempo 20 WP, Tempo Ultra WP	10 grams	
		Tempo 20 WP GC, Power Pak	1 packet/7,800 sq. ft.	
		Tempo 20 WSP	1 packet/5,000 sq. ft.	
	cypermethrin	Demon Max, TC	0.33 to 0.65 fl oz	
	deltamethrin	DeltaGard T&O, DeltaGard GC	0.4 to 0.6 fl oz	
		DeltaGard G, DeltaGard GC Gran	2 to 3 lbs	
fipronil	Chipco TopChoice	2 lbs	Broadcast application. 1 month control for fleas.	
Imidacloprid + bifenthrin	Allectus G, Allectus GC Gran	2.9 lbs		
		Allectus SC, Allectus GC SC	0.4 to 1.65 fl oz, see label	
lambda-cyhalothrin	Demand EZ	28 ml		
	Demand CS, Scimitar GC, CS	3.4 to 7 ml		
permethrin	Astro	0.4 to 0.8 fl oz	Target flea larvae.	
spinosad	Conserve SC	1.2 fl oz	Perimeter treatment.	
Thiamethoxam + lambda-cyhalothrin	Tandem	0.34 to 1.38 fl oz		
Grasshoppers	acephate	Orthene TT&O 75	0.5 oz	Grasshoppers are occasional pests of turfgrass. Usually infestations do not required treatment. During severe infestation, most contact insecticides are very effective.
		Orthene TT&O 97	0.4 oz	
	azadirachtin	Azatrol	Up to 57 fl oz/acre	
	bifenthrin <sup>2</sup>	Onyx	0.07 to 0.15 fl oz	
		OnyxPro	0.08 to 0.16 fl oz	
		Talstar GC Flowable, One, F	0.25 to 0.5 fl oz	
bifenthrin + zeta-cypermethrin+imidacloprid	Triple Crown T&O	0.23-0.46 fl oz		

## INSECT PEST CONTROL

Pest	Pesticide Common Name	Pesticide Trade Name and Formulation <sup>1</sup>	Rate / 1,000 sq. ft.	Pest Biology, Symptoms, Cultural Practices, and Comments
<b>Grasshoppers</b>	carbaryl	Sevin 5 Bait	11 oz	Not for sod farms.
		Sevin 10G	1.4 to 1.9 oz	
		Sevin 80 WSP	2.5 to 5 lb/acre	
		Sevin SL	1.5 to 3 fl oz	
	clothianidin + bifenthrin	Aloft GC SC	11.65 to 19 fl oz	
		Aloft GC G	80 to 132 lbs	
		Aloft LC SC	11.65 to 23.3 fl oz	
		Aloft LC G	80 to 160 lbs	
	chlorpyrifos	Dursban 50W	2 lbs/acre	
		Dursban PRO	1.5 fl oz	
	cyfluthrin	Tempo Ultra SC, Tempo Ultra GC	0.135 to 0.27 fl oz	
		Tempo 20 WP, Tempo Ultra WP	5 to 10 grams	
		Tempo 20 WP GC, Power Pak	1 packet/7,500-11,000 sq. ft.	
	deltamethrin	DeltaGard T&O, DeltaGard GC	0.4 to 0.6 fl oz	
		DeltaGard G, DeltaGard GC Gran	2 to 3 lbs	
	imidacloprid + bifenthrin	Allectus SC	0.4 to 1.65 fl oz	
		Allectus GC SC	0.9 to 1.65 fl oz	
indoxacarb	Provaunt	0.275 oz		
lambda-cyhalothrin	Demand EZ	13.6 to 28 ml		
	Demand G	2 to 3 lbs		
	Demand CS, Scimitar GC, CS	3.4 to 7 ml		
	Tandem	0.24 fl oz		
<b>Greenbugs (Aphids)</b>	acephate	Orthene TT&O 75	0.5 oz	Greenbug is a species of aphid and is usually a pest of grain crops. In some years, greenbugs will invade turfgrass and suck sap from the grass blades. Population begins to build up in the spring; multiple generations per year. A toxic salivary injected during feeding can cause the leaf areas around the feeding site to turn yellow, then brown and eventually die. Dead grass sometimes show burnt orange coloration. Severe infestation can cause patches of dead grass. The honeydew produced by greenbugs is highly attractive to ants.  Infestation is worsened in well fertilized lawns and golf courses. Avoid heavy fertilization. Also allow natural enemies to suppress aphid populations by using less frequent and more compatible insecticides.  Currently, only Orthene is labeled specifically for greenbug control on golf courses and sod farms (not in landscape). Other contact and systemic insecticides are labeled for
		Orthene TT&O 97	0.4 oz	
	bifenthrin <sup>2</sup>	Onyx, Talstar	See label	
	carbaryl	Sevin	See label	
	chlorpyrifos	Dursban	See label	
	clothianidin	Arena .25G	See label	
	clothianidin + bifenthrin	Aloft	See label	
	cyfluthrin	Tempo	See label	
	cypermethrin	Demon	See label	
	imidacloprid + bifenthrin	Allectus	See label	

## INSECT PEST CONTROL

Pest	Pesticide Common Name	Pesticide Trade Name and Formulation <sup>1</sup>	Rate / 1,000 sq. ft.	Pest Biology, Symptoms, Cultural Practices, and Comments
<b>Greenbugs (Aphids)</b>	imidacloprid <sup>2</sup>	Merit	See label	control of aphids on landscape ornamentals.
	lambda-cyhalothrin	Demand, Scimitar	See label	
	permethrin	Astro	See label	
	thiamethoxam	Meridian	See label	
	thiamethoxam + lambda-cyhalothrin	Tandem	See label	
<b>Leafhoppers</b>	acephate	Orthene TT&O 75	1 oz	<p>Leafhoppers can sometime become a significant pest of turfgrass. Leafhoppers overwinter as eggs or adults; with 1-5 generations per year. The adults and nymphs suck sap from grass blades, often causing silvery or whitish flecks or spots. Heavy infestation may cause mottled turf.</p> <p>Leafhopper infestations usually do not require treatment. When necessary, most contact and systemic insecticides are effective. Because of the movement of leafhoppers, repeated applications may be needed.</p> <p>Keep lawns and turf area well maintained. Healthy lawns can outgrow the damage.</p>
	bifenthrin <sup>2</sup>	Orthene TT&O 97	0.75 oz	
		Talstar EZ Golf , GC Gran, PL	1.15 to 2.3 lbs	
		Talstar GC Flowable, One, F	0.25 to 0.5 fl oz	
	bifenthrin + zeta-cypermethrin+imidacloprid carbaryl	Triple Crown T&O	0.23-0.46 fl oz	
		Sevin 10G	1.4 to 1.9 lbs	
		Sevin 80 WSP	2.5 to 5 lb/acre	
		Sevin SL	1.5 to 3 fl oz	
	chlorpyrifos	Dursban 50W	2 lbs/acre	
		Dursban PRO	1.5 fl oz	
		Grandevo PTO	0.75-1.5 oz	
	<i>Chromobacterium subsugae</i> clothianidin + bifenthrin	Aloft GC SC	11.65 to 19 fl oz	
		Aloft GC G	80 to 132 lbs	
		Aloft LC SC	11.65 to 23.3 fl oz	
		Aloft LC G	80 to 160 lbs	
	deltamethrin	DeltaGard T&O, DeltaGard GC	0.4 to 0.6 fl oz	
		DeltaGard G, T&O Gran, GC Gran	2 to 3 lbs	
	imidacloprid + bifenthrin	Allectus G, Allectus GC Gran	1.7 to 2.9 lbs	
		Allectus GC SC	0.9 to 1.65 fl oz	
Allectus SC		0.4 to 1.65 fl oz		
lambda-cyhalothrin	Demand G	2 to 3 lbs		
<b>Rhodesgrass Mealybugs</b>	bifenthrin <sup>2</sup>	Talstar EZ Golf , GC Gran, PL	1.15 to 2.3 lbs	Bermudagrass and St. Augustinegrass are most susceptible to attacks by the Rhodesgrass mealybug. Rhodesgrass mealybugs, similar to aphids and leafhoppers, feed by sucking the sap from leaf blades, stems and crowns. Damaged grass will first wilt, the turn from green to yellow to brown. The damage is especially serious during extended period of drought. When the grass is pulled up, the Rhodesgrass mealybugs are visible as white cottony matted attached to the nodes on grass stems. The mealybugs produced copious amount of honeydew, which is very attractive to ants and wasps.
		Talstar GC Flowable, One, F	0.25 to 0.5 fl oz	
	bifenthrin + zeta-cypermethrin+imidacloprid carbaryl	Triple Crown T&O	0.23-0.46 fl oz	
		Sevin	See label	
chlorpyrifos	Dursban	See label		

## INSECT PEST CONTROL

Pest	Pesticide Common Name	Pesticide Trade Name and Formulation <sup>1</sup>	Rate / 1,000 sq. ft.	Pest Biology, Symptoms, Cultural Practices, and Comments
<b>Rhodesgrass Mealybugs</b>	clothianidin clothianidin + bifenthrin cyfluthrin deltamethrin  imidacloprid + bifenthrin  imidacloprid <sup>2</sup> lambda-cyhalothrin permethrin thiamethoxam thiamethoxam + lambda-cyhalothrin	Arena Aloft Tempo DeltaGard T&O, DeltaGard GC DeltaGard T&O Gran, GC Gran Allectus G, GC Gran Allectus SC, Allectus GC SC Merit Demand, Scimitar Astro Meridian Tandem	See label See label See label 0.4 to 0.6 fl oz 2 to 3 lbs 1.7 to 2.9 lbs 0.9 to 1.65 fl oz See label See label See label See label See label	Normally Rhodesgrass mealybugs are not a problem for turfgrass, except in areas where the natural control by predators and parasites are disrupted. Conserve these natural enemies by reducing the frequency of insecticide applications and using more compatible insecticides. Controlling fire ant may help reduce infestations.  Full coverage and thorough penetration of infested grass is required to control the Rhodesgrass mealybugs. Therefore, use a high volume and a surfactant for the application. Withhold irrigation for 24 hours after the treatment to allow more contact or systemic activity against the mealybugs.  Currently, only Talstar, DeltaGard and Allectus are labeled specifically for mealybug control on turfgrass. Other contact and systemic insecticides are available for control of mealybugs in landscape ornamentals.
<b>Millipedes Centipedes Pillbugs Sowbugs</b>  (Check cross reference table for specific chemicals)	acephate bifenthrin <sup>2</sup>  bifenthrin + zeta-cypermethrin+imidacloprid carbaryl  chlorpyrifos clothianidin + bifenthrin  cyfluthrin  cypermethrin deltamethrin	Orthene TT&O 75 Talstar EZ Golf , GC Gran, PL Talstar GC Flowable, One, F Triple Crown T&O Sevin 10G Sevin 80 WSP Sevin SL Dursban PRO Aloft GC SC Aloft GC G Aloft LC SC Aloft LC G Tempo Ultra SC, Tempo Ultra GC Tempo 20 WP, Tempo Ultra WP Tempo 20 WP GC, Power Pak Demon Max, TC DeltaGard T&O, DeltaGard GC SC DeltaGard G, DeltaGard GC Gran, DeltaGard T&O Gran	1.6 oz/gal 2.3 to 4.6 lbs 0.25 to 0.5 fl oz 0.23-0.46 fl oz 1.4 to 1.9 lbs 2.5 to 5.0 lb/acre 1.5 to 3 fl oz 1.5 fl oz 11.65 to 19 fl oz 80 to 132 lbs 11.65 to 23.3 fl oz 80 to 160 lbs 0.54 fl oz 10 to 20 grams 1 packet/93-100 gal, see label 0.5 fl oz 0.4 to 0.6 fl oz 2 to 3 lbs	Millipedes, centipedes, pillbugs and sowbugs are common arthropods in turfgrass areas. They do not damage turfgrass. Centipedes may be important predators of other turfgrass pests. Control of these arthropods is not recommended. When necessary, perimeter treatment with contact insecticides can reduce the frequency of these arthropods invading buildings from the turfgrass areas.

## INSECT PEST CONTROL

Pest	Pesticide Common Name	Pesticide Trade Name and Formulation <sup>1</sup>	Rate / 1,000 sq. ft.	Pest Biology, Symptoms, Cultural Practices, and Comments
Millipedes Centipedes Pillbugs Sowbugs	imidacloprid + bifenthrin	Allectus G, Allectus GC Gran	2.9-5.7 lbs	Higher rates for pillbug and sowbug control when using granules.
		Allectus SC	0.4 to 1.65 fl oz	
		Allectus GC SC	0.9 to 1.65 fl oz	
	lambda-cyhalothrin	Demand G	2 to 3 lbs	
		Demand EZ	13.6 to 28 ml	
		Demand CS	3.4 to 7 ml	
permethrin	Scimitar GC, CS	3.4 to 7 ml		
		Astro	0.4 to 0.8 fl oz	
Mites (Clover, Bermudagrass, and other eriophyid mites)	azadirachtin bifenthrin <sup>2</sup>	Azatrol	Up to 57 fl oz/acre	For bermudagrass mite  Clover mites are a problem in spring and fall. Feeding damage is a silvery discoloration of grass and often near the house foundation. Bermudagrass mites (an eriophyid mite) are a problem on common bermudagrass during hot, dry weather. Feeding causes yellowing and distortion of the grass, often results in a tufted or twisted 'rosette' or 'witch-broom' growth. Another common eriophyid mite pest of warm-season turfgrass is the zoysiagrass mite which causes rosette growth on infested zoysiagrass. Newer, hybrid bermudagrasses and zoysiagrass are resistant to their respective mite pests.  Management of bermudagrass mite is especially problematic because no registered products are completely effective against this species. Diazinon has been shown in a study conducted in the 1980s to be the most effective active ingredient. Studies are currently underway to determine the best timing and materials to use for the management of bermudagrass mite.  A wetting agent in the spray mixture improves control. Reapply in 10-14 days. Cultural controls include collecting and removing clippings. Reduce mowing height as close as practical if mites are a problem.  Do not use Kelthane and Dicofof on residential lawns.
		Onyx	0.07 to 0.15 fl oz	
		OnyxPro	0.08 to 0.16 fl oz	
		Talstar GC Flowable, One, F	0.25 to 0.5 fl oz	
	bifenthrin + zeta-cypermethrin+imidacloprid chlorpyrifos	Triple Crown T&O	0.23-0.46 fl oz	
		Dursban 50W	2 lbs/acre	
	cyfluthrin	Dursban PRO	1.5 fl oz	
		Tempo 20 WP GC, Power Pak	1 packet/93-100 gal, see label	
	deltamethrin	DeltaGard GC, DeltaGard T&O	0.6 to 0.9 fl oz	
		DeltaGard GC Gran, DeltaGard G, DeltaGard T&O G	2 to 3 lbs	
	dicofof	Kelthane 50 WSP	0.5 to 1 lb/acre	
		Dicofof 4E	2/3 to 1 pints/acre	
imidacloprid + bifenthrin	Allectus SC	0.4 to 1.65 fl oz		
	Allectus GC SC	0.9 to 1.65 fl oz		
lambda-cyhalothrin	Demand G	2 to 3 lbs		
	Demand EZ	13.6 to 28 ml		
	Demand CS	3.4 to 7 ml		
	Scimitar GC, CS	3.4 to 7 ml		
Mole Crickets	acephate	Orthene TT&O 75	1.0 to 1.9 oz	
		Orthene TT&O 97	0.8 to 1.4 oz	
	bifenthrin <sup>2</sup>	Onyx	0.07 to 0.15 fl oz	
		OnyxPro	0.16 to 0.32 fl oz	
		Talstar EZ Golf , GC Gran, PL	2.3 to 4.6 lbs	
		Talstar GC Flowable, One, F	0.25 to 1.0 fl oz	

## INSECT PEST CONTROL

Pest	Pesticide Common Name	Pesticide Trade Name and Formulation <sup>1</sup>	Rate / 1,000 sq. ft.	Pest Biology, Symptoms, Cultural Practices, and Comments
<b>Mole Crickets</b>	bifenthrin + zeta-cypermethrin+imidacloprid carbaryl	Triple Crown T&O	0.46-0.80 fl oz	Mole cricket adults are present during later winter and early spring. Mating flights occur from April through June. Egg hatch occurs from mid-June through July. The tawny mole cricket is a much more serious problem than the southern mole cricket.
	chlorpyrifos	Sevin 5 Bait	20 to 48 lbs/acre	
	clothianidin	Dursban 50W	4-6 lbs/acre	Tunneling is the most obvious sign of mole cricket infestation. To detect mole crickets, use a detergent flush consisting of 1 to 2 fl oz liquid detergent per gallon of water. One gallon will flush a 4 sq. ft. area. Treat when mole crickets and damage are present.
	clothinidin + bifenthrin	Arena .25G	1.84 to 3.67 lbs	
		Arena .5G	1.5 to 1.8 lbs	
		Arena 50 WDG	12.8 oz	
	cyfluthrin	Aloft GC SC, LC SC	11.65 to 23.3 fl oz, see label	Treatment in the early spring is probably beneficial because this will reduce the number of adult mole crickets laying eggs. Although small nymphs cause little noticeable damage, their treatment in late June and July is highly recommended. Sprays and granules should be applied during mid to late June. Application of baits and Orthene should be made when damage first appears (early- to mid-July). Insecticides can be applied later in the year (Aug.-Oct.). Soil should be moist at time of treatment. If soil is not moist, it is important to irrigate before applying sprays, granules and baits. After treatment, irrigate sprays or granulars into soil with 2 inch of water, except Orthene and baits. A surfactant may increase the efficacy of Orthene. Apply all pesticides as late in the day as possible. Do not irrigate after application of baits for 2-3 days if possible. Use a higher rate for large nymphs and adult mole cricket control.
	deltamethrin	Aloft GC G, LC G	80 to 160 lbs, see label	
	dinotefuran	Tempo (various formulations)	See label	
		DeltaGard GC 5 SC	0.6 to 0.9 fl oz	
	nematodes <sup>2</sup>	DeltaGard GC Gran, DeltaGard G	2 to 3 lbs	
		Zylam 20SG	1 oz	
	fipronil	Nematac S, various	See label	
		Chipco Choice 0.1 G	4.6 to 9.4 oz	
		TopChoice	2 lbs	
	imidacloprid <sup>2</sup>	Merit 0.5 G	1.8 lbs	
		Merit 2 F	0.6 fl oz	
		Merit 75 WP	4 teaspoons	
		Merit 75 WSP	1 packet/8,250 sq. ft.	
		imidacloprid + bifenthrin	Allectus G, Allectus GC	2.9 to 5.7 lbs
	Allectus SC, Allectus GC SC		1.32 to 3.3 fl oz	
	indoxacarb	Advion Mole Cricket Bait	1.15 to 4.6 lbs/acre	Cultural controls include not mowing turf shorter than recommended heights. Use a sharp mower blade. Maintain proper fertility and pH levels, as well as irrigation practices.  Advion Mole Cricket Bait is not for use on sod farms and seed productions. See supplemental label.
		Provanut	0.275 oz	
		Lambda-cyhalothrin	Demand G	
	Demand EZ		28 to 56 ml	
	Demand CS, Scimitar GC or CS		7 to 14 ml	
	permethrin	Astro	0.4 to 0.8 fl oz	
	thiamethoxam	Meridian 0.33G	1.42 to 1.88 lbs	
Meridian 25WG		0.3 to 0.39 oz		
thiamethoxam + lambda-cyhalothrin	Tandem	0.32 to 0.64 fl oz		
	trichlorfon	Dylox 80 T&O	3.75 fl oz/100 gal.	
		Dylox 6.2G	3 lbs	



## INSECT PEST CONTROL

Pest	Pesticide Common Name	Pesticide Trade Name and Formulation <sup>1</sup>	Rate / 1,000 sq. ft.	Pest Biology, Symptoms, Cultural Practices, and Comments
<b>Snails and Slugs</b>	iron phosphate	Sluggo	1 lb	Apply late in the evening, especially after rain or irrigation. Reapply when needed. Water infested area thoroughly before application. Do not re-water for 48 hours.
	Iron phosphate + spinosad	Sluggo Plus	0.5 lb	
	mesurol	Mesurol 2% Bait	1 lb	
	metaldehyde	Deadline	6.4 oz	
<b>Spittlebugs</b>	acephate	Orthene TT&O 75	1.0 to 1.9 oz	Spittlebugs are increasingly damaging, particularly to centipedegrass. The most common pest species of turfgrass in South Carolina is the two-lined spittlebugs. Adult two-lined spittle bugs have a reddish black with 2 orange or red lines across the wings and a bright red abdomen. Nymphs are found at the base of the grass plant. The nymphs are enclosed individually in white foamy spittle masses. Feeding causes yellowing of the grass. High mowing height and thatch buildup aggravate the problem.  There are typically two generations in SC: the first peak of adults occurs in June-July and the second peak in August-September. Overwinter as eggs.  Treat when nymphs are present and damage appears. Use a minimum of 50 gallons of water per acre (1.2 gallons/1000 sq. ft.). Mow and irrigate before treatment. Treat also the ornamentals, particularly hollies, for adults.  Dethatching, withholding irrigation when nymphs are hatching in May and July, and avoiding planting Japanese hollies near centipedegrass can help reduce infestations.
		Orthene TT&O 97	0.9 to 1.8 oz	
	bifenthrin <sup>2</sup>	Onyx	0.07 to 0.15 fl oz	
		carbaryl	Sevin 10G	
	Sevin 80 WSP		2.5 to 5.0 lb/acre	
	Sevin SL		1.5 to 3 fl oz	
	clothianidin	Arena .25G	1.84 to 3.67 lbs	
		Arena .5G	1.0 to 1.8 lbs	
	clothianidin + bifenthrin	Aloft GC SC	11.65 to 19 fl oz	
		Aloft GC G, LC G	80 to 160 lbs	
		Aloft LC SC	11.65 to 23.3 fl oz	
	cyfluthrin	Tempo 20 WP GC, Power Pak	1 packet/93-100 gal, see label	
deltamethrin	DeltaGard G, GC Gran, T&O Gran	2 to 3 lbs		
lambda-cyhalothrin	Demand G	2 to 3 lbs		
<b>Wasps, Bees (Burrowing or Digging)</b>	acephate	Orthene TT&O 75	1.6 oz/gal	Mounds and nests made by soil burrowing wasps and bees can interfere with play and the appearance of the lawns and fields. Treatment should be done in the evening when foraging adults have returned to the nest. Thoroughly spray the entrance to the nest.  Burrowing and digging wasps and bees often dig in sandy areas. Improve the grass coverage or re-sodding the thinned areas will help to dissuade the wasps and bees from building a nest.  Treatments of landscape ornamentals that are frequented by the honeybees and the native bees, with the hope of killing or dissuading visits by the bees, are strongly discouraged.
		Orthene TT&O 97	1.2 oz/gal	
	bifenthrin <sup>2</sup>	Talstar One	0.25 to 0.5 fl oz	
		chlorpyrifos	Dursban 50W	
	Dursban PRO		0.17 to 2.7 fl oz/gal, see label	
	cyfluthrin	Tempo Ultra SC, Tempo Ultra GC	0.54 fl oz/gal	
		Tempo 20 WP, Tempo Ultra WP	20 grams/gal	
	cypermethrin	Demon Max, TC	1 fl oz/gal	
deltamethrin	DeltaGard G, DeltaGard GC Gran	2 to 3 lbs		

## INSECT PEST CONTROL

Pest	Pesticide Common Name	Pesticide Trade Name and Formulation <sup>1</sup>	Rate / 1,000 sq. ft.	Pest Biology, Symptoms, Cultural Practices, and Comments
<b>Wasps, Bees (Burrowing or Digging)</b>	lambda-cyhalothrin	Demand	See label	Lambda-cyhalothrin is registered for outdoor ornamental control of wasps.
		Scimitar	See label	
	permethrin	Astro	0.4 to 0.8 fl oz	
<b>White Grubs</b>	<i>Bacillus thuringiensis</i> spp. <i>galleriae</i>	grubGONE! G	37-55 oz	<p>May and June beetle, green June beetle, masked chafer, European chafer, black turfgrass ataenius, oriental beetle and Japanese beetle larvae are all grouped under white grubs. Identification of the species is based on the raster (area of spines, hair and bare spaces on the underside of the last abdominal segment).</p> <p>White grubs live in the soil and feed on the grass roots. Infested turf often appears wilt and turns yellow and then brown. Heavily damaged turf feels spongy underfoot. Damaged sod easily fall apart when cut or lifted. Large green June beetle grubs also burrow to the surface at night and cause small dirt mounds on the turf.</p> <p>To detect grubs, remove 1 sq. ft. of sod and carefully inspect the root zone. Pay particular attentions to areas with high feeding and searching activity of black parasitic wasps and other animals. In most cases, if more than 7 grubs are found per sq. ft., treatment is needed. Apply preventive treatment (using neonicotinoids and chlorantraniliprole) in April – June or curative treatment against small grubs in July-August. Most materials should be watered-in immediately (at least 2 inches) after application. See label directions.</p> <p>Dursban Pro is only for green June beetle grub control.</p>
	bifenthrin + zeta-cypermethrin+imidacloprid carbaryl	Triple Crown T&O	0.46-0.80 fl oz	
		Sevin 10G	1.9 lbs	
		Sevin 80 WSP	10 lb/acre	
		Sevin SL	6 fl oz	
	chlorpyrifos	Dursban 50W	2 to 8 lbs/acre	
		Dursban PRO	1.5 fl oz	
	chlorantraniliprole	Acelepryn	0.184 to 0.367 fl oz	
		Acelepryn granule	1.15 to 2.3 lbs	
	clothianidin	Arena .25G	1.84 to 3.67 lbs	
		Arena .5G	1.0 to 1.8 lbs	
		Arena 50 WDG	6.4 to 12.8 oz	
	clothianidin + bifenthrin	Aloft GC SC	11.65 to 19 fl oz	
		Aloft GC G	80 to 132 lbs	
		Aloft LC SC	11.65 to 23.3 fl oz	
		Aloft LC G	80 to 160 lbs	
	<i>Chromobacterium subsugae</i>	Grandevo PTO	4-8 lbs	
	cyantraniliprole	Ferenca	0.184-0.367 fl oz	
	dinotefuran	Zylam 20SG	1 oz	
	halofenozide	Mach 2 2SC	2.9 fl oz	
		Mach 2 1.5G	3 lbs	
	imidacloprid <sup>2</sup>	Merit 0.5 G	1.4 to 1.8 lbs	
		Merit 2 F	0.4 to 0.6 fl oz	
	Merit 75 WP	3 to 4 teaspoons		
	Merit 75 WSP	1 packet/11,000 sq. ft.		
imidacloprid + bifenthrin	Allectus G, Allectus GC	2.3 to 2.9 lbs		
	Allectus SC, Allectus GC SC	1.32 to 1.65 fl oz		

## INSECT PEST CONTROL

Pest	Pesticide Common Name	Pesticide Trade Name and Formulation <sup>1</sup>	Rate / 1,000 sq. ft.	Pest Biology, Symptoms, Cultural Practices, and Comments
White Grubs	lambda-cyhalothrin  thiamethoxam  thiamethoxam + lambda-cyhalothrin trichlorfon	Demand SC, Scimitar SC Demand EZ Demand G Meridian 0.33G Meridian 25WG Tandem Dylox 6.2G Dylox 80 T&O	7 ml 28 ml 3 to 4 lbs 1.42 to 1.88 lbs 0.3 to 0.39 oz 0.32 to 0.64 fl oz 3 lbs 3.75 fl oz/100 gal	Demand and Scimitar only provide suppression.

<sup>1</sup>Always check to be sure the formulation that you purchase is labeled for the site and pest you intend to use it for. No endorsement of products is intended, nor is criticism of unnamed products implied. **Read container label carefully for, use directions, application techniques, irrigation requirements, worker protection information, and precautions.** Be sure the formulation of pesticide you buy and use is labeled for use on turfgrass.

<sup>2</sup>Several trades names available. Check label for active ingredients, formulations and instructions.

**Cross reference table of insecticides for major turfgrass pests.**

Insecticide (Trade Names)	Armyworms	Mites	Billbugs (Adult)	Billbugs (Larva)	Cutworms	Mole Crickets	Sod Webworm	Chinch Bugs	Spittlebugs	White Grubs
azadirachtin (Azatrol)	yes	yes			yes		yes			
acephate (Orthene)	yes				yes	yes	yes	yes	yes	
<i>Bacillus thuringiensis</i> (Dipel, etc.)	yes				yes		yes			
<i>B. t.</i> subsp. <i>Galleriae</i> (grubGONE! G)										yes
bifenthrin (Onyx, Talstar, Allectus, Aloft)	yes	Onyx	yes		yes	yes	yes	yes	yes	
carbarvl (Sevin)	yes		10G	yes	yes	Bait	yes	yes	yes	yes
chlorpyrifos (Dursban)	yes	yes	yes	50W	yes	50W	yes	yes		yes
chlorantraniliprole (Acelypryn)	yes			yes	yes		yes	yes		yes
<i>Chromobacterium subtsugae</i> (Grandevo)	yes				yes		yes	yes		yes
clothianidin (Arena, Aloft)	0.25G		yes	yes	yes	yes	yes	yes	G	yes
clothianidin + bifenthrin (Aloft)	yes		yes	yes	yes	yes	yes	yes	yes	yes
cyantraniliprole (Ference)	yes			yes	yes		yes	yes		yes
cyfluthin (Tempo)	yes		yes		yes	yes	yes	yes	WSP	
cypermethrin (Demon)						yes		yes		
deltamethrin (DeltaGard)	yes	yes	yes		yes	yes	yes	yes	Granule	
dicofol (Kelthane)		yes								
fipronil (Chipco Choice, Chipco TopChoice)						yes				
halofenozide (Mach2)	yes			yes	yes		yes			yes
imidacloprid (Merit)				yes	yes	yes		yes		yes
imidacloprid + bifenthrin (Allectus)	yes	SC	yes	yes	yes	yes	yes	yes		yes
indoxacarb (Advion, Provaunt)	yes				yes	yes	yes			
lambda-cyhalothrin (Demand, Scimitar)	yes	yes	yes		yes	Yes	yes	yes	Demand G	Demand
permethrin (Astro)	yes					yes	yes	yes		
spinosad (Conserve SC)	yes				yes		yes			
thiamethoxam (Meridian)				yes		yes		yes		yes

**Cross reference table of insecticides for major turfgrass pests.**

<b>Insecticide (Trade Names)</b>	<b>Armyworms</b>	<b>Mites</b>	<b>Billbugs (Adult)</b>	<b>Billbugs (Larva)</b>	<b>Cutworms</b>	<b>Mole Crickets</b>	<b>Sod Webworm</b>	<b>Chinch Bugs</b>	<b>Spittlebugs</b>	<b>White Grubs</b>
thiamethoxam + $\lambda$ -cyhalothrin (Tandem)	yes		yes	yes	yes	yes	yes	yes		yes
trichlorfon (Dylox)	yes				yes	yes	yes	80 T&O		yes
zeta-cypermethrin + bifenthrin + imidacloprid (Triple Crown T&O)	yes	yes	yes		yes	yes	yes	yes		yes



Cross reference table of insecticides for minor and nuisance turfgrass pests.

Insecticide (Trade Names)	Nuisance Ants	Red Imported Fire Ants	Chiggers	Centipedes	Fleas	Greenbugs	Grasshoppers	Leafhoppers	Mealybugs	Millipedes	Pillbugs	Sowbugs	Snails & Slugs	Ticks	Wasps & Bees
thiamethoxam (Meridian)		yes				yes?			yes?						
thiamethoxam + $\lambda$ -cyhalothrin (Tandem)		yes	yes		yes?	yes?	yes	yes?	yes?						yes?
zeta-cypermethrin + bifenthrin + imidacloprid (Triple Crown)	yes	yes		yes	yes		yes	yes	yes	yes	yes	yes		yes	