Research *You Can Use*

Innovative Management of Earthworm Castings on Golf Course Turf

Can a simple topdressing application provide long-term relief from annoying earthworm activity?

BY R. CHRIS WILLIAMSON

Earthworms are abundant, well-known inhabitants of the soil, referred to by a variety of names such as angleworms, fishworms, nightcrawlers, and dew worms. Earthworms play an important role in recycling nutrients from leaf litter and other organic debris back into the soil. They live in a variety of locations ranging from forests to lakes and streams. They also are found in a wide variety of soil types, though they tend to be relatively scarce in sandy soils.

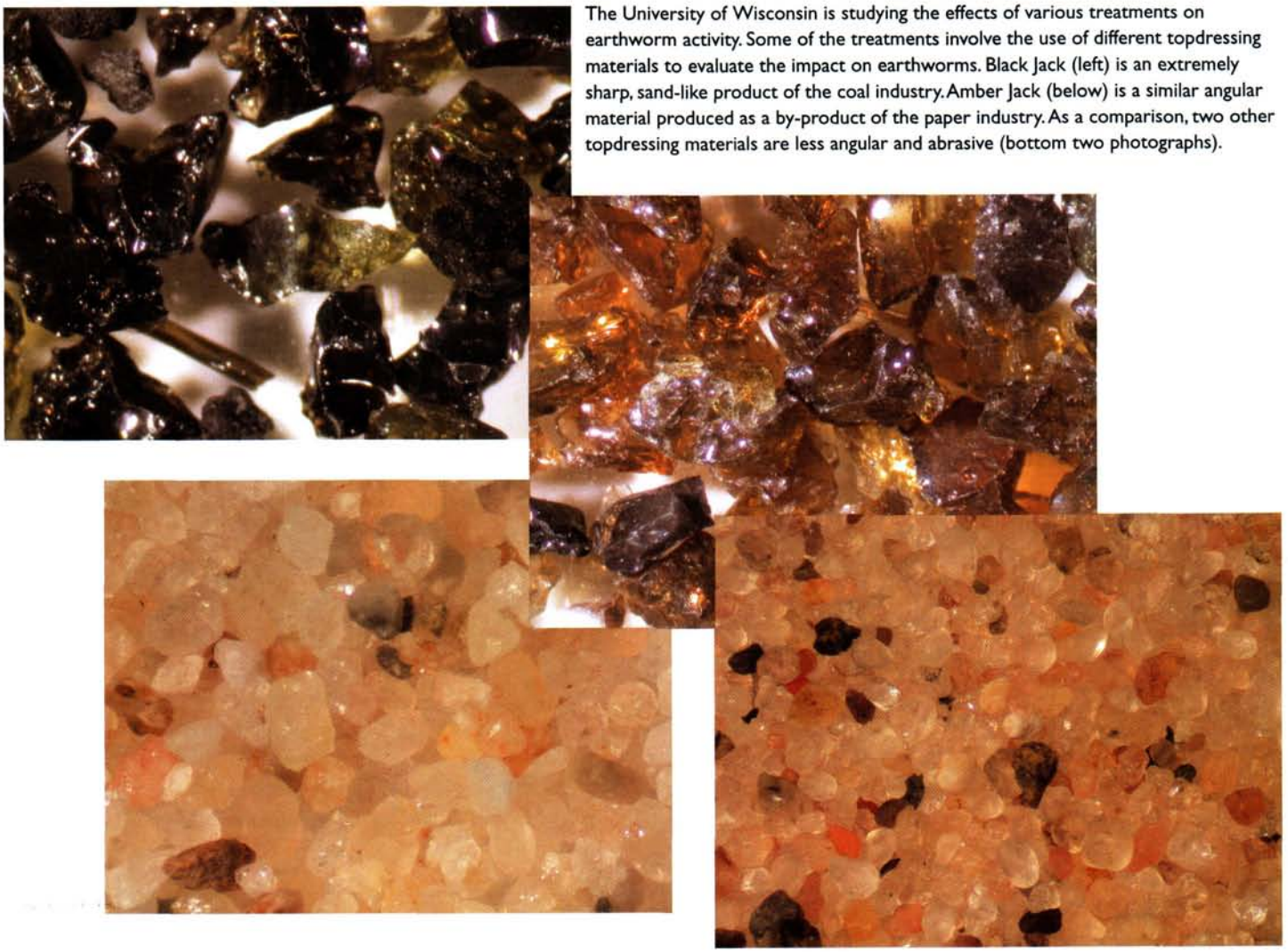
Earthworms have two primary requirements: 1) moist soil and 2) an organic matter food source, and there is no shortage of either on the average golf course. Consequently, earthworms often populate greens, tees, and fairways. They can be particularly abundant in shaded, well-irrigated sites.

Although earthworms are highly beneficial to the soil ecosystem, they can be a major nuisance on golf courses by creating soil mounds, called *castings*, on closely cut playing surfaces. Earthworms feed by ingesting soil and organic matter, such as turfgrass leaf tissue. The soil and organic matter pass through the digestive system and are then deposited as fecal matter castings at the entrance to the earthworm burrow.

There are 24 known species of earthworms in North America; only three species have been reported to occur in turfgrass. Of these three earthworm species, only two create soil castings. *Lumbricus terrestris* Linnaeus, the night crawler, is the most common and abundant species of the two that construct earthen castings. It is understood that *L. terrestris* is native to Europe and was introduced in America like many other pests such as the Japanese beetle.

Although earthworms are highly beneficial to the soil ecosystem they can be a nuisance on golf courses by creating soil mounds called castings. During periods of heavy earthworm activity, a casting will be deposited above a burrow each night.

Soft, wet castings are readily mashed flat by early morning mowing operations. Closely mowed turf under the leveled casting is smothered. As a result, the appearance and playability of the course is affected in areas densely populated by earthworms. Because earthworms are considered beneficial organisms, **NO** pesticides are registered or labeled for control of earthworms; therefore, **ANY** pesticide application specifically intended to control earthworms is illegal. For this reason, alterna-



The University of Wisconsin is studying the effects of various treatments on earthworm activity. Some of the treatments involve the use of different topdressing materials to evaluate the impact on earthworms. Black Jack (left) is an extremely sharp, sand-like product of the coal industry. Amber Jack (below) is a similar angular material produced as a by-product of the paper industry. As a comparison, two other topdressing materials are less angular and abrasive (bottom two photographs).

tive, non-chemical earthworm management strategies are needed.

Earthworms migrate up and down through the soil profile in response to changes in soil moisture content and soil temperature. The cuticle (skin) of earthworms is remarkably sensitive, and sand and other abrasive substances would probably irritate and repel them. We directed our research to exploit this weakness.

In the spring of 2002, an earthworm activity study was initiated that included the following treatments: 1) untreated control; 2) thiophanate-methyl (Cleary's 3336) fungicide applied every 14-21 days; carbaryl (Sevin) insecticide applied every 14-21 days; 4) soap, Joy® dishwashing detergent applied every 7 days; 5) Hydroject™ water injection every 28 days; 6) Dragon spice (ground oriental mustard seed), one application; 7) Zeolite soil amendment, one ⅛-inch application; and 8) Black Jack™ 20/40 crushed coal slag, one ⅛-inch application.

Treatments were applied to a bentgrass/*Poa annua* fairway (Blackhawk Country Club, Madison, Wisconsin) maintained at 7/16 of an inch. This site was selected based on a history of earthworm activity.

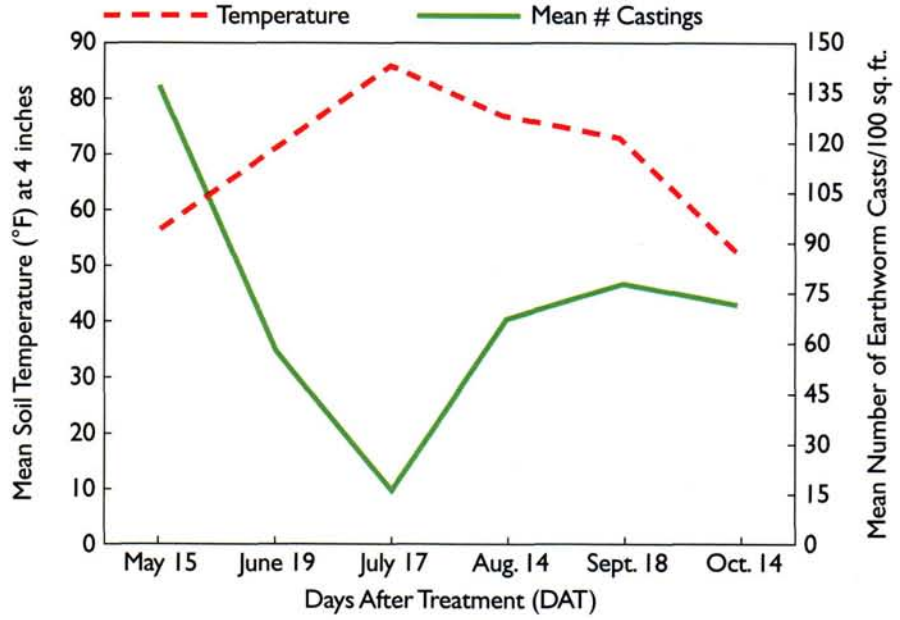
Treated turf plots were evaluated for the mean number of castings every 7 days. The fungicide and insecticide treatments reduced earthworm castings. The soil amendments (i.e., Black Jack and Zeolite) reduced earthworm castings to levels comparable to pesticide applications. Other treatments had relatively little effect on earthworm activity.

Based on the promising results of the 2002 study, another similar experiment was initiated during the spring of 2003. New treatments included a finer grade of Black Jack, another abrasive aggregate called Amber Jack, and an angular topdressing sand.

Black Jack is a by-product of the coal industry; essentially, it is the remains of coal after it is burned for production of electricity. Once burned, it is processed by crushing the resulting 1-2 inch colloids, fractionated into respective size ranges, de-magnetized, and kiln dried. Black Jack is essentially inert, extremely hard, highly angular, and predominantly black in color. Amber Jack is comparable to Black Jack, however Amber Jack is a by-product of the paper industry. It too is inert, highly angular, extremely hard, and considerably lighter in color,

Figure 1

Correlation between soil temperature and earthworm castings on creeping bentgrass turf located on a golf course fairway.



ranging from almost clear to a reddish amber.

The effects of spring vs. fall applications of topdressing and the effects of multiple light applications of topdressing will be evaluated in 2003. Turf quality, thatch accumulation, and disease activity will be rated throughout the season to document any adverse effects a thin layer of abrasive material might have in the upper rootzone of intensively managed golf course turf.

What is the significance of this research to the golf course superintendent, and why is further research needed? Just compare the following scenarios.

BEST CASE SCENARIO

Several approach areas to a green are plagued by earthworm castings every season. The superintendent makes an application of abrasive topdressing to these sites and the worms are irritated to the point where they migrate to the adjacent roughs. The castings in the roughs are not a problem in the 2½-inch turf. In addition, the topdressing firms up the approach areas, and golfers can now play a bump-and-run shot to the green. Life is good.

WORSE CASE SCENARIO

The superintendent makes the same application of sharp topdressing material to approaches. Worms go away, but the layer begins to abrade and injure turf roots and shoots in response to the compaction caused by mowers, motorized carts, and concentrated foot traffic. Roots die back, diseases run rampant, and the turf wilts constantly. Life is not good and you realize that it is very easy to add a foreign material to the rootzone and very difficult to remove it.

Needless to say, thorough research is needed to determine which scenario is most likely to occur before jumping on the Black Jack bandwagon.

DR. R. CHRIS WILLIAMSON *is quite familiar with taking a worm's-eye view of the turfgrass ecosystem as assistant professor of turfgrass and ornamental entomology at the University of Wisconsin – Madison. His research regarding cutworm control for putting greens required long hours observing the nighttime feeding and movement habits of this pest.*

Figure 2

Effect of various treatments to suppress earthworm castings on creeping bentgrass turf located on a golf course fairway.