Mole cricket management using a soil fumigant

Long used in agriculture, 1,3-D is being tested for controlling mole crickets in turf.

J. Bryan Unruh, Ph.D., and Darin W. Lickfeldt, Ph.D.

Mole crickets have long been troublesome pests in turf-covered venues, particularly in the southeastern United States. Imported from South America in the early 1900s, mole crickets damage turfgrass in several ways. They tunnel through the soil near the surface, loosening the soil and leaving the grass uprooted. As the soil dries, the roots desiccate and turf death ensues. Mole crickets also cause direct injury as they feed on grass roots, causing thinning of the turf and inevitably leading to bare soil. Indirect injury also occurs when predatory animals such as armadillos and opossums seek their nightly meal of these soil-borne insects.

Mole crickets are extremely prolific. Each spring, overwintered adults emerge, fly around and mate and then deposit eggs in chambers hollowed out in the soil. Most chambers are found in the upper 6 inches of soil, but cool temperatures and/or dry soil result in chamber construction at greater depths. After hatch, the young nymphs escape from the egg chamber and burrow to the soil surface in search of food. These young mole crickets begin feeding on roots, organic material and other small organisms, including insects.

During warm weather, most mole cricket feeding occurs at night after rain showers or irrigation events. During the day mole crickets stay in their permanent burrows and may remain there for long periods when the weather is unfavorable. Adult mole crickets are strongly attracted to lights during their spring flights, and there are reports of mole cricket sightings on well-lit, offshore oil rigs.

Mole cricket control

Control of mole crickets has largely been accomplished with synthetic insecticides (5,6) and, more recently, with biological control agents such as the entomopathogenic nematode Steinernema scapterisci and the Brazilian red-eyed fly, Ormia depleta (4). Recently, however, several researchers have been evaluating 1,3-dichloropropene, a soil fumigant, for its usefulness in controlling mole crickets. 1,3-dichloropropene (1,3-D) was developed in 1943 and was the first effective and inexpensive nematicide

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- Mole crickets kill turf by feeding on roots and by uprooting grass through tunneling.
- Long used in agriculture, the pesticide 1,3-dichloropropene has recently been tested on turf under an Experimental Use Permit.
- In comparative tests with products used to control mole crickets, 1,3-D’s performance was similar to that of the other products.
for general field use (2). In turf, 1,3-D was tested for nematode control in bermudagrass turf in 1953 (1). Over the years, researchers and practitioners have noted that 1,3-D (sold under the agricultural trade name, Telone II) provided not only exceptional control of nematodes, but also control of some soil-borne insects (3). Therefore, Dow AgroSciences has been in the process of developing turf use labels for 1,3-D. Tested under an experimental use permit, 1,3-D (turf trade name, Curfew) has been very effective when injected into the soil under a turfgrass sod for nematode management. However, to substantiate the claims of mole cricket and ancillary insect control, extensive testing has been conducted since 1999.

**Research projects**

Trials have been conducted each summer since 1999 to determine the efficacy of 1,3-D for insect control in Florida. In all the studies, three or four replications of relatively large plots (≥1,500 square feet) were used, and the applications were made using a tractor-driven coulter/shank injection rig. 1,3-D was injected to a depth of at least 6 inches and the coulters/shanks were spaced 12 inches apart. Tests have been conducted on golf course Tifway bermudagrass fairways and driving ranges maintained at 0.5 inch. Because use of 1,3-D requires a 24-hour re-entry interval and a 100-foot setback from an occupied structure (such as a school, hospital, business or residence), care was given to assure compliance with these regulations. Nitrogen rate varies from location to location.

**Sandestin Golf and Beach Resort — 1999**

**Methods.** A trial was conducted at the Sandestin Golf and Beach Resort in Destin, Fla., in the Florida panhandle, in summer 1999 to determine the level of turf injury that 1,3-D might cause versus the level of turf injury caused by the application equipment. 1,3-D (9.4 SL formulation: 94 percent 1,3-dichloropropene) was applied on July 7, at 5 gallons per acre, using the equipment described above. The fumigant was injected at 4, 6 or 8 inches below the turf surface. To assess the turf injury from the equipment alone, plots were treated in a similar manner, without applying the fumigant. An untreated control was also included.

**Results.** Regardless of rating date, no significant differences were noted among application depths or between plots treated with 1,3-D or equipment only (data not shown).
Effect of 1,3-D and chlorpyrifos on turf quality

Bars labeled with the same letter indicate values that are not significantly different from one another. The trial was conducted at Fort Walton Beach (Fla.) GC by J. Bryon Unruh, University of Florida, Joy.

Methods. A trial was conducted at the Ft. Walton Beach (Fla.) Golf Club in the Florida panhandle in summer 2000 to determine whether 1,3-D would provide effective control of mole crickets when soil-injected on a golf course driving range. Using the equipment described above, 1,3-D was applied at 5 and 10 gallons per acre on June 22. As a comparative treatment, chlorpyrifos (Dursban Coated Granules, 2 percent a.i.) was applied at 200 pounds/acre.

Results. At 20 and 39 days after treatment (DAT), 1,3-D at both 5 and 10 gallons/acre provided mole cricket control that was not significantly different from the control provided by chlorpyrifos. By 69 DAT, however, 1,3-D control of mole crickets diminished to 57 percent for the 5-gallon rate and 70 percent for the 10-gallon rate, while chlorpyrifos continued to provide 85 percent control.

Some surprising observations were noted with turfgrass quality, however. At 39 DAT, both rates of 1,3-D had unacceptable turf quality, attributed largely to burn associated with the fumigant. By 69 DAT, turf quality in plots treated at the 5-gallon rate did not differ from turf quality in the untreated plots. Turf quality in plots treated at the 10-gallon rate was significantly below that of the untreated plots. The treated area was a driving range, and the turf had received inadequate irrigation and only minimal fertilizer application so that it did not have the needed resources to recover from the application injury.

Bottom line. Results from this study showed that chlorpyrifos and 1,3-D can control tawny mole crickets effectively. Results from this trial also revealed the importance of optimal

Bottom line. A minimal level of injury (necrosis or browning of the turf) occurred where the coulter cut the turf and the fumigant was injected. However, after two weeks, the brown "cut lines" were hardly noticeable and were typically greener.

Ft. Walton Beach Golf Club — 2000
pre- and post-application cultural practices. Irrigation and nutrient management must be adequate to offset the limited injury that can be observed when using 1,3-D.

**Shoal River Country Club — 2001**

**Methods.** A trial was conducted at Shoal River Country Club in Crestview, Fla., in summer 2001 to determine whether soil-injected 1,3-D would provide effective control of mole crickets on a golf course fairway. Using the equipment described above, 1,3-D was applied at 5 and 10 gallons per acre on May 29. As a comparative treatment, fipronil (Chipco Choice, 0.0125 G) was surface broadcast at 12.5 pounds/acre.

**Results.** On all three rating dates (31, 51 and 79 DAT), there were no significant differences in mole cricket control among all the treatments. In this study mole cricket control with 1,3-D was more variable than that achieved with fipronil, an industry standard.

**Bottom line.** 1,3-D is a contact soil fumigant, killing biological organisms that come into contact with it. Furthermore, environmental monitoring research has shown that there is little to no residual material left in the soil. Therefore, if 1,3-D is applied before mole cricket spring mating flights and subsequent egg laying, these insects probably will not be controlled because the fumigant will have dissipated.

**Winter Garden, Fla. — 2001**

**Methods.** A trial was conducted at Orange County National Golf Center in Winter Garden, Fla., to determine whether soil-injected 1,3-D would effectively control mole crickets on a golf course fairway. On May 15, 2001, 1,3-D was applied at 5 gallons/acre using the equipment described above. As a comparative treatment, chlorpyrifos (2 percent a.i.) was applied at 200 pounds/acre.

**Results.** As in the other studies, 1,3-D provided greater than 80 percent control of mole crickets for up to 69 DAT, which was not significantly different
from the control shown by chlorpyrifos for the duration of the trial. For 97 DAT, turf quality in 1,3-D-treated plots was significantly greater than that in plots treated with chlorpyrifos, but no treatment differences were noted in plots at 141 DAT (data not shown). These plots also contained a significant number of sting nematodes (Belonolaimus longicaudatus) that were controlled by 1,3-D (data not shown).

Bottom line. Trials conducted at geographically different locations performed similarly. By using a broad-spectrum soil fumigant, golf course superintendents can gain control of several soil-borne pests.

Conclusions

These research trials, which were conducted across a large geographic region, demonstrate that 1,3-D soil fumigant can be successfully used to control soil-borne pests without causing disruption to the turf. One should expect a minimal level of injury where the coulters cut the turf, but after two weeks, this should no longer be evident.

Optimal pre- and post-application cultural practices such as proper irrigation and nutrient management should be performed to promote recovery from injury by coulters. It is critical that irrigation or precipitation totaling 1/4 to 1/2 inch of water occurs as soon as possible following application. This allows 1,3-D soil fumigant to dissipate through the soil so that it comes into contact with the soil-borne pests. Soil moisture at the time of application should be adequate to support good turf growth and maintained at that level for at least seven days. It is also advisable to fertilize a week before the 1,3-D application.

For the best level of mole cricket control, application of 1,3-D should coincide with peak egg hatch. Failure to do so will likely result in less mole cricket suppression. Although the active ingredient in the 1,3-D soil fumigant dissipates very quickly, mole crickets usually avoid treated areas for 60-90 days after application on sites treated under the experimental use permit. The mechanism of mole cricket suppression is currently being investigated.

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J. Bryan Unruh, Ph.D. (e-mail: jbu@mail.ifas.ufl.edu), is an assistant professor at the University of Florida's Institute of Food and Agricultural Sciences, West Florida Research and Education Center near Jay, Fla. Darin Lickfeldt, Ph.D., is a field research biologist for Dow AgroSciences LLC in Fayetteville, Ga.