

WARM-SEASON INSECT CONTROL

The dry summer and mild winter means that southern turf managers can expect a fierce battle on their hands this year.

by Patricia Cobb, Ph.D., Auburn University

Insect control programs are an important part of the total system of growing grass for most southern turf managers. Drought, high temperatures and insect damage are three factors that have greatly influenced warm-season turf management the last three years.

Although we can only talk about the weather, insect control strategies must be reconsidered and updated annually. In the Southeast, "the big three"—mole crickets, grubs and fire ants—continue to require the most intensive and expensive control efforts.



Control of soil insects such as grubs, mole crickets and fire ants is often complicated by fall drought conditions.

Mole crickets

Mole crickets—now the South's most damaging turf insects—caused severe turf losses in 1988 as far west as Louisiana, and northward along the eastern coast of the Carolinas.

Mole crickets are annual pests in Florida, southern Georgia and the southern half of the mid-Gulf states. Most turf managers believe the drought conditions that existed during spring mole cricket flights resulted in higher infestations on irrigated turf. In addition, control strategies were complicated by the fact that mole crickets were two weeks late in hatching this past season.

Mole cricket control costs often range from \$7,000 to \$15,000 or more annually on golf courses. Monitoring populations in order to time controls properly is essential, and can reduce costs substantially. The loss of

organochlorine residuals in the soil and an increase in irrigated, higher quality turf are often cited as reasons for the increase in grub problems each year.

While grub damage in warm-season turf has been more widespread, the severity of problems reported in most areas generally decreased during 1988. Dan Potter, Ph.D., at the University of Kentucky, reports that drought conditions in soil adversely affect grub hatching and development. (Perhaps there is one drought advantage, after all!)

Fire ants

Fire ants are a major "people problem" in the South.

Pat Cobb, Ph.D., has been at Auburn University for 12 years. She is a professor, extension entomology, Department of Entomology.

Fire ant mounds are unsightly and make mowing difficult. But painful stings are the real problem. Several million dollars are spent in Alabama alone each year for fire ant control.

A hybrid form, found in northern Georgia, Alabama and Mississippi is reportedly more cold-tolerant than either of the two introduced parent fire ant forms. "Multi-queen" fire ant colonies are becoming common in many areas. Control strategies are complicated by drought conditions that drive fire ants down deeper into the soil.

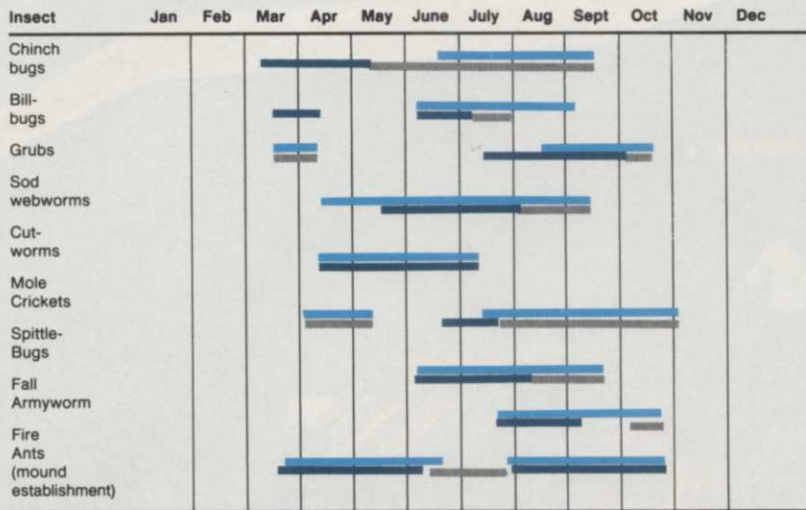
Effective insect control programs are based on knowledge of pests, and of effective control options. While efforts continue in the development of biological controls, for most southern pests our options are properly timed and correctly applied insecticides.

This season, turf insecticides are still few in number. Some are currently under EPA review. A few are restricted to very precisely defined sites for use by permit only. New formulations of older products (Sevimol, a carbaryl formulation; Mocap 5G, an ethoprop formulation) have been introduced. Continued regulations of pesticide use will make wise and timely use essential.

High pressure liquid injection (up to 2000 psi) and gravity-flow, low volume granular applicators are parts of the new technology available for making more effective use of what we have available.

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*MONTHS DURING WHICH DAMAGE IS MOST LIKELY TO OCCUR (——);
MONTHS WHEN INSECTICIDE TREATMENTS MAY BE RECOMMENDED
(—— = 1ST CHOICE, —— = 2ND CHOICE)



*Timing of treatments varies from one area to another, and is considerably different in South Florida. Check with Extension Agents in your area and monitor pest populations to determine exact timing of controls.

Biological control products are, for the most part, still in the future. However, insect-infecting nematodes are for the first time being marketed for such lawn pests as grubs.

Research with "bio-engineered" insect bacterium-bearing endophytes (plants within plants) holds promise for making some warm-season grasses exempt from insect damage.

Back to basics

Adverse weather conditions that complicate and increase costs of strategies often remind us of the need to get "back to basics." There is no substitute for proper timing of cultural and insecticidal control efforts. Healthy grass sustains and recovers from damage quicker.

Monitoring pest populations and directing insecticidal controls at the vulnerable pest stage is more cost effective than "hit-and-miss" preventive treatments. The information contained herein is intended to assist the Southern turf manager with development of control strategies for common insect pests.

Late winter

Billbug and chinch bug adults may become active during warm days of late March in some years. Treatment if adults are numerous and active may prevent population build-up and turf damage later in the season.

Zoysia and Bermudagrasses are preferred by the hunting billbug. St.

Augustinegrasses (except Floratam in most extreme southern areas) and occasionally Bermudagrasses are infested by chinch bugs.

Early season treatments should be done during midday when billbug and chinch bug adults are most active. Re-infestation later in the season may occur from infested, untreated adjacent turf areas.

Grubs become active in more southerly areas in late March. Evidence of "varmint" digging—armadillos, skunks, raccoons—may indicate movement of grubs into the root zone of the turf.

Generally, treatment at this time is "second best" behind middle to late summer applications for smaller grubs. However, late March treatments may be necessary in areas where grubs are detected for the first time, especially in cool-season grasses in order to reduce damage before the turf enters summer dormancy.

Warm-season grasses, in many instances, will recover from early season grub damage. In the south, the period between spring grub activity and pupation is short. (The pupa is the stage from which the beetle emerges that is not affected by insecticides). Therefore, if spring treatment is done it is most effective during late March or early April.

Areas receiving spring grub treatment should be checked in middle to late summer for small grubs since re-infestation may occur. Mole crickets

are the most damaging turf insect pests in the southeastern U.S. Timing of controls may vary from one area to another. Therefore, monitoring populations is critical since proper timing is often as important as insecticide choice.

In southern Florida mole crickets are active year around. Mole crickets may be active during winter months anytime a few consecutive days of warm weather occur. In mild winters—such as the last three—tunneling damage may continue periodically from November into late winter months. However, tunneling usually increases dramatically during late March in most areas.

Mole crickets begin mating flights in late March, so in most areas March treatment is not recommended. Turf should be maintained properly throughout this time however, in order to minimize tunneling damage.

Spring (April-May)

Chinch bug and billbug adults become more active during the warmer days of spring. Generally, egg laying occurs in April on warm-season turf. April treatments may prevent population build-up by eliminating egg-layers and, therefore, reduce damage later in the season.

Chinch bug treatments in May reduce the first nymphal (immature) population. Grubs that have not pupated can be controlled during early April. Infested areas that don't "green up" should be checked to verify the presence and stage of development of grubs.

Irrigation or rainfall should follow grub applications. In some areas of the South, Japanese beetle grubs are a problem on lawns. Spring is a good time to make applications of milky spore disease products for these grubs. However, other grub species are not controlled by these products.

Mole crickets remain active during April and early May. Spring treatments may be needed in severely damaged areas if overwintered crickets are present. To determine cricket presence, pour soapy water (2 tbs. liquid dishwashing soap in 1 gal. water) on turf areas where infestation is suspected. Crickets will usually surface in three to 15 minutes (longer in cool weather).

Irrigate soap-flushed areas afterwards to avoid sun-scald damage to the grass. Egg laying takes place during April and May. Nymphs usually hatch in central Florida during April and May. Farther north, hatching begins in late May or early June. Sod webworm larvae that have overwintered in the turf begin feeding when



Overwintered spittlebug eggs hatch in the spring. Noticeable damage usually appears in June and July and may continue during the summer and fall.

the grass greens up in spring. These larvae soon pupate, and moth flights are common in April. Larvae usually hatch about two weeks after the moth flight peaks.

Sod webworm damage to the turf may resemble disease injury. Areas frequented by birds (such as starlings) can be flushed with soapy water to verify the presence of sod webworms.

Cutworm moths begin egg laying in the spring. The larvae hatch, and feed at night on grass blades. Damage is most often a problem on golf greens. Moths prefer to lay eggs in aeration holes, so larval feeding may be mostly associated with the turf around these holes.

Feeding damage is usually a spring problem (April-May), but some years is observed throughout the summer. Insecticides for cutworm control should be applied late in the afternoon so that contact will be made with the night-feeding larvae. Little, if any, irrigation after treatment is advised, unless specified by the product label.

Fire ants continue to be a "people problem" throughout the South. These ants inflict painful stings to man and animals. Quarantine and regulatory measures require treatment and inspecting sod and nursery stock that is shipped out of the fire ant zone.

Fire ants begin to establish new mounds during warm, wet spring days. During this time these ants are near the soil surface and workers are actively foraging for food. Fire ant baits often work well during this time, and broadcast treatments may eliminate new mounds that are not yet visible above the turf surface.

Old, established colonies can be

mound-treated with a contact insecticide about two weeks after baits are broadcast. Most baits work slowly. Delaying treatment of established mounds gives the ants a chance to find the bait and feed it to the queen(s), but eliminates workers that might otherwise be present for several weeks.

Summer (June-August)

Chinch bug damage usually first appears during dry periods of June. Damage may continue into fall since there are several overlapping generations. St. Augustinegrass varieties (except Floratam in most extreme southern areas) are most commonly attacked, but as in the past dry summers, Bermudagrasses may occasionally be damaged.

Treatments may have to be repeated if re-infestation from untreated borders or lawns occurs. Billbug grubs can be found in the soil by middle to late June. Check areas of turf, especially zoysias and Bermudagrasses, where adult billbugs were observed in the spring.

Persistent drought stress symptoms on irrigated turf, or "thin" sod may indicate a billbug problem. Treatments should be applied like other grub treatments: watered immediately after application.

Grub problems are becoming more widespread in southern turf. Late summer treatments are usually the most effective for controlling grubs.

Beetle flights most often peak sometime in June, and "new generation" grubs are usually present by middle to late August. However, during drought years such as the last three seasons, grub emergence patterns, egg laying and survival may be

affected.

Check turf where spring grub activity occurred, or where bird feeding is observed, before treatment is done. If the weather is hot and dry, irrigate the day before treatment to move grubs into the root zone. Remember to also irrigate after treatment.

Green June beetle grubs may move over the turf surface (on their backs with legs up). These are large grubs that cause mostly mechanical injury. Because of their mobility they can move from untreated, unmanaged areas onto turf.

Mole crickets hatch during late spring and early summer. By late June and early July, newly-hatched nymphs of both species are present. In most areas of the South, mole crickets hatched almost two weeks late in 1988.

Because of the voracious feeding by the tawny mole cricket (and the short-winged mole cricket in south Florida), there is the potential for sudden, serious turf loss as nymphs increase in size during July and August. Timing of controls for mole crickets varies with location.

Monitoring hatching and weekly presence of newly hatched nymphs by soap flushing is suggested as an aid to developing a seasonal control program.

Residual controls, such as Mocap 5G and Oftanol, are most effective on younger nymphs. Treatments should be watered immediately. Triumph 4EC has provided several weeks residual control. Current registrations within southern states (Special Local Needs, 24(c), registrations) specify sites for Triumph's expanded use. Less residual mole cricket treatments include bait applications and/or sprays with Orthene 75S. Baits are most effective in the mid-Gulf states from July through September. Orthene sprays seem to be more effective on two- to three-week-old nymphs than on newly-hatched mole crickets. Orthene sprays and/or bait treatments should be applied late in the day to turf irrigated several hours earlier, and not irrigated (or as label specifies) after treatment.

Sod webworms damage warm-season turf most severely from late June through August. Insecticide applications should be made when larvae are present or a week or two after peak moth flights from infested turf. Twolined spittlebugs are primarily lawn pests. However, other turf areas have been damaged in recent years. Since spittlebugs are highly dependent upon moisture for survival any area with thick turf, thatch accumulation and high humidity is susceptible to

USE SUMMARY OF SOME COMMON TURF INSECTICIDES*

Common Name	Trade Name	Major Uses	Primary Use Site ***	Common Name	Trade Name	Major Uses	Primary Use Site ***
acephate	Orthene 75S	fire ants mole crickets	A, G, L, S	diazinon	Diazinon	billbugs chinch bugs fall armyworms fire ants grubs sod webworms spittlebugs	L
**bendiocarb	Turcam	grubs mole crickets	A, L	**ethoprop	Mocap 5G	grubs mole crickets	A, G, L, S
carbaryl	Sevin SL Sevimol	billbug (adults) cutworms fall armyworms green June beetle grubs grubs sod webworms	A, G, L, S	isofenphos	Oftanol	fire ants grubs mole crickets	A, G, L, S
chlorpyrifos	Dursban	billbug (adults) chinch bugs cutworms fall armyworms fire ants sod webworms spittlebugs	A, G, L, S	**isazofos	Triumph	chinch bugs mole crickets grubs	L (G&S in some states)
				trichlorfon	Dylox, Proxol	cutworms fall armyworms grubs sod webworms	A, G, L, S

*Fire ant baits (Affirm, Amdro, Logic, Pro-Drone) are not included above, but may be used in non-crop areas. ***A=athletic turf L=lawns
**Restricted Use G=golf courses S=sod farms

damage.

Adult spittlebugs are pests of ornamentals, but the piercing-sucking feeding of nymphs (immatures) damages turf. Adults are especially attracted to Japanese hollies, and move from these shrubs to surrounding turf.

Overwintered eggs, laid in the turf, hatch in the spring. Noticeable damage usually appears in June and July and may continue during the summer and fall due to at least two overlapping generations.

A variety of warm-season grasses may be infested. Damage first appears as yellow spots, then these areas spread and eventually die. Masses of "spittle" enclosing nymphs located deep within the turf may give the turf a "squishy" feeling when walked on. Infested areas should be mowed (remove clippings) and watered before treatment. Thatch management and prevention of excessive watering may disrupt the humid environment necessary for spittlebug survival.

Spittlebugs are usually not a widespread problem during drought years except on thick turf with irrigation.

Fall armyworm moths arrive in the spring from southerly areas such as Central and South America. Along the Gulf Coast, fall armyworm damage to turf is usually reported by late June. Bermudagrasses that are highly maintained are preferred. Although several generations may occur each year, damage to turf is usually not permanent unless disease, drought or other stress follows.

Damage to turf from fall armyworm feeding during summer can be "repaired" by proper fertilization and watering. Although fall armyworms may feed in large numbers anytime during the day, they are often most active in early morning and late afternoon. Treatments are most effective at these times.

Ground pearls are scale insects that live up to 10 inches deep in the soil. They are found in areas along the Gulf Coast, sandy soils of the central Gulf states, southern east coast areas and parts of the Midwest.

These pests damage turf most severely during summer when other factors such as heat stress, disease and drought weaken the grass. Centipede grass is especially susceptible to damage when over-fertilized. Eggs hatch within the soil in the spring, and nymphs feed throughout the summer by piercing root tissue and extracting plant fluid.

Chemical control of ground pearls has not been effective. Rather, proper fertilization, disease control and adequate irrigation have been effective in controlling damage.

Fall (Sept.-Oct.)

Fall may be the most difficult time of the season to control southern turf insect pests. Attacks on turf by surface feeders, such as fall armyworms and sod webworms, may result in damage that is difficult to repair on warm-season grasses before winter dormancy. Thatch-dwellers such as chinch bugs

and spittlebugs can be controlled during fall; but again, stress to the turf may be greater entering dormancy because of damage by uncontrolled populations.

Control of soil insects such as grubs, mole crickets and fire ants is often complicated by fall drought conditions. Irrigating turf before treatment as well as after treatment may be necessary to realize effective control of these pests.

Grubs and mole crickets are more effectively controlled at smaller, more immature stages earlier in the season. Grub treatments are usually most effective during August and September. Treatments become less effective as the soil temperature decreases and grubs move deeper into the soil to overwinter.

Mole crickets fly again in the fall, and damage is more severe as turf growth slows. As the temperature decreases, insecticides work more slowly. Fall mole cricket treatments of Orthene 75S are more effective in August and September than in October. As for residual treatments, Triumph 4E has provided effective fall mole cricket control (for use by professional lawn care only; or restricted in designated areas).

Fire ants that have become established during the season are difficult to control during hot, dry fall periods. Once rain begins, new mounds are established and area broadcast treatments, as well as mound treatments, may be necessary in heavily-infested areas. **LM**

COOL-SEASON INSECT CONTROL

The good news is that the drought last summer reduced grub populations. The bad news is that chinch bugs will pick up the slack.

by Harry D. Niemczyk, Ph.D., Ohio Agricultural Research & Development Center

What impact will the Midwest's drought of 1988 have on turfgrass insects in 1989? Well, it should come as no surprise that there is both good and bad news.

The good news is that grub populations in many areas are reduced. The drought delayed emergence of adult beetles that often had to lay eggs in dry soil. Because these eggs need to absorb soil moisture soon after being laid, many eggs did not survive. Eggs that did hatch produced larvae that had a tough time surviving in dry soil.

Though the population of egg-laying adults was reduced in 1988, irrigated turfgrass areas often had grub infestations that were near "normal."

Chinch bugs are pests that are at their peak under hot, droughty conditions, which is why they thrived last summer. The fact that the turfgrass turned brown and went into dormancy poses no problem for these pests. Though dormant, the plant is still very much alive so chinch bugs can probe plant stems, crowns and roots with their piercing, sucking mouthparts and obtain all the plant fluids necessary to keep them alive and well.

The bad news

The real damage is caused by them simultaneously feeding and injecting salivary fluids into the plant. The presence of this foreign substance reduces the plant's capability to circu-

late water and nutrients, and can ultimately lead to its death. Turfgrasses under moisture stress are particularly susceptible.

Billbugs lay their eggs in early April and May. Therefore, when turfgrasses became dormant in 1988, the larvae were well established and had no problem finding living crowns, roots and rhizomes to feed on.

Unlike the chinch bug, which can frequently be seen darting around the turfgrass surface on adjacent paved areas in July and August, billbug larvae feed beneath the soil surface, hidden from view. Damage from both these pests is most severe in turfgrass areas under moisture stress, where damaged turf looks no different than



Is it drought, insect injury or both? Damage from chinch bugs (left), like billbug damage, is frequently masked by the similar symptoms associated with moisture stress (right).

the dormant turf and is therefore frequently undetected. It often becomes apparent only after the turf receives rain or irrigation yet fails to recover.

Look for an abundance of chinch bugs and billbugs this year.

Despite the influence of the 1988 drought, near "normal" infestations of grubs can be expected in 1989, especially if "normal" amounts of precipitation occur.

Life cycle is key

Knowing the life cycle of pests is still at least as important as selecting an insecticide for their control. This guide points out some of the seasonal occurrence of some important cool-season pests to be on the lookout for this year. Best control will come when you apply insecticides during the pest's most vulnerable stages, which are outlined here. No endorsement of products is intended, nor is criticism implied for those not mentioned.

Late winter

Chinch bugs and billbugs—

In northern zones chinch bugs and billbugs both overwinter as adults in thatch or sheltered sites near buildings. Summer drought has led to high overwintering populations.

They can become active during warm days in March. Infestations of hairy chinch bugs and bluegrass billbugs also occur in zoysia, Kentucky bluegrass and fine fescues.

Grubs—The larvae of this group of pests normally overwinter six inches or deeper in the soil. If spring comes early, grub activity can be expected along with skunks and raccoons, which tear up the turf in search of them. Moles, which feed on grubs and earthworms, also become active at this time.

Black turfgrass atanius—This golf course pest overwinters as an adult in the soil under debris in roughs or other protected areas. A few may be seen flying about on warm afternoons in early March. Usually this activity begins when crocus starts blooming and intensifies as the bloom of red bud appears.

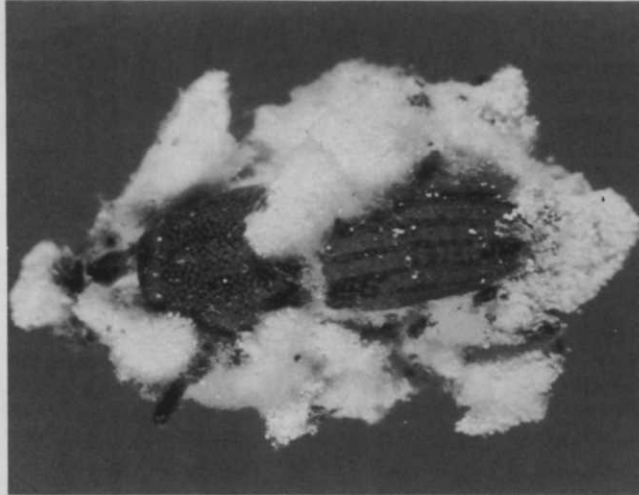
Greenbug—The only stage of the greenbug known to overwinter in northern states is the egg. Shiny black eggs deposited the previous fall may be found adhering to grass blades, fallen tree leaves or other debris.

Sod webworms—The most com-

mon sod webworm species overwinter as larvae in the thatch or upper inch of soil. Feeding does not resume until hibernation (dipause) is broken by early spring warmth.

Spring

Chinch bugs and billbugs—As warm days of spring approach, movement of chinch bug and adult billbugs increases rapidly. Generally, egg laying begins the first week of May, but can begin in mid-April if spring arrives early. Occasionally adult billbugs can be seen on sidewalks on warm after-



A bluegrass billbug infected with the parasitic fungus (*Beauveria* spp.).

noons.

Generally, application of insecticides to prevent infestations of chinch bugs and billbugs should be completed by the first week in May. Applications may begin as early as the last week of March. Such applications must be made before significant numbers of eggs are laid. This time may vary as much as a week or more, depending on spring weather.

Grubs—Overwintered grubs return to the surface and begin feeding on turfgrass roots in April. Increased activity and damage from birds, moles, skunks and raccoons foraging on grubs can also be expected. Feeding by birds, mammals and grubs continue through May.

Treatment should be delayed until the grubs are in the top one inch of soil. Irrigation or rainfall should follow such applications to aid in moving the insecticides to the target grub as soon as possible.

Although milky disease products for control of Japanese beetle grubs may be applied any time there is no frost in the soil, spring is a good time for such applications. The soil is open and frequent rains move the disease spores into the soil and thatch.

Milky disease products are primarily effective against Japanese beetle larvae. Ineffectivity against other species is low.

Incidents of large grub infestations (larvae of June bugs, for example) have been increasing in cool-season areas. Locations of such infestations should be identified because reinfestation is likely every three years.

Eggs are laid in May and June, therefore treatment should be made in late summer, early fall of that year or the next spring while the larvae are small. Later applications against full-grown larvae have given inadequate control in past studies.

Black turfgrass

ataenius—Adults of the black turfgrass atanius can be seen "at wing" in April and are often found in clipping catchers after early mowing of golf course greens. These adults begin laying eggs in early May, or about the time Vanhoutte spirea first comes into bloom. Dursban applied to a fairway at this time kills adults and prevents summer infestation of larvae. Check with local extension entomologists for the precise time if needed.

A second application, two weeks after the first, may be needed to successfully prevent infestation.

Sod webworms—Overwintered larvae of the sod webworm begin feeding as soon as the grass begins to grow. Usually damage is insignificant, but areas that do not green up may be infested. These areas frequently have probe holes from starlings feeding on larvae.

Moth flights begin in May in northern areas. Young larvae are usually present about two weeks after the spring moth flight peaks, so treatment of young larvae can be done in May in some areas.

Cutworms—Moths of cutworms begin laying eggs on golf course greens and other turf areas in the spring. These eggs hatch, producing larvae that feed on grass blades during the night. The black cutworm is the most common species on cool-season turf.

While visible damage is uncommon on home lawns, damage can be significant on golf course greens in late May.

Greenbug—Greenbug eggs begin hatching as early as April, but significant infestations do not develop until later in the year. Greenbugs are also brought into the region from the south

SUMMARY OF GRUB CONTROL TESTS IN OHIO - 1971-81¹

INSECTICIDE	LB AI/A	MEAN % CONTROL	(NO. OF TESTS) ²
ethoprop (Mocap)	5.0	83	(10)
isazofos (Triumph)	2.0	92	(20)
bendiocarb (Turcam)	2.0	83	(18)
isofenphos (Oftanol)	2.0	80	(37)
carbaryl (Sevin)	8.0	64	(14)
trichlorfon (Proxol)	8.0	81	(23)
diazinon	5.5	60	(16)
chlorpyrifos (Dursban)	4.0	43	(11)

¹ Includes Japanese beetle, *Cyclocephala* spp., *Phyllophaga* spp. only. ² Each test replicated 3 or 4x. Generally, treatments applied late summer or early spring. Irrigated (1/4-1/2 inch) after application, thatch - 1/2 inch, readings taken ca. 4-8 weeks after treatment.-H.D. Niemczyk & K.T. Power.

on upper air winds. Aphid numbers are too low to detect in lawns at this time.

Winter grain mite—Damage from this mite is often first noted in March or April when turf areas are receiving spring fertilizer applications. Winter grain mites are identifiable by eight bright red legs and a dark body. By late May, the mites will have laid their eggs and died. Mites do not appear again until the eggs hatch in October.

Clover mites—Incidents of visible damage to home lawns are often seen in April in several Ohio cities and Denver. Usually a nuisance pest in and around homes, the clover mite occurs in large numbers (5,000 per square foot) across entire lawns and on turf next to building foundations. Symptoms of injury were the same as the winter grain mite. Turf next to foundations may be killed.

The clover mite has a slightly pink body and eight pale-colored legs. The first pair of legs is extremely long and protrude well out in front of the mite. The absence of bright red legs distinguishes the clover mite from the winter grain mite.

Summer (June-August)

Chinch bugs—Chinch bug eggs continue to hatch into June. Bright red nymphs with a center white band appear. The number of chinch bugs in-

creases rapidly in June. Their populations peak in July and August, when northern lawns can receive severe damage. This damage is often masked by summer dormancy of turf caused by drought. Hot, dry conditions are ideal for chinch bugs.

During August the nymphs molt into adults that mate and lay eggs, thus producing a second generation. Some northern areas have only one generation per year.

Billbugs—Bluegrass billbug larvae feed in grass stems during June and move to the plant crowns, roots and rhizomes during July. This feeding pattern causes brown spots that frequently resemble the symptoms of some fungus diseases. Symptoms are also often masked when the turf is dormant from drought.

The larvae usually move deeper into the soil under dry soil conditions. During late July and August the larvae burrow deeper into the soil to pupate and transform into adults.

Grubs—By June, grubs have stopped feeding and are in the pupal stage, three to four inches in the soil. Beginning in mid-June and continuing through mid-July, the adults of various species emerge and burrow into the soil to lay eggs. Hatching and appearance of young larvae occur during July and August.

Extreme heat and drought during

the summer may cause some grubs to move deeper in the soil. Under such conditions, irrigation several hours before treatment and a thorough soaking afterward is advisable.

Black turfgrass ataenius—Eggs laid by beetles during May hatch in June and the larvae immediately begin feeding on turf roots and thatch.

From late June to mid-July, symptoms of injury include wilting in spite of irrigation. In July, larvae move deep into the soil, pupate and emerge as adults. These adults lay eggs during August, producing a second generation in some states. The second generation larvae are capable of damaging turf. States farther north have only one generation.

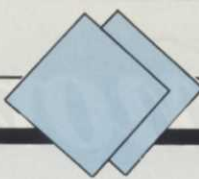
Sod webworms—Damage from sod webworm larvae occurs occasionally in most of the cool-season turf region. Injury is more common in mid-western states, usually in July and August. Older sod fields or areas with heavy thatch are good candidates for infestation. There are generally one or two generations per year, depending on the species.

Cutworms—Cutworm larvae continue to cause damage to golf course greens from June through August. These larvae pupate in the soil or thatch and emerge as moths that lay eggs for additional generations.

Fall armyworm—The fall ar-

INSECT

CONTROL



COOL SEASON*	LATE WINTER	SPRING (April-May)	SUMMER (June-Aug.)	FALL (Sept.-Oct.)
CHINCH BUGS	When summer damage is expected preventative application of liquid or granular Dursban (1 lb. Ai/acre) or Oftanol (2 lbs. Ai/acre) may be used as soon as the insects become active.	Preventative applications of insecticides should be completed by the first week in May.	Treat before injury is severe with Dursban (1 lb. Ai/acre), diazinon** (2.5-5.5 lbs. Ai/acre), or other labeled insecticides.	Treat if necessary, but generally infestation levels are not high enough to warrant using insecticides.
BILLBUGS	Same as for chinch bugs.	Same as for chinch bugs	Treat infestations at same rates as grubs with Triumph ¹ diazinon**, Turcam, Proxol or Sevin. Irrigate following application.	Treatment is usually not appropriate at this time.
GRUBS	Application of Oftanol (2 lbs. Ai/acre) during March may provide control of overwintered grubs. This may not provide control into late summer.	A single application of Oftanol (2 lb. Ai/acre) made in April may control overwintered grubs. Can also be controlled in May by spot or general treatment with Triumph ¹ (2 lb. Ai/acre) Turcam (4 lb. Ai/acre) or Sevin (8 lb. Ai/acre). Golf course superintendents can use Mocap (5 lb. Ai/acre) or Sevin (6-8 lb. Ai/acre) to control green June beetle. Irrigate with application.	Existing infestations found in July or Aug. may be treated with Triumph ¹ , Proxol, Turcam, Oftanol, Sevin or Mocap (commercial turf only) at rates used in spring. Treat green June beetle with Sevin (6-8 lbs. Ai/acre).	Treatment can be made as late as Mid-September. Irrigate first if thatch or soil is dry.
SOD WEBWORMS	Treatment is not appropriate at this time.	When necessary, apply diazinon** (5 lb. Ai/acre) Triumph ¹ (1 lb. Ai/acre) Dylox or Proxol (6-8 lb. Ai/acre). Orthene (1-3 lb Ai/acre).	Make application when larvae are present or two weeks after peak moth flight. Use Dursban (1 lb. Ai/acre), Triumph ¹ (1 lb. Ai/acre), Diazinon** (5 lbs. Ai/acre), Sevin (6-8 lbs. Ai/acre) or Proxol (6-8 lbs. Ai/acre).	Larvae are small and cause little damage at this time. Treatment in September reduces population for next spring.
GREENBUGS	Treatment is not appropriate at this time.	Aphid numbers are too low to detect.	Use Orthene (1 lb. Ai/acre) or Dursban (1 lb. Ai/acre) or diazinon** (2.5 lbs. Ai/acre).	Severe infestations may occur as late as December. Use the same insecticides as in the summer.
BLACK TURFGRASS ATAENIUS	An application of Oftanol (2 lb. Ai/acre) in March may prevent summer infestations of larvae, but it's best to wait until April.	Application of Oftanol (2 lbs. Ai/acre) during April or May can prevent larval infestations during summer. Dursban (1-2 lbs. Ai/acre) applied to fairways in April also prevents infestations. Retreatment after 2 weeks may be necessary.	If preventative applications were not made, spot or generally treat with Triumph ¹ (2 lbs. Ai/acre), Proxol (8 lbs. Ai/acre), Turcam (2-4 lbs. Ai/acre), Sevin (8 lbs. Ai/acre) or Mocap (5 lbs. Ai/acre), as needed.	Undeveloped larvae die with frost.
CUTWORMS	Treatment is not appropriate at this time.	The insecticides effective against sod webworm are also effective against cutworms. Apply late in the afternoon. Do not irrigate following liquid applications unless specified on label.	Use Orthene (1-3 lb. Ai/acre), Dursban (1 lb. Ai/acre), Triumph ¹ (1 lb. Ai/acre), Proxol (8 lbs. Ai/acre) or Sevin (6-8 lbs. Ai/acre). Do not irrigate following liquid applications unless specified on label.	Same as for summer.
CLOVER MITES	Treatment is not appropriate at this time.	Liquid diazinon** (2.5 lbs. Ai/acre) or Dursban (1 lb. Ai/acre) may be used.	Treatment usually is not necessary.	Treat as needed with liquid diazinon** (2.5 lbs. Ai/acre) or Dursban (1 lb. Ai/acre).
WINTER GRAIN MITE	If needed, use spring treatment.	If treatment is necessary, use liquid diazinon** (2-3 lbs. Ai/acre) or Dursban (1 lb. Ai/acre). Avoid repeated use of Sevin.	Treatment is not appropriate, since mite is in egg stage.	Treatment is not appropriate since mite is in egg stage.

¹ For use only by commercial lawn pest control personnel except in states where Special Local Needs labeling permits use on golf course tees, greens and aprons, and on sod farms. A maximum of one application per year is permitted for the 2 lbs. Ai/acre rate. A maximum of two applications per year at least 60 days apart is permitted for the 1 lb. Ai/acre rate.

* See accompanying text for details; always follow label directions.

** Diazinon may not be used on golf courses or sod farms.

INSECTS from page 54

myworm is seldom a problem of cool-season turf.

Greenbug—Damaging populations of greenbugs can occur from June through August. Populations and incidents of damage frequently vary from area to area, even within the same city.

Symptoms of injury include turf under the dripline of trees and in open areas having a burnt orange color. When symptoms are apparent, numerous aphids (40 or more) may be seen on a single grass blade. Close examination of damaged turf is necessary because the aphids are small. If left untreated, a heavy infestation can kill the turf.

Fall (Sept.-Oct.)

Chinch bugs—In the northern U.S. the second generation of chinch bug is at peak numbers in September. Nymphs complete their development to adults in late October. Most chinch bugs overwinter in the turf, but some move

to protected areas before winter.

Generally, infestation levels at this time are not high enough to warrant the use of insecticides. Early fall rains and infection by a parasitic fungus (*Beauveria* spp.) usually provide sufficient control.

Billbugs—During September, billbug adults that developed from summer larvae are often seen on sidewalks, driveways, or other paved surfaces. Before winter, these adults seek shelter in thatch, along sidewalk edges or near foundations and overwinter there. Many, if not most, overwinter in turf.

In some areas a partial second generation may occur. Larvae of this generation have been known to cause visible damage in September and October.

Grubs—Most species of grubs are in the third of their three stages of development and are feeding actively. When soil temperatures decrease in late October, the larvae

burrow deeper into the soil to overwinter. If soil temperatures remain warm, larvae stay at the surface and continue feeding. Severely cold winters have little effect on survival.

Black turfgrass ataenius—By September, adults of the current generation begin to fly into protected areas, such as golf course roughs, to overwinter. Larvae that have not completed development to adults before the first frost are killed.

Sod webworm—Northern sod webworm larvae are small and cause little if any damage in the fall. Late in the fall the larvae construct a cocoon-like shelter in which they overwinter.

Greenbug—Severe infestations of greenbug have been known to occur as late as the first week of December. Areas having a history of infestation should be re-examined when mild temperatures extend late into the fall. Heavily-infested turf will not survive through winter. **LM**

INSECT EXPERT OR NOVICE?

Quiz yourself or your crew to see how much training is needed.

1. Droughty, dormant turf often masks chinchbug and billbug damage.

- true
- false

2. The rastral pattern of the northern masked chafer is two parallel rows of spines.

- true
- false

3. Black turfgrass ataenius lay most of their eggs in _____.

- April
- May
- June
- July
- August

4. *Beauveria* is a fungus that infects and kills chinchbugs.

- true
- false

5. The northern masked chafer completes its life cycle in _____ year(s).

- one
- two
- three

6. Chinchbugs have _____ mouthparts.

- chewing
- piercing-sucking
- rasping

7. Grubs consume _____.

- turf roots only
- thatch
- soil
- soil, turf roots and thatch

8. Bluegrass billbug adults lay eggs in _____.

- soil
- thatch
- grass crowns
- grass stems

9. Greenbugs feed on tree leaves.

- true
- false

10. _____ is a common pest of golf greens in the cool-season region.

- sod webworm
- armyworm
- black cutworm

11. Most species of grubs overwinter as _____.

- larvae
- pupae
- adults
- eggs

12. Chinchbugs can be controlled by spring application of insecticide.

- true
- false

13. Mites have _____ legs.

- four
- six
- eight

14. The phone number of the Poison Control Center nearest my place of business is posted where it is readily available to me and my employees.

- true
- false

15. Resistance is usually not the problem when poor insect control is obtained with insecticide.

- true
- false

If you got:
 15 right you're super
 14 right: a job well done
 13 right: not bad
 12 right: OK but...
 11 or fewer correct means you need some training!

1. True. 2. False. 3. May. 4. True. 5. One. 6. Piercing-sucking. 7. Soil, turf roots and thatch. 8. Grass stems. 9. False. 10. Black cutworm. 11. Larvae. 12. True. 13. Eight. 14. True (I hope). 15. True.