Microbial Basis of Disease Suppression in Composts Applied to Golf Course Turf

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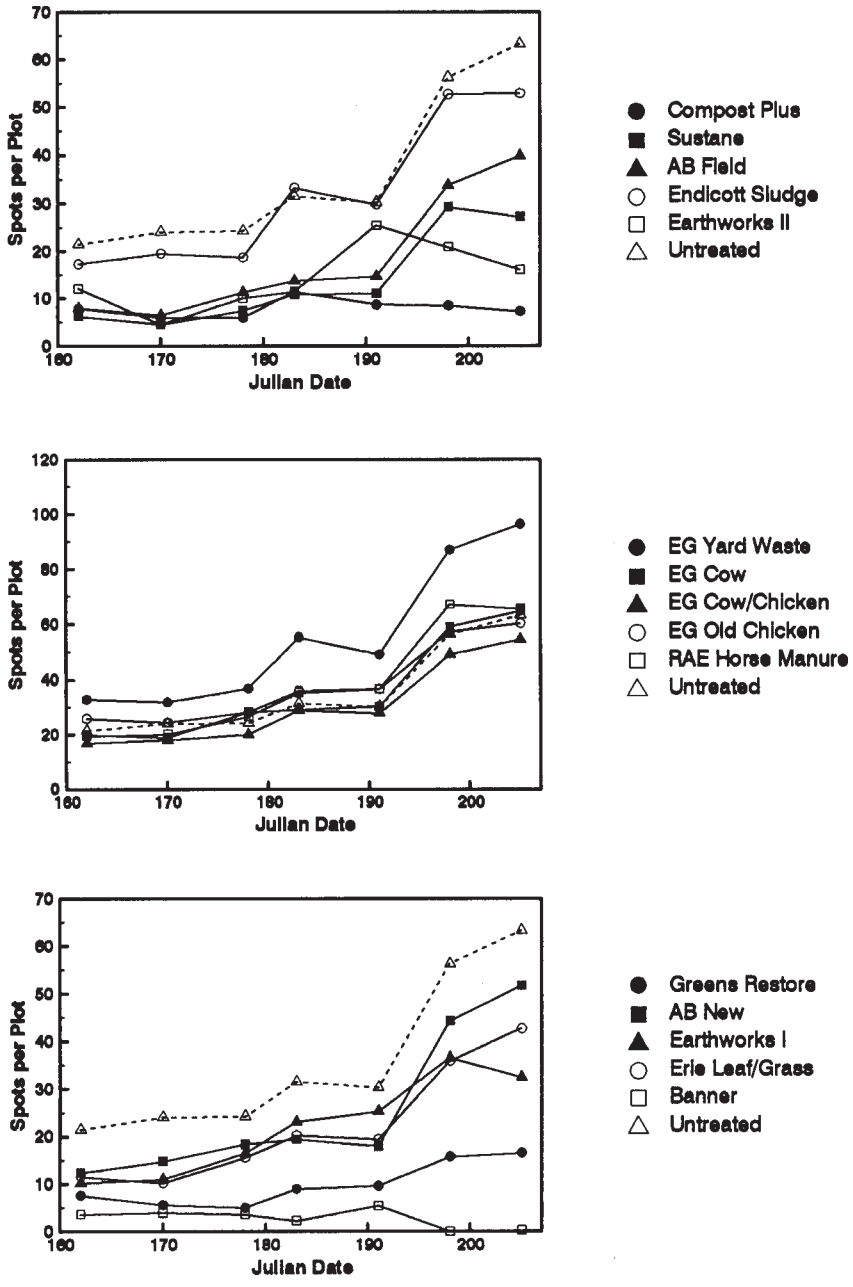

Figure 1

Effects of various composts on the development of dollar spot on a creeping bentgrass putting green at the Cornell University Turfgrass Field Research Laboratory. Disease development arose from natural inoculum and was monitored through June and July. Dashed line in all three figures represents untreated plots.

Our goal in this project is to develop more effective biological control strategies with compost-based organic fertilizers by understanding the microbial ecology of disease-suppressive composts. In particular, we hope to understand the microbiology such that disease-suppressive properties of composts might be predicted and an assemblage of beneficial microorganisms useful in the development of microbial fungicides for turfgrass disease control might be discovered.

The objectives of our study are to:

1) determine the spectrum of turfgrass pathogens suppressed by compost applications,
2) establish relationships between overall microbial activity, microbial biomass, and disease suppression in composts,
3) identify microorganisms from suppressive composts that are capable of imparting disease-suppressive properties to conducive composts or those rendered conducive by heat treatment, and
4) determine the fate of compost- derived antagonists in golf course putting greens following application of individual antagonists and composts fortified with these antagonists.

1992 Efforts

Over the past year, our efforts have been focused on:

1) further evaluating composts in the field for disease suppression (see figure 1); our goal has been to verify previous findings as well as expand the diseases for which composts are suppressive;
2) further developing laboratory assays to assess microbial activity and biomass; and
3) enumerating and recovering specific isolates of bacteria, fungi, and actinomycetes from suppressive composts. Much of our emphasis in 1992 was on objective 3.

Although 1992 was not a good year for disease development in our experimental plots, data were obtained for the suppression of dollar spot with various composts. Additional evaluations for snow mold suppression are underway.

Table 1. Pythium suppression and populations of fungi, bacteria, and Pythium-suppressive actinomycetes from composts

Compost	Microbial Populations (log CFU/g dry wt. compost)			*Pythium graminicola* Suppression Disease Rating[d]	
	Heterotrophic Bacteria[a]	Heterotrophic Fungi[b]	Antibiotic-producing Actinomycetes[c]	Uninoculated	Inoculated
Brewery Waste 1989	8.65	7.53	9.86	1.0	2.3
Brewery Waste 1991	9.85	5.73	8.00	1.5	3.5
Brewery Waste 1992	5.04	4.72	NA	1.0	2.3
Endicott Sludge 1989	9.65	6.54	6.43	1.0	1.8
Leaves A4-21-92	8.99	5.87	NA[e]	1.0	2.0
Leaves A5-20-92	9.34	5.04	6.34	1.0	3.3
Leaves B6-4-92	8.61	5.59	6.79	1.5	1.8
Leaves/Chicken Manure A4-21-92	8.90	3.77	NA	1.0	1.5
Leaves/Chicken Manure A5-20-92	9.23	5.23	6.91	1.0	4.8
Leaves/Chicken Manure A6-4-92	9.38	4.00	NA	1.0	2.0
Chicken Manure A6-4-92	8.80	3.65	<2.26	1.0	1.0
Chicken Manure B6-4-92	9.18	4.87	NA	1.0	1.0
Chicken/Cow Manure A6-4-92	9.36	5.04	NA	2.0	2.0
Yard Waste Grind B4-21-92	8.67	4.41	NA	1.0	1.5
Yard Waste Grind B5-20-92	9.43	5.04	6.68	1.0	3.3
Yard Waste Grind A5-20-92	9.34	5.04	6.89	1.0	4.5
Food Waste B6-4-92	9.36	3.90	NA	1.5	2.0
Food Waste B7-1-92	9.18	4.15	NA	1.0	2.0
Food Waste A6-4-92	8.70	3.83	5.23	2.3	2.8
Food Waste A7-1-92	8.62	3.49	NA	2.5	2.0

[a] Heterotrophic bacterial populations determined by plating on 1/10-strength trypticase soy agar (TSA).
[b] Heterotrophic fungal populations determined by plating on 1/3-strength potato dextrose agar (PDA).
[c] Pythium-suppressive antibiotic-producing actinomycetes determined by a triple-layer agar plating procedure described by Herr (1959).
[d] Compost mixed with sand at the rate of 80 mg dry wt/cm^3 sand. Rated after 5 days on a scale of 1-5 for which 1=no disease and 5=completely dead or unemerged seedlings of *Agrostis palustris.* Controls consisted of sand to which no compost was added (Disease rating 1.0 and 5.0 for uninoculated and inoculated, respectively).
[e] NA=data not yet available.

We have performed isolations of bacteria, fungi, and actinomycetes from over 20 different composts (see table 1). Actinomycetes have been the most difficult group to enumerate and purify since they are extremely slow-growing and cultures can be easily contaminated with bacteria and fungi. As a means of better recovering antagonistic actinomycetes, we have employed a triple layer agar technique to recover antibiotic-producing actinomycetes. We have over 100 strains of actinomycetes that are currently being evaluated for their disease-suppressive properties. We are currently in the process of characterizing the fungal and bacterial populations from composts and we are just beginning to screen these organisms for disease suppression.

We have also been successful in refining our microbial biomass assay. We are now able to generate repeatable standard curves from both inorganic phosphate and glycerol phosphate and we are proceeding to assess biomass with this procedure in a number of different composts. During the first half of 1993 we hope to be able to assess over 25 different materials for levels of biomass and activity to determine whether this method may be suitable for assessing and thus predicting disease-suppressive properties of composts.

We hope to understand how disease-suppressive properties of composts might be predicted.