CORNELL UNIVERSITY TURFGRASS TIMES

CUTT

Spring 1990 • Volume One • Number One • *A Publication of Cornell Cooperative Extension*

The Advent of Biological Controls for Turfgrass Disease Management

A new era of disease management is emerging as we enter the 1990's. Biological forms of disease control offer the potential to largely replace conventional chemical fungicides. Research at Cornell and other universities around the country is focussing on this novel and environmentally sound approach to turfgrass disease control; methods that could revolutionize the turfgrass industry ■

Over the past five to ten years, there has been a great deal of concern regarding the high volumes of fungicides being applied to turfgrasses. Of greatest concern are the problems of soil and water contamination, as well as undue exposure of consumers and turfgrass managers to fungicides. Moreover, continued application of many of the modern systemic fungicides has led to the development of pathogen resistance, making turfgrass disease control no longer effective. Therefore, alternative management practices are being explored to not only reduce overall fungicide use, but to prevent the development of fungicide-resistant pathogen strains.

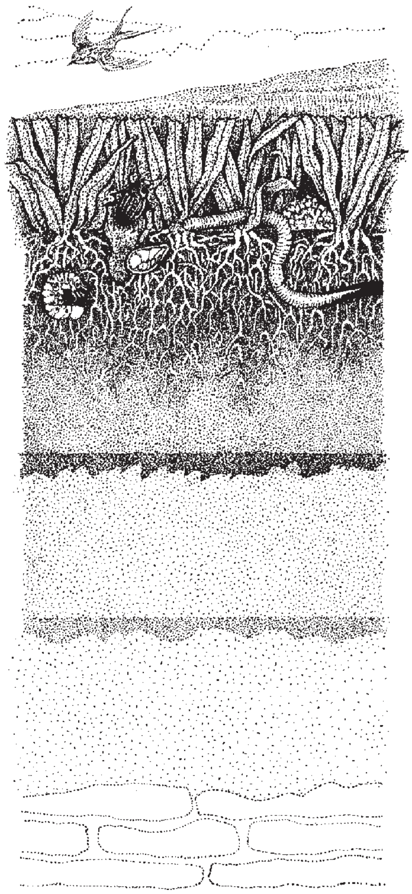
Among the technologies most attractive for reducing chemical fungicide usage are biological controls using microbial based fungicides. This strategy has been used successfully on an experimental and commercial basis the control of plant pathogens on several crop plant species. Several types of biological control products are commercially available and many others are likely to become available in the next few years.

Approaches to Biological Control

Plants rely heavily on microorganisms to promote an environment conducive to plant health. Microorganisms release nutrients in soil, produce substances stimulatory to plant growth and development, and protect plants against infection from pathogenic fungi. The use of biological control as a management tool takes advantage of these interactions among microbial populations to limit the activities of plant pathogens.

Nearly all organisms that are antagonistic to turf pathogens are capable of surviving on dead and decaying organic matter such as thatch, decaying plant tissues, and soil organic matter. Some methods used to maintain golf course turf will discourage the development of a diverse microflora. Examples include the use of low organic matter sands in new green construction and in top-dressings, as well as the continued use of broad-spectrum, long-residual pesticides. Although pathogens are suppressed by most fungi

continued on page 4



This Times

Biological Controls

continued from cover

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cides, these chemicals also harm many other non-target organisms, including organisms antagonistic to diseases. Likewise, many herbicides, insecticides, and plant growth regulators have similar detrimental effects on non-target microorganisms. Reduced populations of the natural antagonistic organisms will allow pathogenic microorganisms to more readily become established on susceptible plants. This is one of the major reasons why turf diseases are generally so devastating and difficult to control. It also partly explains the emergence of "new" turf diseases, especially some of the more destructive root and crown diseases.

The biological balance must be restored to turfgrass soils if we are to take advantage of beneficial microbial interactions to manage turfgrass diseases. We must learn to not only manage the turf, but to also manage the microorganisms associated with it. This will undoubtedly be the key to sustained turfgrass management in the future.

Composts and Organic Fertilizers

In order to re-establish the microbiological balance of turfgrass soils, sufficient organic matter must be introduced into the soil/plant system. Unfortunately, peat has no disease suppressive properties. Some of the best sources of both organic matter and populations of antagonistic microorganisms are composted materials and organic fertilizers. In composting, organic materials are broken down in a controlled manner so that a very uniform and nutritive material is produced. Composting requires the activity of different microorganisms during various phases of organic matter decompostion. It is only after decomposition slows that a more stable and disease-suppressive microflora develops.

Results of our research over the past two years have shown the potential to biologically suppress dollarspot, brownpatch, and red thread with topdressing applications of composts and organic fertilizers (see table). This concept is now being widely accepted by golf course superintendents who are enthusiastically incorporating it into golf course disease management programs. They have reported improved disease control with reductions in fungicide use.

Unfortunately, we currently do not know how predictably suppressive certain composts might be from year to year and batch to batch. It is clear that composts of different origin and stage of decomposition differ in their disease-suppressive properties as well as in the spectrum of diseases that are controlled. This is primarily a result of the microbial variability among different composts and among the different qualities of organic matter present in any one compost at various stages of stabilization. Although microbial activity is necessary for a compost to suppress disease, we know nothing of the specific microorganisms that are involved. Identification of the specific organisms in composts with biological control activity will be a key factor in understanding how composts suppress diseases.

Eric B. Nelson, Turfgrass Pathologist, Department of Plant Pathology

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Biological Suppression of Dollar Spot, Brown Patch, & Red Thread with Compost-Amended Topdressings, 1989

Treatments	Dollar Spot	Brown Patch	Red Thread
	Spots/plot	% plot area diseased	% plot area diseased
Controls			
Untreated1	9.8	72	47
Banner (Fungicide check)	0.6*	8*	-
E. cloacae	8.6*	-	-
Composts & Organic Fertilizers			
Ringer® "Compost Plus"	5.2*	18*	20
Ringer® "Greens Restore"	6.8*	24*	43
Sustane® (Poultry compost)	13.8	18*	10*
Endicott Sludge Compost	13.0	42*	40
IPS Cow Manure Compost	16.9	54	43
Baltimore Sludge Compost	17.3	60	23
Peat	17.4	50	37
AB Brewery Compost	17.8	54	30
Endicott Leaf Compost	18.9	44*	53
MH Manure Compost	20.2	72	53
Autoclaved Cornmeal Sand	21.0	-	-
Schenectady Sludge Compost	21.4	66	57
Spent Mushroom Compost	21.8	54	53

*Numbers followed by an * are not significantly different from untreated plots.*