

Adventures in Earthworm Control

By: Pat Gross, Director, Southwest Region, USGA Green Section

I recently returned from the USGA Regional Green Section Conference in Portland, Oregon where Dr. Tom Cook of Oregon State University gave an excellent presentation on the biology and history of control of earthworms. I thought this was an especially interesting topic for the Southwest due to the persistent rain and heavy earthworm activity in recent months. The following is a summary of the information he presented during the conference.

Earthworms are beneficial soil invertebrates that serve several important functions in the soil/turfgrass system:

- Earthworms reduce soil acidity by bringing soil from deep within the soil profile to mix with the more acidic thatch and soil layers near the surface.
- Improvement of soil structure.
- Improvement of the soil infiltration rate.
- Initiate thatch breakdown by mixing soil within the thatch layer.

Dr. Cook related some interesting facts concerning the biology and life cycle of earthworms. Earthworms have a life span of 1.5 to 9 years. They reach sexual maturity in less than one year and obtain their maximum size within three years. Earthworm cocoons hatch in the spring, and juvenile earthworms generally dominate most soils. Earthworms will make permanent burrows, up to six feet deep, unless the soil is cultivated or disturbed in some manner. There are many different species of earthworms, but the following three species dominate in most turfgrass soils:

Apporectodea tonga, *A. caliginosa*, and *lumbricus terrestris* (the most common species).

Although earthworms provide many

benefits, the main problem encountered in golf turf is heavy deposits of earthworm casts. The casts are deposited on the surface of the turf, and mowing and other operations spread the casts over the surface of the turf, similar to spreading peanut butter on the grass. The glue-like casts shade and suffocate the turf causing thinning and bare areas. Earthworm activity and cast deposits are favored by the following conditions:

- Soil pH greater than 5.0
- Fine-textured soil.
- Vigorous grass growth.
- Earthworms actually have feeding preferences, and prefer perennial ryegrass to other turf species.
- Regular irrigation and adequate soil moisture.
- Adequate soil nitrogen.
- Modest amounts of thatch.

The presence of earthworms is a sign of a healthy soil, and earthworms are commonly used as "poster children" for the environmental movement. Given this fact, several scientists have studied the effects of fertilizers and pesticides on earthworm activity in turfgrass soils. These studies indicated that most commonly used herbicides had little or no effect on earthworm populations, however, the fungicide benomyl and the insecticides ethoprop, carbaryl, fonofos, and bendiocarb at labeled rates reduced earthworm populations by 60% to 99%. Dr. Cook also summarized the history of earthworm control from WWII to the present noting the use of such products as bandane, calcium arsenate, potassium permanganate, chlordane, and the mercury fungicides, which are no longer allowed by law.

It is important to note that since 1980, there are **NO** registered chemicals for the control of earthworms. Dr. Cook discussed various cultural control practices that helped discourage earthworm activity. These included:

- Earthworms are less of a problem on sandy soils, since earthworms do not like to ingest sand. After several years of fairway topdressing, earthworm activity appears to have diminished in several locations.
- Maintain moderate to low nitrogen levels.
- Increase soil acidity by spoon feeding with ammonium sulfate or other sulfur containing fertilizers.
- Try to remove turfgrass clippings to reduce the organic matter source for worm feeding.

Dr. Cook just completed the first year of a multi-year project to study the biology and cultural control programs to reduce earthworm activity. The goal of the project is to learn more about worms and the various species that inhabit turfgrass soils and develop a set of integrated cultural control programs. One of the more interesting control methods being studied is the use of hot mustard drenches to discourage earthworm activity. Currently, the mustard causes phytotoxicity on some grass species, and more work must be done on proper rates and timing. This research is being supported by the Pacific Northwest Golf Association, which includes the support of the Oregon and Washington Superintendents Associations. Field research is currently being conducted on four golf courses in Washington and Oregon. While deliberately killing earthworms is illegal and politically incorrect, it is hoped that the research at Oregon State University will help reduce the problems associated with excessive earthworm casting on turf during the winter season.

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