

The Effect of Benomyl and Thiophanate Methyl on Earthworm Populations and Subsequent Development of Thatch

David L. Roberts and J. M. Vargas, Jr.
Botany and Plant Pathology, M.S.U.

Benomyl (Tersan 1991) and Thiophanate Methyl (Fungo 50) are important broad spectrum systemic fungicides for the control of dollar spot, brown patch and stripe smut as well as other turfgrass diseases. Their use is not limited to turfgrass but is extended for other areas of plant disease control such as those of field crops, vegetables and orchards. In orchards in past years the build up of leaves, twigs and other organic matter has been noticed in areas where Benomyl is frequently sprayed. Since earthworms are known to play an important role in the degradation of organic matter it was assumed that benomyl must have some inhibitory or toxic effect on the activity of the earthworms. This idea was substantiated when practically no earthworm activity was observed in the sprayed areas. A series of experiments followed and by rather crude methods of dipping of the earthworms into pesticide solutions or forced feeding benomyl was shown to be toxic to earthworms. Due to the importance of Benomyl and its similar cousin Thiophanate Methyl, and because Benomyl was placed on the KPAR list a couple of years ago, the EPA has delegated funding for the study of Benomyl. One such area of research involves the effect of Benomyl and Thiophanate Methyl on earthworm populations and subsequent development of thatch.

Unlike most crop plants which have a soil plant interaction, turfgrass has plant, soil and thatch interactions. It is assumed that earthworms are important in the management of thatch. Since benomyl has been shown to be toxic to earthworms the inhibition of earthworm activity by benomyl may lead to an increase in thatch. To determine the effects of these pesticides on earthworms and thatch, specially designed turfgrass boxes were constructed. These boxes had two large glass sides for observing thatch and earthworm activity. The boxes were filled with one cubic foot of a greenhouse soil mix. Uniform thatched Kentucky Bluegrass sod was cut to the dimensions of the box 0.5 ft. X 2 ft., and placed in the boxes. Twelve Lumbricus terrestris earthworms were placed in appropriate boxes. One, three and five treatments of Benomyl and Thiophanate Methyl were drenched into the turf at the appropriate time through the course of the experiment. The boxes were fertilized every two weeks (with analysis of 23-19-17). A high rate of fertilizer and high clipping height was necessary for stimulation of thatch development. The experiment was allowed to progress for approximately 12 wk. At the termination of the experiment the sod was peeled from the soil and % organic matter of the thatch was determined. Earthworms were screened from the soil for ascertaining survival.

Treatment of the turf boxes with different levels of pesticides did not significantly decrease the survival of the earthworms. This suggests that normal pesticide application rates may not be as toxic as earlier research has shown. The survival ranged from about 44% to 72% at the end of the 12 wk experimentation period. This survival may be reasonable considering that these nightcrawlers are not known to survive well in artificial environments. The literature suggests that these pesticides are very toxic to Lumbricus terrestris, however, their results are obtained by forced feeding and may not be accurate. Also, observations of the lack of earthworm activity in areas of frequent benomyl sprays may not take into account other pesticides such as insecticides and herbicides which are frequently used in orchard environments. Moreover, Benomyl may be a repellent rather than as poison, something which has not been looked into in great depth.

To determine the effect of earthworms and pesticides on thatch, six 25 cm² thatch samples were taken from each treated sod piece and combusted at 930°F for determination of organic matter content. If earthworms have any effect upon the thatch, the organic matter content should decrease by removal or alteration and the inorganic or soil content should increase by the action of the earthworms activity.

Earthworms in this experiment did not have any great effect upon the thatch when we compare nontreated boxes with and without earthworms. Organic matter contents were not significantly different. These findings may support previous data (MSU) that leaf cuttings do not significantly affect the thatch. Earthworms were observed to feed primarily on the easily degradable leaf cuttings rather than the rather recalcitrant stems, crowns, rhizomes. Three pesticide treatments (one and five Fungo applications, three Benomyl applications) resulted in a significant decrease in the organic matter content of the thatch. Either a large degree of variables exists or there is some stimulation of the microbial activity.

In conclusion, earthworms survival was not affected by the application of Benomyl and Thiophanate Methyl. Furthermore, earthworms did not affect the thatch to any great extent. If Benomyl or Thiophanate Methyl have any effect upon thatch it would presumably be due to their effect upon the microorganisms that subsist within the thatch. Further research is necessary before definite conclusions can be drawn.