Fine root density, branching pattern and mycorrhizal diversity across Pinus pinaster stands in south west France: methodology and first results

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Objectives

The *Pinus pinaster* forest in South-west France produces the fifth of French wood. It covers 0.9 million hectares over sandy spodosols and is characterised by a large variation in productivity. As a contribution for understanding these variations we carried out a project aiming at linking them to both hydrological and nutritional soil status.

Methods

25 experimental plots were selected in order to cover a range of forest productivity, fertilisation and water availability levels. Site productivity was estimated from a standard forest inventory carried out in 2005. In April 2006, 8 pairs of sample points (soil cores 15 cm deep and 8 cm diameter) were chosen on the tree line and between the tree lines close to random selected trees. Figure 1 gives the procedure applied to core soils and the experimental data obtained. Statistical analysis of data was carried out to compare plots without any P application (control) or with P application once at the plantation (standard), or repeated P (P) or N (N) application; in addition, P or N plots received irrigation or not (irrigated or not irr).

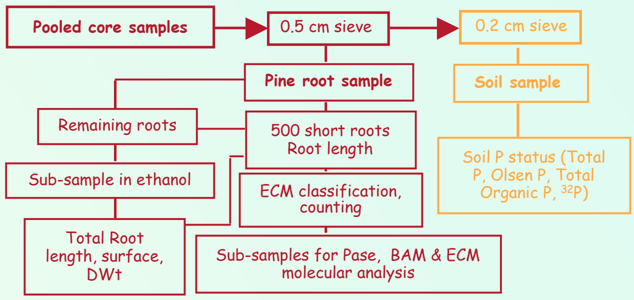

Figure 1. Simplified scheme of sampling and analysis

Results

Root parameters: Fine root length density (FRLD) and specific root length (SRL) were affected by fertilisation, especially by repeated fertilisation, and not by irrigation (Fig. 2).

Root branching, estimated by the total number of short roots (SR), ranged from 37 to 45 SR/m root and was little affected by fertilisation or irrigation (not shown).

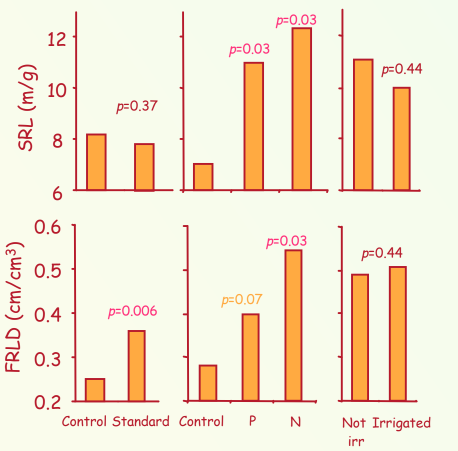

Figure 2. Effect of human practices on root growth of *P. pinaster* in spodosol. Mean differences are tested against control or not irrigated treatment using Student-t-test.

Ectomycorrhizal diversity: Number of ECM types ranged from 2 to 13 among the sites and examples of ECM are given in figure 3. However, mean ECM types per treatment ranged from 4 to 8 and was not significantly affected by fertilisation, irrigation or water availability .

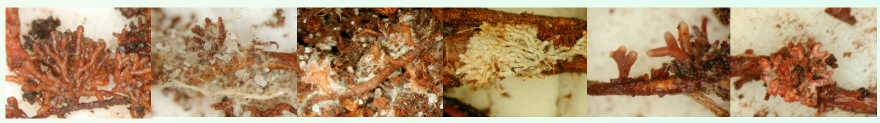

Figure 3. Examples of ECM sampled on *P. pinaster* roots.

Soil P status and ECM Pase activity: As expected, mineral P availability estimated using Olsen P was increased in soil receiving regular N and P fertilisation (not shown). Interestingly, total content of organic P was clearly increased by the P fertilisation supplied regularly (P) and by irrigation (Fig. 4). ECM Pase activity was highly variable but a significant difference was only found between irrigated plots and non irrigated plots (Fig. 4), suggesting that the regulation of this activity may depend on numerous soil factors.

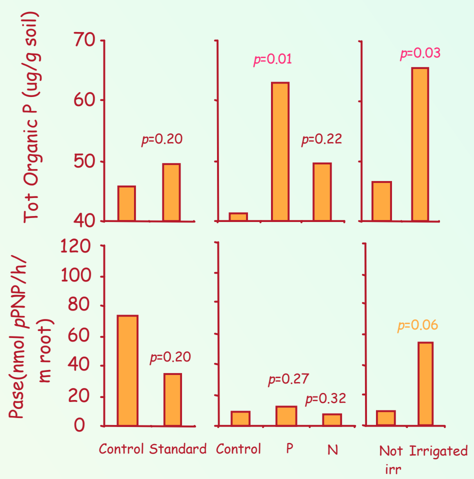

Figure 4. Effect of human practices on soil Organic P status and Pase activity of ECM from *P. pinaster*.
Mean differences are tested against control or not irrigated treatment using Student-t-test.

Conclusions and perspectives

To our knowledge, our methodology to address the question of productivity determinism of *Pinus pinaster* stands has not been used before. The first results show that there are differences between experimental plots affecting root growth and ECM activities. This first set of data will be completed by a second campaign in November 2006, the whole data should enable us to carry out a statistical analysis between stand productivity and all the studied variables. In addition, this project should provide information about the actual role of ECM and their associated bacterial populations on organic P mobilisation.

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