Arbuscular mycorrhizal fungi

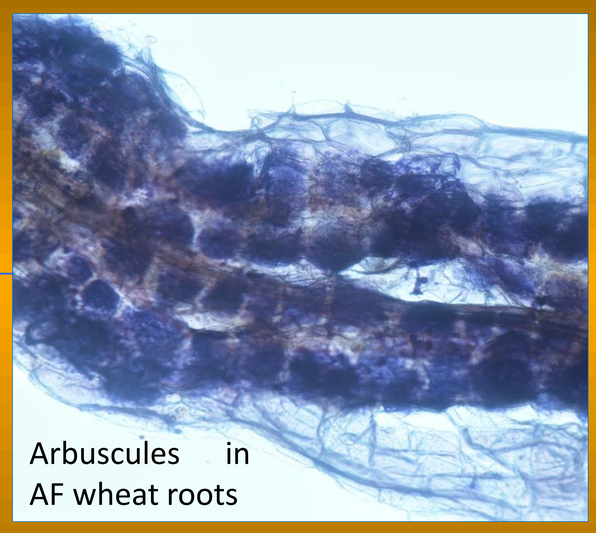
Impact of olive trees on the soil beneficial interaction between durum wheat roots and arbuscular mycorrhizal fungi

Anna Panozzo [1], Hsin-Ya Huang [2], Robin Duponnois [3], Yves Prin [3], Dominique Desclaux [2]

[1] Department of DAFNAE, University of Padova, Legnaro (Padova), Italy

[2] INRA - DiaScope unit, Mauguio, Domanine de Melgueil, France

[3] LSTM, UMR 113 CIRAD, IRD, University of Montpellier II, Montpellier, France



Arbuscules in AF wheat roots

Interactions between tree and crop root systems are poorly understood in agroforestry systems, but they are crucial for the success of co-existing crops. Agroforestry is often described as an important practice that should be promoted for maintaining the mycorrhizal inoculum potential in farming systems, in order to increase nutrient uptake and sustain crop productivity. **The aim of the study was to investigate the AMF colonization of durum wheat roots grown in an olive grove in South of France**

Materials and Methods

- The experiment was conducted in South of France at INRA DiaScope experimental unit. Durum wheat was sown in 3 conditions (10 m² plot): AF: yearly pruned olive orchard, AF+: never pruned olive orchard (both 6x6 m planting design, C: open field without trees
- Wheat-legume crops annual rotation (chickpea, fababean, forage mix): nitrogen supply was only driven by legumes crops incorporated into the soil. No treatments have been done during the four-year period of the study (from 2014 till 2017), neither protection neither fertilization products;
- Organic regulation

Mycorrhizal analysis performed on 6 durum wheat cultivars. For each treatment and cv, 3 replicates of 90 root fragments were analyzed at the LSTM lab.

Durum wheat yield. At the end of June, after mechanical harvesting, grain yield and grain protein were determined for each genotype/treatment.

Results

All the root fragments coming from AFs treatments were colonized and 96.4% for C. The intensity of AMF colonization, which expresses the % of the root fragment length being colonized, was significantly higher in AFs treatments (+51% compared to C), as the arbuscular abundance in the root systems (+74% compared to C) (Table 1).

Table 1: frequency =% of colonized fragments
intensity =% of fragment length colonized
arbuscular abundance =% of fragment length with arbuscular presence.

	Frequency %	Intensity %	Arbuscular abundance %
C	96.4 b	43.7 b	17.2 b
AF	100 .0 a	66.0 a	30.0 a
AF+	99.8 a	61.7 a	28.6 a

Arbuscules in AF+ wheat roots

A **wide variability was observed among genotypes** within the same treatment. The intensity of AMF colonization ranged from 11% up to 57% in C, and from 55% to 74% in AF. The genotype showing the highest intensity of AMF colonization and arbuscular abundance in AF treatment had the lowest values in C treatment.

Table 2. Yield and grain protein content of the 6 wheat varieties tested. Means with different letters are significantly different (P ≤ 0.05).

	Yield (tons/ha)	Grain protein (%DM)
C	1.8 a	10.3 c
AF	1.0 b (- 44% vs C)	12.1 b (+ 17% vs C)
AF+	0.3 c (- 83% vs C)	13.5 a (+ 31% vs C)

Wheat yield was reduced within agroforestry treatments, with greater severity according to the shade level (Table 2).

Conclusions

- AMF colonization intensity and abundance of arbuscules were significantly enhanced in durum wheat roots within the olive orchard
- Olive trees seem to play the role of permanent reservoir of AM fungal diversity, available to associated cereals or crops.
- To further our understanding of AM fungal dynamics in tree-based intercropping systems, future studies should focus on relating mycorrhizal diversity in the agroforestry systems to performance and yields of field crops

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