Research *You Can Use*

# Worming Your Way Out of a Turf Situation

## Development of an integrated pest management system to reduce earthworm casts.

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Earthworm casting on golf course fairways is an extremely challenging turfgrass management issue that faces many golf course superintendents. For this reason, the Northwest Turfgrass Association and Western Canada Turfgrass Association funded a multi-year study to evaluate earthworm casting on golf course fairways. The initial phase of the project focused on identifying the earthworm species that causes casting damage and learning more about its biology. Phase two evaluated soil acidity, clipping removal, hollow-core aeration, and sand topdressing for effects on casting.

Casting occurs when earthworms ingest soil and leaf tissue to extract nutrients, then emerge from their burrows to deposit the fecal matter (casts) as mounds of soil on the turfgrass surface. There are no products developed or labeled specifically to control earthworm casting, and the effects of long-residual pesticides from past decades have worn off. The result has been an exponential increase in casting on golf course fairways over the last decade. Extensive earthworm casting interferes with proper maintenance practices, playabilty of the turfgrass surface, and the overall aesthetic value of the affected fairways.

The earthworm species depositing casts throughout the Pacific Northwest and much of the northern United States is *Lumbricus terrestris*, the common night crawler. Night crawlers build semi-permanent vertical burrows that can extend up to several meters deep in the soil. However, due to regular irrigation and constant food supplies (clippings and soil organic matter) associated with fairways, these earthworms tend to remain closer to the surface, migrating up and down in the soil profile with fluctuations in moisture content, soil temperature, and atmospheric pressure. Peak earthworm casting damage occurs during the cool, wet weather in the spring and late fall through winter, especially when conditions of stable low atmospheric pressure exist. The most severe casting damage occurs in late fall and winter when the recuperative ability of the turf is at a minimum.

Earthworm casts and mowing equipment don't always mix well together. The result can smother the nearby turf, resulting in poor playing conditions.

### EFFECTS OF CLIPPING REMOVAL AND HOLLOW-CORE AERATION ON CASTING

*Lumbricus terrestris* feeds directly on decaying leaf clippings and organic matter in the soil. A study was conducted to evaluate clipping removal and hollow-core aeration as methods of reducing the food supply. The treatments were initiated in January of 1999 and continued for two years. Even though *L. terrestris* feeds directly on decaying leaf clippings, the results of the study showed that two years of clipping removal had no effect on reducing earthworm casting caused by *L. terrestris.* The spring and fall hollow-core aeration treatments also had no effect on casting after two years.

### EFFECTS OF SOIL pH ON CASTING

The acidifying effects of certain fertilizers have been reported to reduce earthworm casting. A multi-year study evaluated fertilizer treatments of ammonium sulfate (AS) 21-0-0, ferrous sulfate ($FeSO_4$)(20%), dolomitic lime,

and Nitroform 38-0-0. Soil acidity was monitored at 0-2 cm and 2-6 cm. After two years of fertilizer treatment applications, there were some large decreases in the soil pH in the top 0-2 cm and 2-6 cm. The effects of increasing soil acidity had no impact on reducing casting. Likewise, an increase in casting was not observed after two years of heavy lime applications. The response curve of earthworms to various soil factors is not the same for all earthworm species. There are several species of earthworms that are much more intolerant of acidic conditions than *L. terrestris*.

## EFFECTS OF SAND TOPDRESSING ON CASTING

It has been reported that the abrasiveness of sand particles and sand's susceptibility to drought influences both earthworm species composition and earthworm numbers in the soil. A topdressing study included treatments of high sand (1.5 inches of sand per year), low sand (0.75 inches of sand per year), and a control which did not receive sand. Six sand topdressing applications were made between May 30 and August 22, 2000. The high sand received .25 inch of sand per application, and the low sand .125 inch per application. The results of the sand topdressing are shown in Figure 1.

The first count after the treatments were in place was taken on September 15, 2000, and resulted in significant differences in casting among all three treatments. The high-sand plots were dramatically better than the low sand and the control. The significant reductions continued through the fall and winter casting counts (October 15, 2000, and March 10, 2001). Sand topdressing proved to be an effective method of reducing earthworm casting.

## CONCLUSION

The issue of earthworm casting will continue to be a difficult management issue in the future. It is unfortunate that there are superintendents who face extreme pressure on this issue from golfers. After all, these earthworms prefer the same conditions that are required to maintain healthy turfgrass. For superintendents, it is extremely important to educate the parties involved on the biology of earthworms, benefits of earthworm activity, and the lack of products available for control.

In attempting to manage earthworm casting on fairways, superintendents need a detailed map that identifies the areas most damaged by casting as well as areas with moderate casting. Casting severity is highly variable from fairway to fairway; even within a fairway there are heavily infested areas and areas with zero casts. Superintendents must know where their trouble areas are. The fact that *L. terrestris* earthworms have been reported to live for up to 6-9 years in the soil means that problems come back in the same place year after year, with casting severity expanding out laterally from those areas.

There are casting control strategies implemented on golf courses not discussed in this update, including physical removal of the worms by harvesting companies and applications of products that inhibit casting. These measures typically provide only short-term relief, and the legality of some of these applications is in question. We've learned through numerous field observations and the dramatic reductions in earthworm casting after one growing season that sand topdressing is a viable control strategy for earthworm casting. Sand topdressing requires a long-term commitment, as multiple applications are necessary. It also is very expensive and labor intensive. In most cases, sand topdressing and any other control strategies being implemented can be made with a spot treatment mentality. This emphasizes the need for an acccurate map.

Earthworm casting is an issue that inevitably will require some tolerance on the part of golfers and superintendents. We must remember that earthworms provide far more benefits to the soil/turf environment than they do harm. The earthworm's burrowing and feeding activity initiates thatch decomposition, stimulates microbial activity, makes particular plant nutrients more available, increases soil aeration, and in general improves overall soil quality.

PAUL BACKMAN *casts his lot in golf as the Executive Director of the Northwest Turfgrass Association and Western Washington Golf Course Superintendents Association.*

**Figure 1**
**Effects of Sand Topdressing on Earthworm Casting Numbers**