

# EFFECT OF PHYSICOCHEMICAL CHARACTERISTICS OF AGRICULTURAL SOILS ON FUNGAL BIOMASS. IMPACT OF COPPER POLLUTION

M. Legras<sup>\*1</sup>, C. Bailleul<sup>1</sup>, D. Tessier<sup>2</sup>, J.C. Dur<sup>2</sup>, C. Gangneux<sup>1</sup>, S. Taïbi<sup>3</sup> & K. Laval<sup>1</sup>

<sup>1</sup> Laboratoire BioSol, Esitpa - Ecole d'Ingénieurs en Agriculture, 13 rue du Nord, 76000 Rouen, France

[mlegras@esitpa.org](mailto:mlegras@esitpa.org) ;

<sup>2</sup> Unité PESSAC, INRA Centre Versailles-Grignon, RD10, 78026 Versailles, France ;

<sup>3</sup> LAMSAD, Esitpa – Ecole d'Ingénieurs en Agriculture, 13 rue du Nord, 76000 Rouen, France

The agricultural management of soils has a great impact upon the functional process of soil microbial communities, particularly on fungal biomass. So, fungal biomass could be used as a biomarker to assess soil fertility and evaluate impact of environmental pollution.

This work consists in the determination of fungal biomass by several approaches: (1) genetic using real time PCR (18S rDNA) (2) chemicals, by extraction and quantification of total ergosterol, free ergosterol and specific PLFAs (C18:2 $\omega$ 6,9, C16:1 $\omega$ 5). Those results are compared to physicochemical characteristics of soils (microbial carbon, cation exchange capacity, carbon content, phosphorus, total nitrogen, pH, apparent density, moisture and granulometric data). Two experimental sites located in Normandy with contrasted agricultural practices (grassland, intensive management crop) have been chosen (i) to evaluate the consistence of the selected parameters (ii) to establish the relationships between physicochemical characteristics and fungal biomass. Four samplings (April, June, August, October) have been realised in order to observe seasonal impact on the measured parameters.

The results show significant rank correlations between total ergosterol (**Legras 2004**) and free ergosterol (**Gong 2001**), however free ergosterol is 30% of total ergosterol in intensive management and 50% in grassland. Both extraction methods give access to two types of fungal biomass (degraded or total biomass). The mean values of fungal biomass are higher in meadows than in crops and their spatial variations are less in crops than in meadows. As for the ergosterol contents, the mean values of the physico-chemical characteristics behave in the same way (higher contents in meadows, variations are less in crops)

Relationships between physicochemical characteristics and fungal biomass show that pH, carbon content and clay content are discriminant variables. But there is no direct correlation between the physicochemical characteristics of the soil and the fungal biomass (at the plot scale). Moreover, by taking into account all the data of the study, there is a good relation between the apparent density and the total ergosterol content ( $r=0,88$ ). A multiparametric modeling is necessary to reach a better understanding of the effect of the various variables.

Moreover, whatever the approach (18S rDNA, ergosterol, PLFA), very significant correlations were found (Legras 2006) indicating that molecular and chemical protocols are efficient to access fungal biomass (Linear correlation: Free ergosterol vs 18S rDNA: 0.72 - Non-Linear Correlation (Spearman test): Total ergosterol vs 18S rDNA: 0.69).

Experiments of inoculation of various copper concentrations in 90 soil core microcosms do not show any significant effect on the fungic biomass.

Legras M., Gangneux, Tessier D., Dur J-C., Bailleul C., Taïbi S. and Laval K., 11th International Symposium on Microbial Ecology, Vienna, 20-25 August 2006

Legras M., Bailleul C. and Akpa-vinceslas M., Eurosoil 2004, Freiburg, Germany, 4-12th September 2004

Gong P., Witter E., Applied Soil Ecology, 17 (2001) 285-289.