



Tropentag, October 9-11, 2007, Witzenhausen

“Utilisation of diversity in land use systems:
Sustainable and organic approaches to meet human needs”

Effect of Plant Residue Quality on Soil Fungal Community in a Vertisol

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Abstract

Fungi play a major role in C and N cycling of plant residues, because of their ability to degrade complex substrates. Slow growing saprotrophic fungi are able to degrade lignin using extracellular enzymes and thereby gaining access to protected cellulose and hemi-cellulose compounds. On the other hand, fast growing opportunistic fungi (sugar fungi) are stimulated by easy accessible carbon sources. To evaluate the effect of plant residue quality on soil fungal community, an incubation experiment was conducted with highly ¹⁵N-enriched (99 atom%) plant residues of different quality, i.e. maize (C:N= 32, lignin:N=2.2) and soybean (C:N= 15, lignin:N=1.1), incorporated (1%) in a Vertisol soil, taken from a long-term field experiment carried out in Venezuela since 1997. The residues were incubated for 30 days (25 °C) at 40% WHC. A control without residue was also used. The ergosterol content was measured after 3, 7, 15 and 30 days. DNA was extracted and the active and passive fungal community composition is being analysed by using the ¹⁵N-DNA stable isotopic probing (SIP) and molecular (DGGE, cloning and sequencing) techniques. Residues additions stimulated soil fungal activities and the quality of residues influenced the microbial biomass. The fungal biomass was higher in the soybean treatment already at early stages of decomposition compared to the maize treatment. This seems to indicate that quality of residues affected the fungal community, i.e. in soybean it is probably composed mainly of sugar fungi and in maize probably dominated by slow growing lignocellulytic fungi. Further DNA analysis should help clarifying this difference. High correlation was found between fungal biomass and enzymes activities involved in C-cycling suggesting that fungi play a major role in the recycling of C and nutrients in the tropical soil.

Keywords: Ergosterol, fungal community, residue quality