Elucidating fungal-bacterial interactions within compost systems

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Introduction
Agaricus bisporus, the button mushroom, is cultivated commercially on a composted mixture of straw, manure, and gypsum. Different temperatures and conditions are used in substrate production with the aim to make the compost microbiologically and nutritionally specific for the mushroom. Previous studies have shown that A. bisporus depends on the rest of the microbial community during its life cycle, for nutrient uptake and fruiting body production. This dependence is poorly understood as is the food-web of the bial community during its life cycle, for nutrient uptake and fruiting body production.

Aim
The aim of this project is to elucidate the food web and nutrient flows within compost systems in order to increase the yield and reduce waste in the commercial production of Agaricus bisporus.

Results

![Figure 1: PLFAs 13C Absolute Content](image)

**Figure 1** PLFAs 13C Absolute Content represents a measurement of 13C incorporation within the biomass

![Figure 2: Fraction of 13C on the total carbon trapped in sodium hydroxide](image)

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![Figure 3: Total community respiration as measured with infrared carbon dioxide sensor](image)

**Figure 3** Total community respiration as measured with infrared carbon dioxide sensor

<table>
<thead>
<tr>
<th>PLFAs</th>
<th>Microbial group</th>
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</thead>
<tbody>
<tr>
<td>18:2ω6</td>
<td>Fungi[1]</td>
</tr>
<tr>
<td>vα-15,17:0</td>
<td>Gram positive bacteria[2]</td>
</tr>
<tr>
<td>Cy-19:0; 16:1ω7</td>
<td>Gram negative bacteria[3]</td>
</tr>
<tr>
<td>Me-16,18:0</td>
<td>Actinomycetes[1]</td>
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</tbody>
</table>

**Table 1** Examples of PLFAs identified from compost’s fatty acids

![Image 1: NanoSIMS imaging of hyphal section](image)

**Image 1** NanoSIMS imaging of hyphal section. Hyphae grown on support inserted in the compost were prepared using a dehydration fixation protocol. Left: SEM picture; Middle: surface; Right: subsurface.

Methods

Stable isotope labelling: addition of 13C-glucose and 15N-ammonium chloride as substrate.

Biomarker analysis: phospholipid derived fatty acids (PLFAs) as biomarkers of fungi, actinomycetes and other bacteria (Table 1). GC-c-IRMS for quantification and isotopic composition measurement.

Nanoscale secondary ion mass spectrometry (nanoSIMS): isotopic composition and imaging of fungal samples from compost or in vitro.

Conclusions

Stable isotope labelling and biomarker analysis are suitable methods for elucidating fungal-bacterial interactions.

Microbial communities can be prepared for nanoSIMS imaging.

Preliminary results confirm the bacterial population as a carbon source for A. bisporus during late vegetative state.

The start of predatory phase coincides with maximum of fungal biomass.

Acknowledgments

Special thanks to Anna de Kluijver for advise on biomarker analysis methods and tools. I also thank my colleagues from the Department of Biology, Robert-Jan Bleichrodt and Koen Herman, for their help and feedback on fungal culturing.

References


