The Utilization of Aqueous Compost Fermentation Extracts ("Compost Tea") for the Suppression of Turfgrass Pathogens

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Our initial goal in this project was to expand upon work conducted over the past decade in Germany on compost teas. Our goal has been to optimize the fermentation process to maximize disease suppression, focusing on the microbiological changes that accompany this fermentation. In so doing we will be able to optimize fermentation parameters to maximize the proliferation and activities of the component microorganisms. A further goal is to integrate the fermentation processes with our knowledge of the composting process, so that optimum stages of composting can be identified as appropriate for extract preparation.

The objectives of the project are to:

1) determine the spectrum of composts that are suitable for the preparation of disease-suppressive fermentation extracts,
2) identify the stage of the composting process most suitable for the preparation of a highly disease-suppressive extract,
3) determine the fermentation parameters (i.e. temperature, aeration, extraction time, and selective microbial inhibitors) on the development of disease suppressiveness,
4) determine if the microflora is the active element in the expression of disease-suppressive properties in extracts,
5) identify the specific bacteria, fungi, and yeasts involved in disease-suppressive properties and determine the timing of their occurrence in fermentation extracts,
6) compare these microbial communities from among different composts to determine if the same microflora develops regardless of the starting material, and
7) evaluate extracts, produced under optimized conditions, for their efficacy against Pythium root rot in the field on a creeping bentgrass putting green.

Results thus far show compost extracts to be effective in the suppression of Pythium spp. affecting turfgrasses. Differences in quality of compost extracts exist depending on the composition of the compost. A study of the effect of fermentation time on the extract microflora indicated an early rise in bacterial populations with a concomitant drop in fungi and actinomycete populations. Subsequent experiments have shown that disease suppression is largely due to the microflora that develops during the fermentation process. Extracts that were filtered to remove microbial cells were ineffective in suppressing Pythium seed and seedling rots whereas the microbial pellet, when resuspended in a buffer and drenched into the Pythium-infested soil, completely restored the disease-suppressive properties of the crude extract. Selected bacterial strains from the microbial pellet were also effective in restoring disease suppression when applied individually.

An investigation of fermentation parameters important in disease suppression has revealed that the longer the fermentation period, the less active the extract. Similarly, the higher the extraction temperature, the less active the extract. We have also shown that composts (particularly yard waste composts) that are not particularly suppressive to Pythium spp. by themselves can give rise to extracts that are suppressive. Current investigations are focusing on the microbiological aspects of the fermentation process.

Our preliminary study of the bacterial flora has revealed a relatively non-diverse bacterial community; only two or three different morphological "types" predominate the extract. This suggests that the fermentation process provides a selection for a limited number of microbial groups from the compost that are capable of providing a high level of disease control. This further suggests that the study of these extracts may provide a ready means of recovering antagonistic microorganisms from composts that can be used subsequently as inoculants to provide consistently disease-suppressive composts.

Compost extracts are effective in the suppression of Pythium spp. affecting turfgrasses.

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