Endophyte Fungi as Indicators of Soil Health in Continuous Cropping Systems. Case Study Peach Tree and Horticultural Crops

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❑ Europe´s fruit trees are concentrated in Spain, Italy, France, Portugal and Greece accounting for 93% of the Community's fruit growing areas. Spain and Italy are the most important producers of stone fruits, however a reduction of total surface of peach has been observed since 1996 in Italy.

❑ Intensive cultivations (orchards, vineyards, vegetables, cereals crops) which dominate agriculture in the Mediterranean area are often affected by problems linked to desertification (SOM decline)

❑ Soil microbial diversity is broadly related to land use and it represents one of the main components of soil quality in agricultural soils. Indeed, it is the main factor involved in soil suppressiveness of soil-borne pathogens, agents of decline in vegetable crop yields in intensive systems as well as replant problems in orchards .

❑ Biotic and abiotic components of replant problems are the technical reasons of that.

❑ Soil borne pathogens represent the main biotic component of replant problems; therefore a study was carried out in an intensively cultivated area of southern Italy

❑ The role of soil-borne pathogens in fruit tree 'replant disease' has been clearly explained following studies carried out in the 80's with soil fumigants. Those studies clarified the important role of biotic components and the primary role of the complex of soil-borne fungi such *Cylindrocarpon* sp., *Pythium* sp. *Rhizoctonia* sp. and *Phytophthora cactorum*.

The objective was to investigate on the possibility of planting new peach orchards on soils cultivated with horticultural crops, to avoid either fumigation or a fallow period.

Methods

❑ **Environment**: The study was performed in an agricultural area (Eboli) of the Salerno province in Campania (Lat 40° 36' N, Long 15° 4' E) an plots chosen for homogenity of pedoclimate conditions

❑ **Cropping systems**: i) five peach orchards (replanted orchards, sod system) .
ii) five fields intensively cultivated with vegetables. (2- cycles per year)

❑ **Indicators** endophytic soil fungal communities on vitroplants of rootstock GF677 grown on soil samples under controlled conditions in greenhouse bioassay (fig.1)

❑ **Pathogenicity** test of soil borne pathogen by growth of GF677 on artificially inoculated soil. (fig.2)

❑ **Data analysis:** *Diversity*. Pooled data of fungal communities from peach orchards and vegetable plots were compared using PAST, a software for analysis in ecology.
Similarity of fungal communities was analyzed by cluster analysis using with the Bray Curtis distance and computed on 1000 bootstrappings permutations.

Fig.1 Greenhouse biossay

Fig.2 Pathogenicity test of *Cylindrocarpon* Isolates on on young rootstock plants

Conclusions

❑ The deep difference between the diversity and community compositions in the two cropping systems and the high similarity observed within the five sites with the same crop, showed that intensive cropping system strongly affected fungal communities

❑ The results of this study suggest that peach rootstock can be attacked by the typical soil borne pathogens of horticultural crops.

❑ Replanted peach orchards in this study did not seem affected by biotic components of replant.

❑ In case of replant of new fruit tree orchards in intensively cultivated areas with continuous crops, greenhouse bioassay with target crop and evaluation of root endophyte fungal communities may help in deciding the best soil use.

Results

❑ Diversity in the two cropping systems differed significantly (tab.1)

❑ Cluster analysis applied to data of endophytic fungal communities divided the ten sites in two homogeneous groups corresponding to the two cropping systems

❑ GF677 plants showed a growth reduction significantly higher on horticultural soils than on peach soil.

❑ No species known as agent of replant problems were isolated from the samples grown on peach replant soil, On the contrary *Cylindrocarpon sp.*, Thielaviopsis sp. and some root pathogens were isolated from rootstock grown on soils coming from plots of vegetable.

❑ The *Cylindrocarpon* sp.and T*hielaviopsis* sp.isolates showed significant difference in pathogrnicity and they gave the same symptoms. (internode reduction) (fig.3) and (fig.5)

Fig.3 Symptoms **of internode reduction** observed on young rootstock plants grown on soill artificially inoculated with *Cylindrocarpon* and *Thielaviopsis* isolates.

Fig.4 Variability of growth reduction in young plants of GF677 rootstock grown on soil artificially infected with *Cylindrocarpon destruictans*

Diversity indices	Peach orchard	Horticultural crop	Sign.
Taxa (S)	21	13	**
Shannon H	2,42	1,97	**
Simpson	0,87	0,82	**
Menhinick	0,76	0,53	**
Margalef	3,01	1,87	**
Equitability J	0,79	0,77	n.s.
Fisher alpha	3,99	2,34	**
BergerParker (1/d)	5,28	3,73	**

Tab.1 The comparison was performed with two different randomisation procedures: Bootstrapping and Permutation. A small probability value p indicates a significant difference in diversity index between the two samples

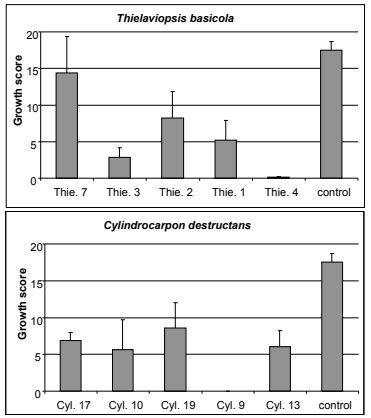

Fig 5. Pathogenicity test of five isolates of *Cylindrocarpon* and five of *Thielaviopsis*. Growth score of micropropagated plants of rootstock GF677 grown on inoculated soil compared to control.

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