



**Miglioramento della qualità,
sicurezza e tracciabilità del
riso e valutazione della
tossicità dei suoli agricoli**

Topic 1: effects of AM fungi on plant growth and root development: a pioneer work

New Phytol. (1990), 114, 207–215

Morphogenetic modifications induced by the mycorrhizal fungus *Glomus* strain E₃ in the root system of *Allium porrum* L.

BY G. BERTA, A. FUSCONI, A. TROTTA AND S. SCANNERINI



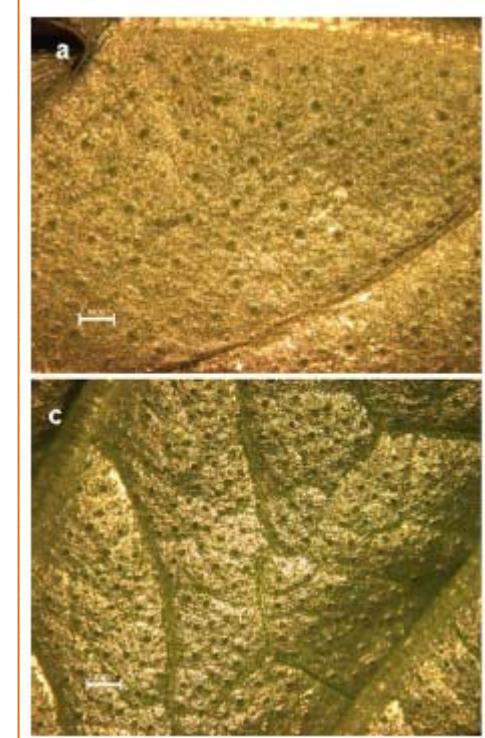
- Mycorrhizal plants showed more numerous and shorter adventitious roots than controls
- Mycorrhizal roots became progressively more branched than controls
- The apical meristems of mycorrhizal roots showed a lower mitotic index compared to controls

Effects of AM fungi on plant growth and essential oils production



- AMF improved the growth of the plants and affected root architecture
- AMF increased the content of essential oil (especially α -terpineol) and the number of peltate glandular trichomes (sites of essential oil synthesis) in the basal leaf zones.

Control

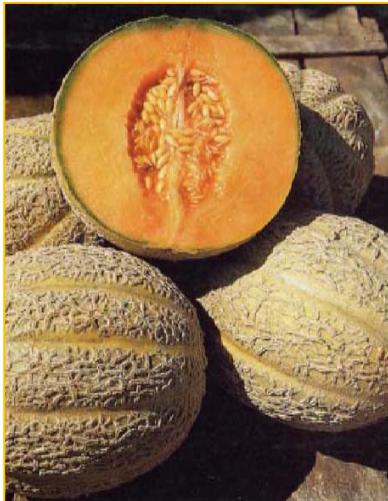


AMF

Copetta A, Lingua G, Berta G 2006 Effects of three AM fungi on growth, distribution of glandular hairs, and essential oil production in *Ocimum basilicum* L. var. Genovese. *MYCORRHIZA* 16:485-494

Effects of AMF on plant growth and fruit quality

In field experimentation years 2006, 2007

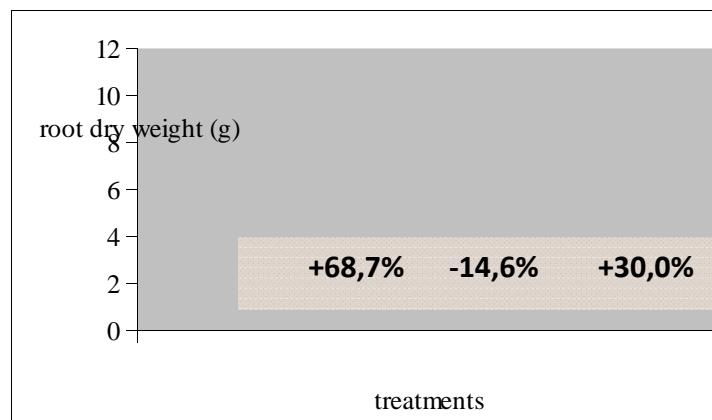
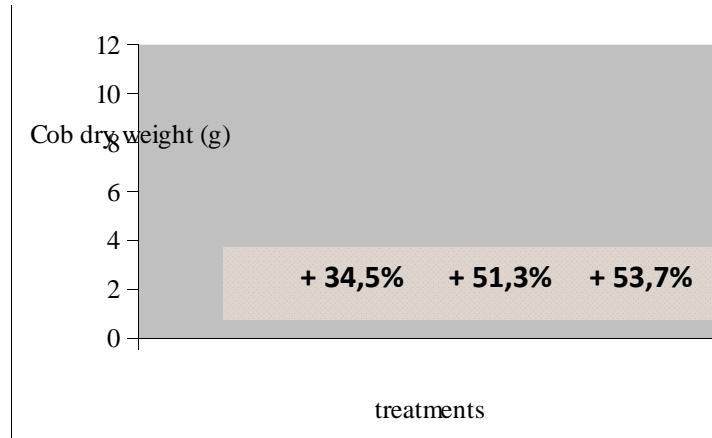
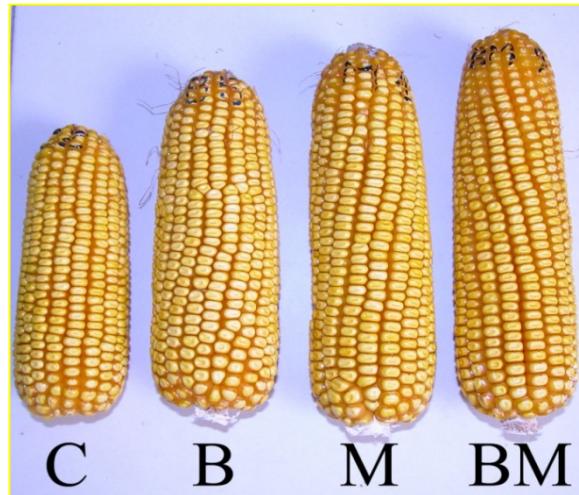


AMF

- Induced earlier flowering
- Affected melon plants in the first stage of transplanting
- Improved fruit quality increasing sugars and carotenoids of flesh, and thus consumer acceptance.

Effects of AMF+PGPB on plant growth, root development and yield

In cooperation with Mybasol s.r.l., spin off of the University of East Piedmont



In field experimentation year 2007



Effects of AMF on plants exposed to abiotic stresses: As and *Pteris vittata*

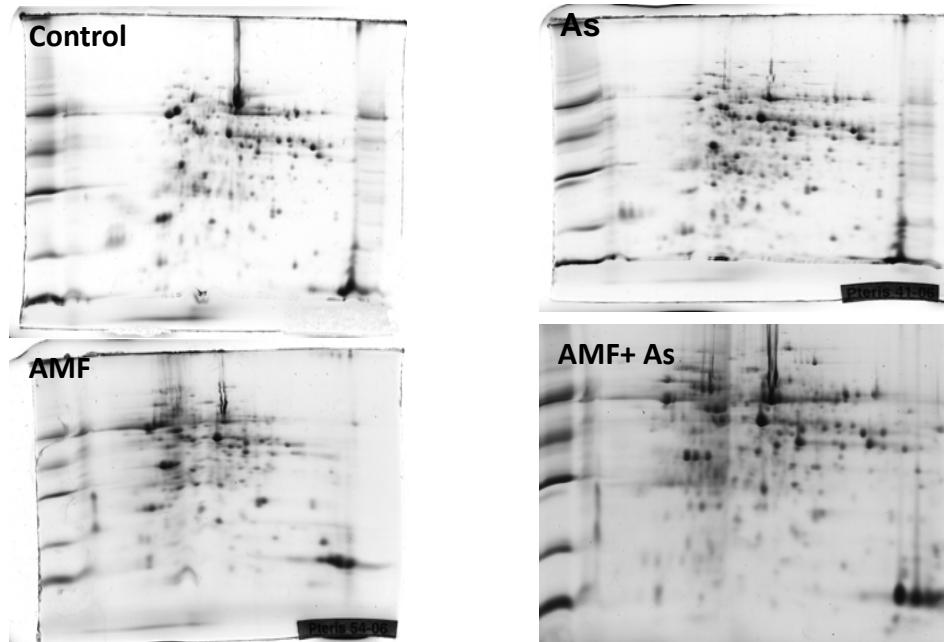


- As treatment increased As concentration in pinnae and roots.
- AMF increased pinnae dry weight and leaf area.

	Root dry weight (g)	Pinnae dry weight (g)	As translocation factor
Control	3,15 a	0,64 a	
As	2,55 b	0,48 b	50 a
AMF	3,35 ab	0,71 a	
AMF+As	3,92 a	0,80 a	730 b

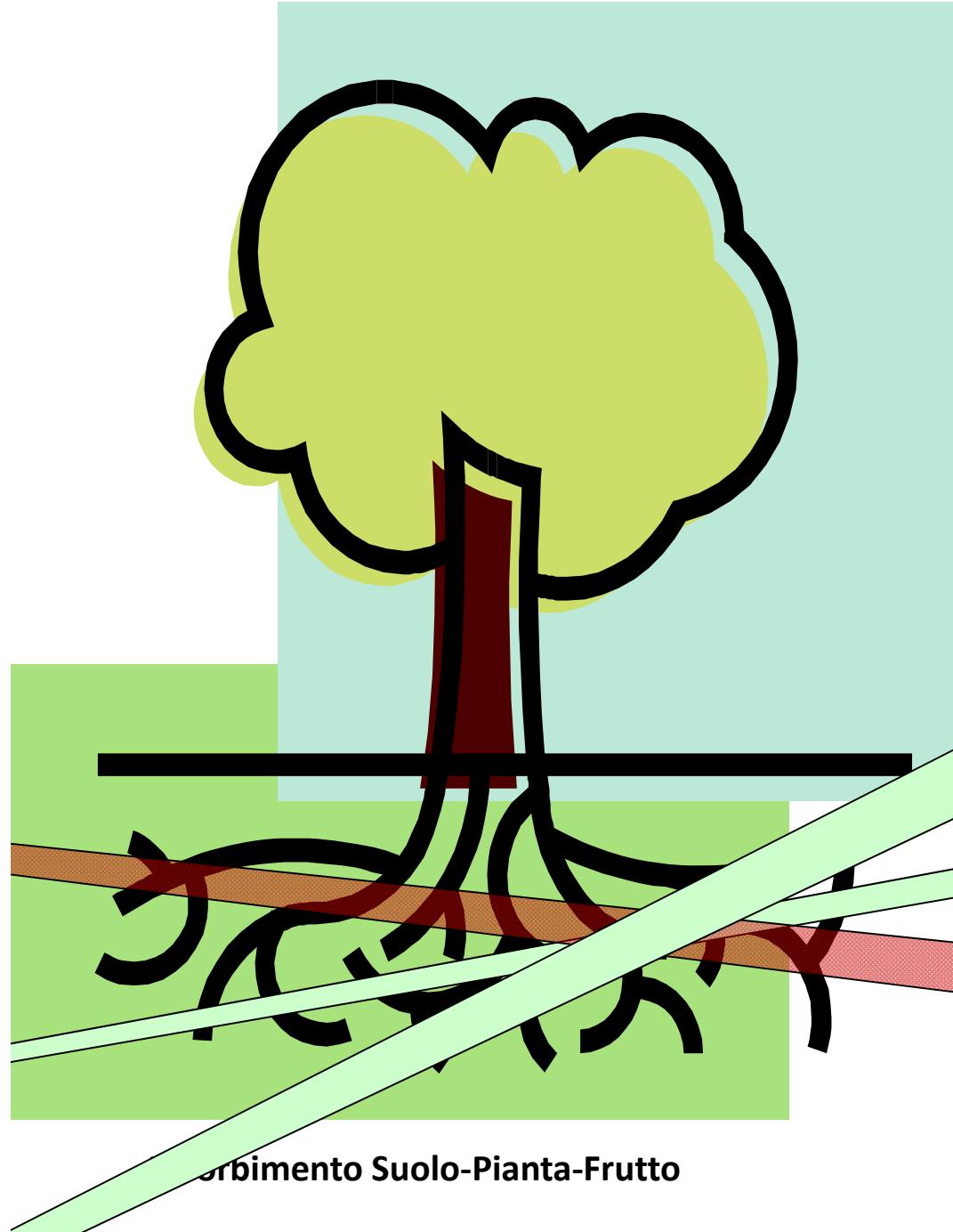
Effects of AMF on plants exposed to abiotic stresses: As and *Pteris vittata*

frond proteome of
P. vittata



- As induced the differential expression of 130 proteins with specific responses in AM plants.
- Up-regulation of multiple forms of glyceraldehyde-3-phosphate dehydrogenase, phosphoglycerate kinase, and enolase, in AM plants exposed to As suggests a central role for glycolytic enzymes in arsenic metabolism.
- A putative As transporter has been identified as an up-regulated protein by As treatment

fungi differentially modulate protein expression under arsenic contamination. Proteomics 2010 in press.

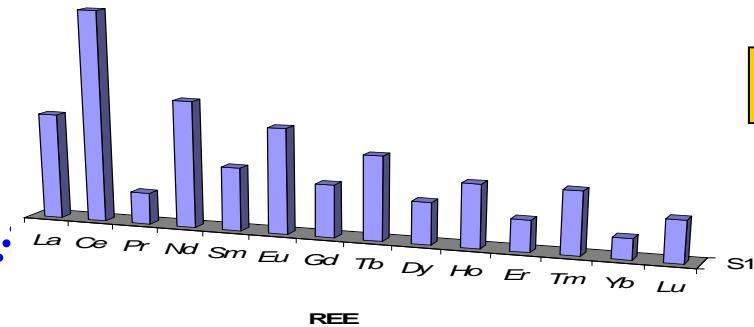
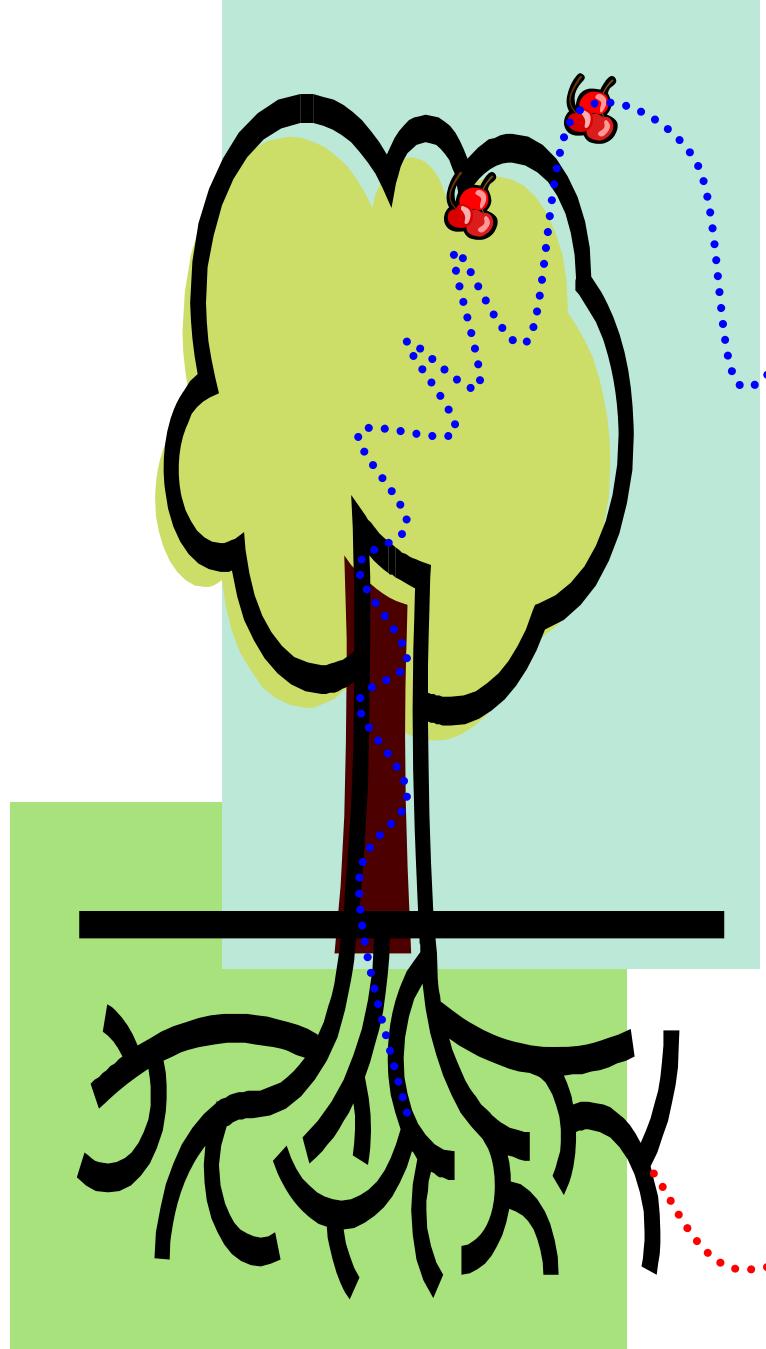


Attraverso le radici, le piante assorbono sia i nutrienti essenziali per il proprio metabolismo sia elementi non indispensabili o tossici

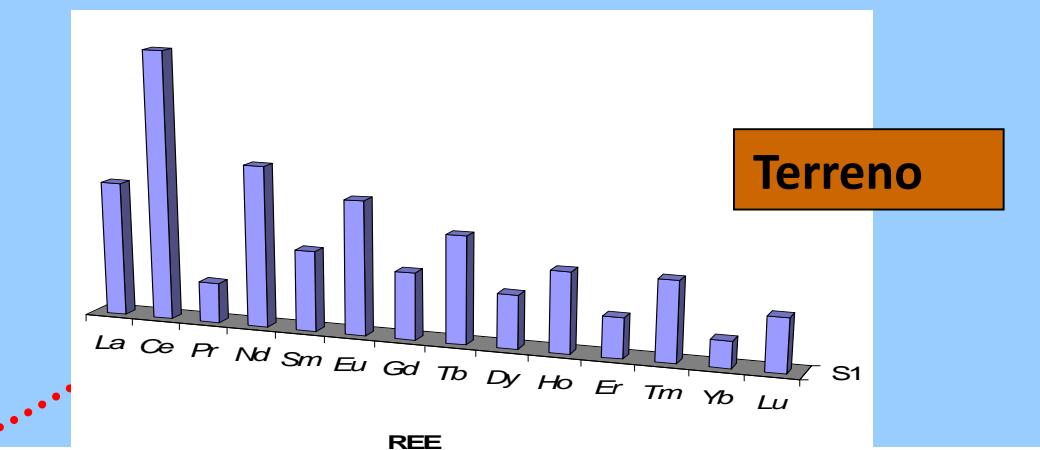
MACRONUTRIENTI:
K-N-S-Ca-Na-Mg..

MICRONUTRIENTI:
Fe-Cu-Zn-Se..

NON ESSENZIALI:
As-Ag-Au-Be-Cd-Cs-Pb.
TERRE RARE

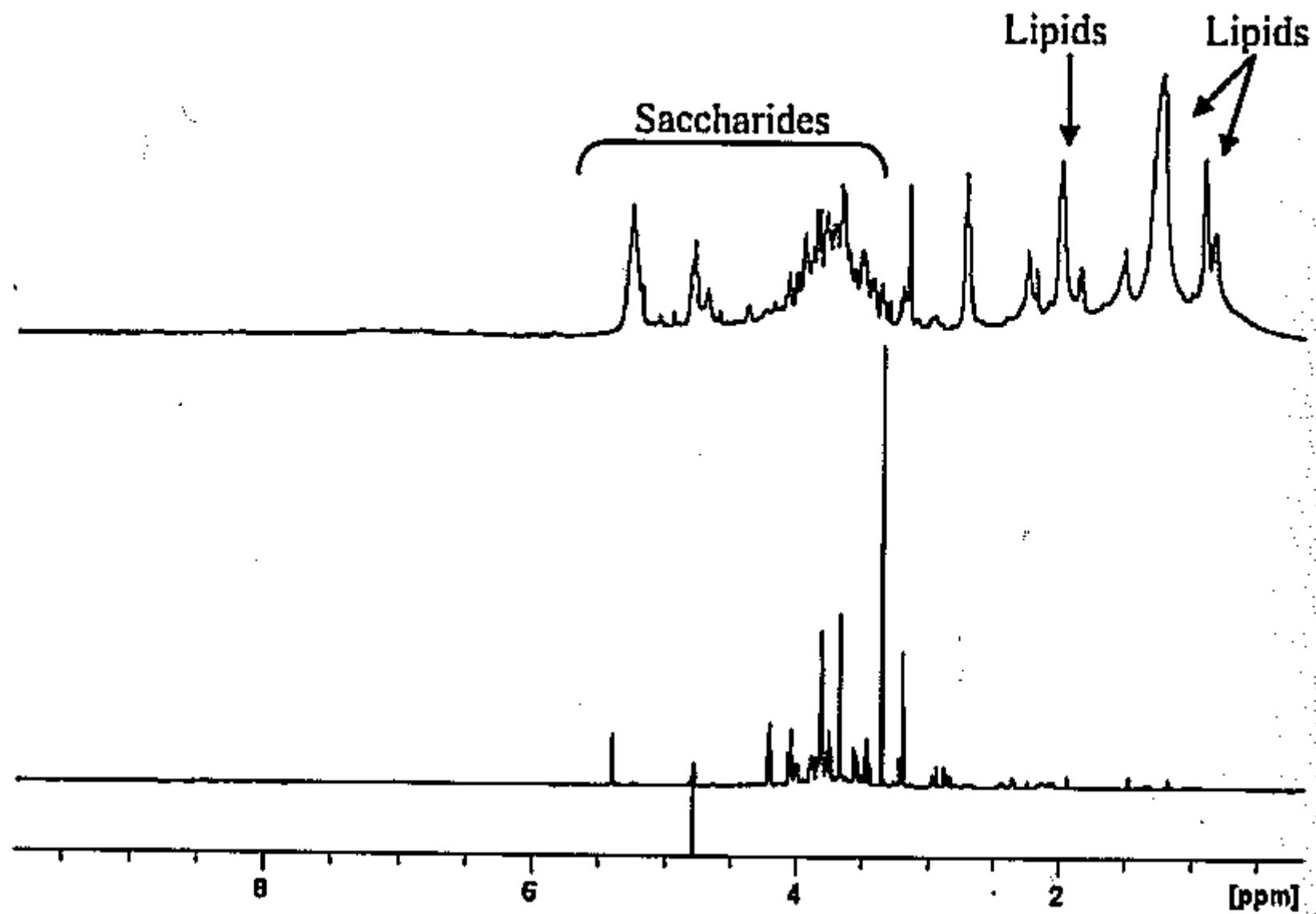


Attraverso le radici, le piante assorbono in blocco i Lantanidi dal terreno di sviluppo. Il processo non è selettivo pertanto la distribuzione del terreno è correlabile con la distribuzione dei frutti con un opportuno fattore di diluizione.



METABOLOMICA

Fumagalli et al, 2009, J. Agronomy & Crop Science, pp 77 – 88.



Eisenia andrei / Lumbricus rubellus

Biomarker a differenti
livelli di complessità
funzionale



Biomarker di stress
a livello cellulare

- attività della Ca²⁺-ATPasi
- stabilità delle membrane lisosomiali
- contenuto lisosomiale di lipofuscine
- contenuto lisosomiale di lipidi neutri

Biomarker di danno
tissutale

- rapporto lisosomi/citoplasma

Livello di organismo

- mortalità e tasso di riproduzione

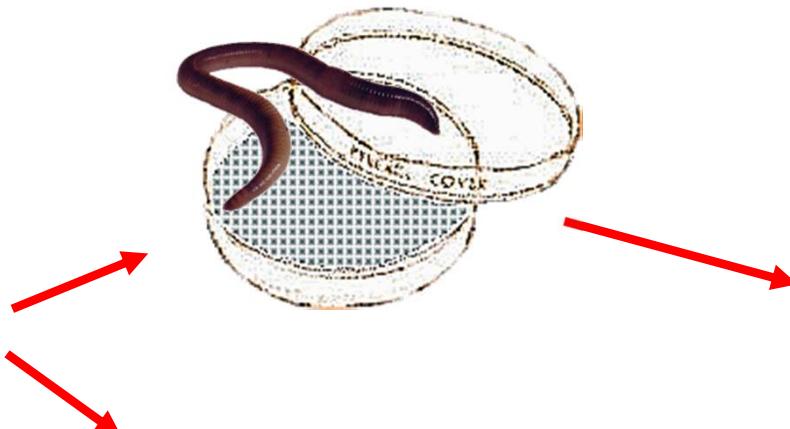
Biomarker di
genotossicità

- danno al DNA damage (Comet assay) e frequenza dei micronuclei

Biomarker di
esposizione

- contenuto di metallotioneine (esposizione a metalli pesanti quali Cd, Hg, Zn and Cu)
- Inibizione dell'attività AchE (esposizione a pesticidi)

Filter paper test & Artificial soil test



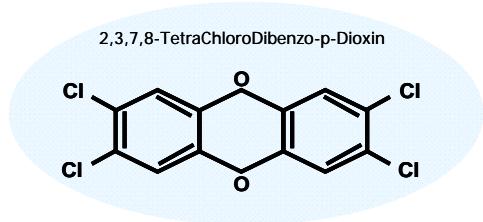
camera climatica



10% torba di sfagno
20% argilla caolinitica
70% sabbia di quarzo

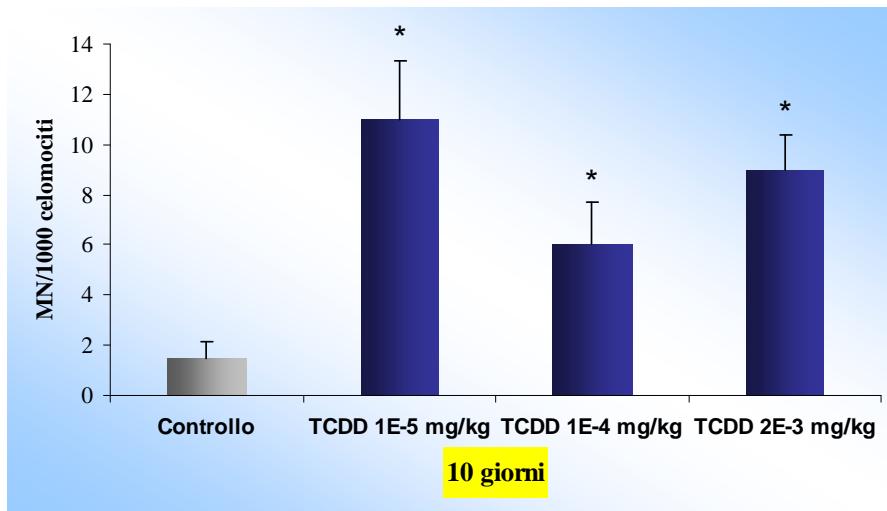
Test con suoli di campo



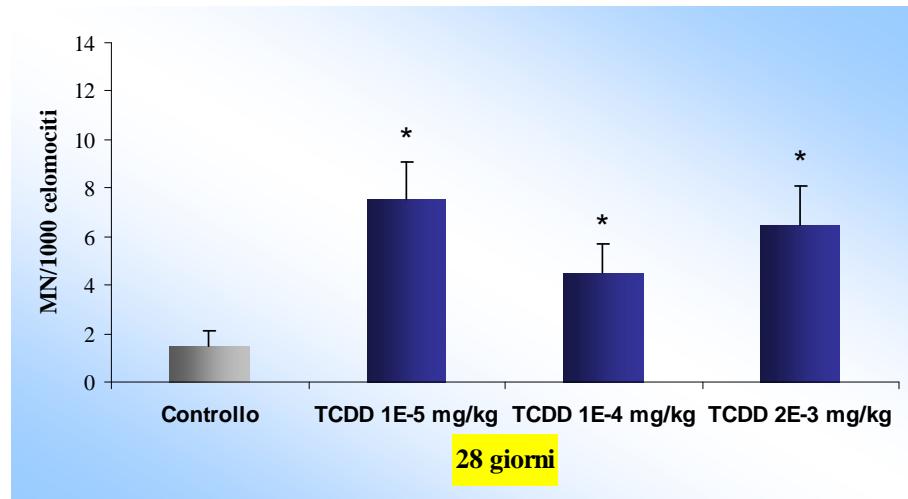


TCDD 1×10^{-5} - 1×10^{-4} - 2×10^{-3}
mg/kg

10/28 giorni



10 giorni

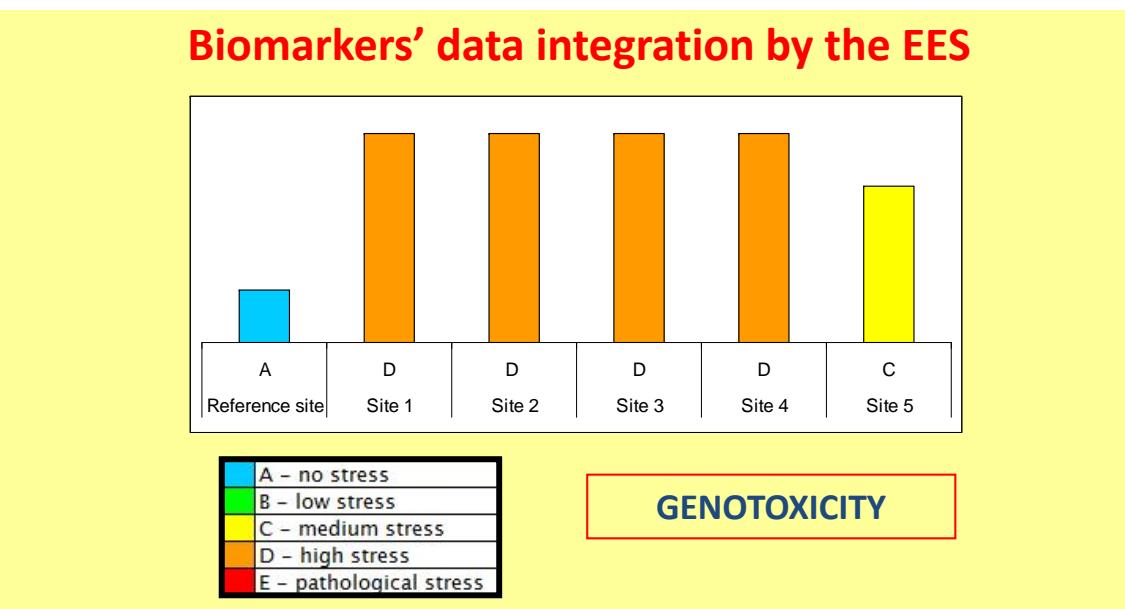
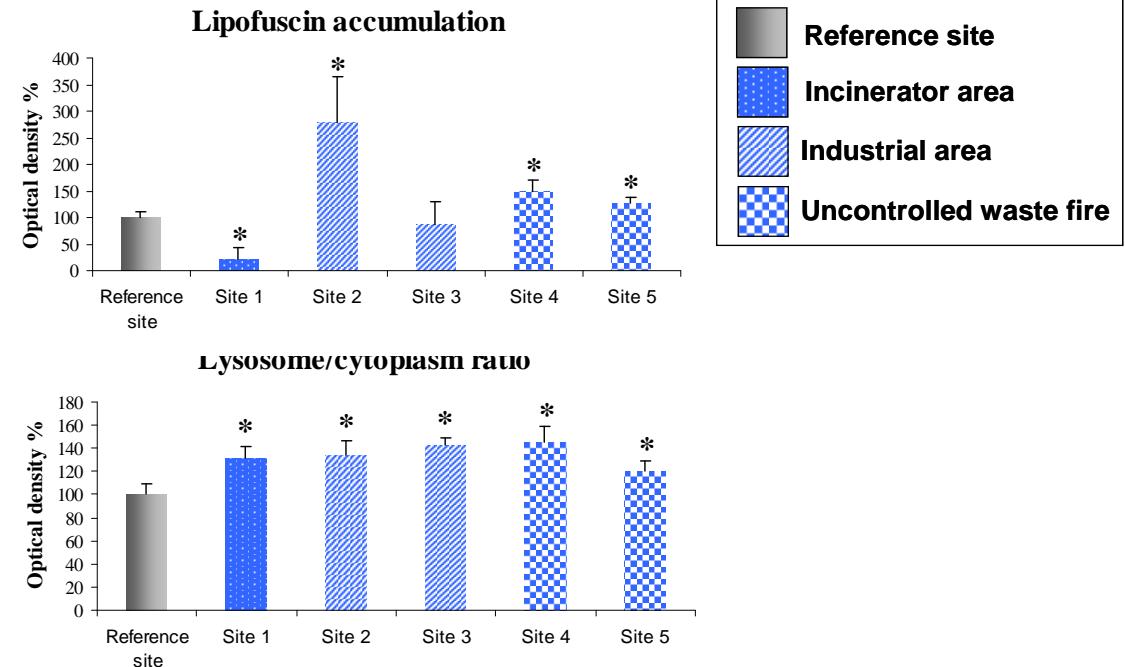
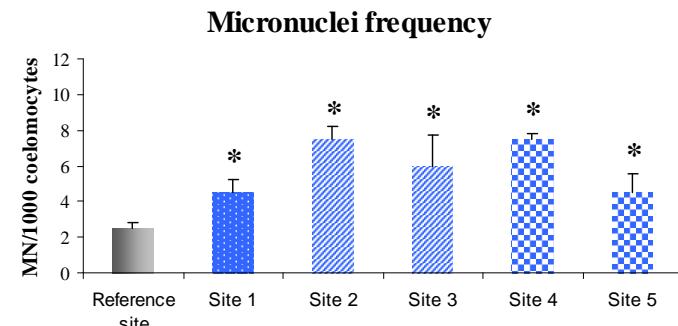
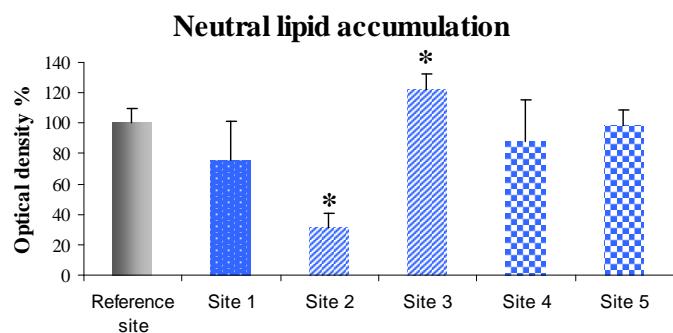
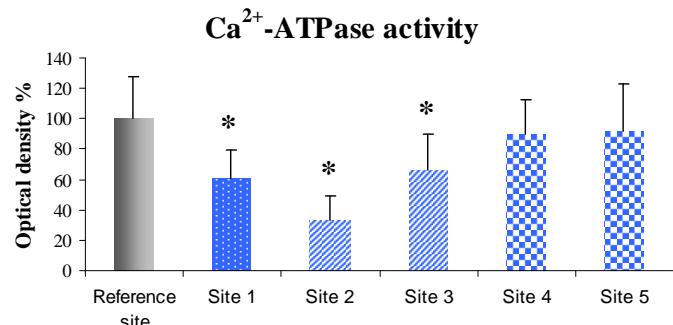


28 giorni



Standardized criteria for scoring micronuclei

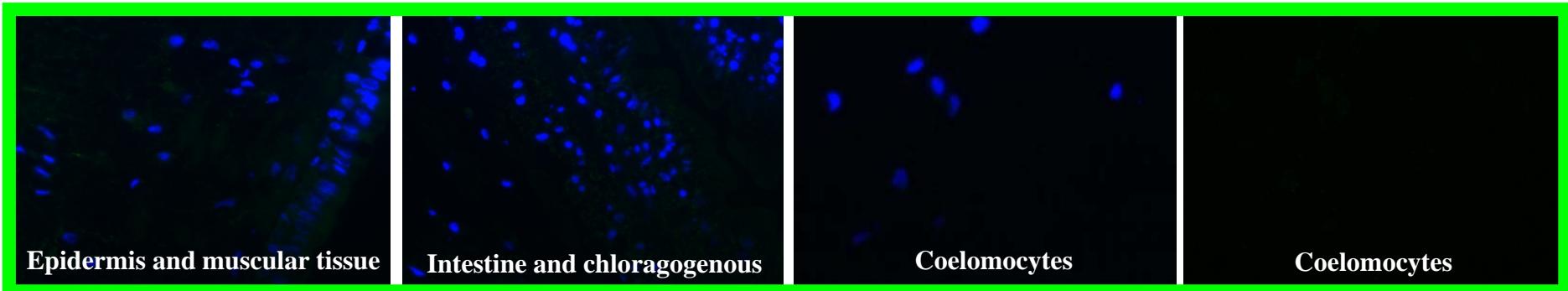
Campania



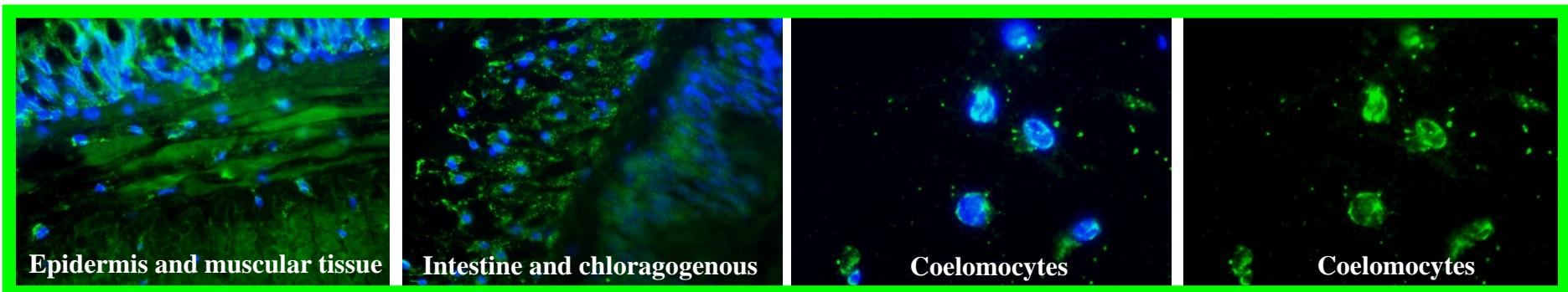
Campania

blue: DNA-specific fluorescent dye DAPI
green: anti-PAHs antibody
red: anti-PCBs antibody

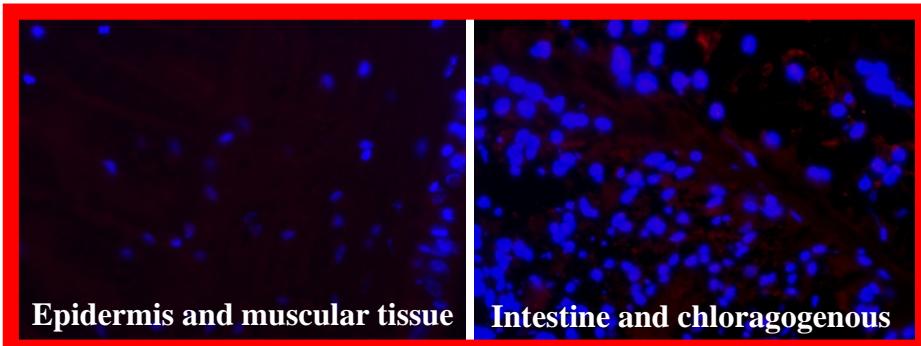
Control – reference site



Site 5: uncontrolled waste fire



Control – reference site



Site 3: industrial area

