Spatial soil fertility gradient in a mature agroforestry system under a Mediterranean climate

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- Agroforestry systems are known to limit soil degradation, deeply store carbon and have positive impact on different indicators of soil quality.
- What is the functional impact of tree-crop associations on soil microbial functions involved in carbon, nitrogen and phosphorus recycling? Is there a spatial and temporal gradient of the soil fertility, linked to microbial activity, in this kind of system?
- Our aim is to monitor in time and space, perpendicularly to the tree line of a Mediterranean agroforestry system, the occurrence of chemical and biological fertility gradients.

**Experimental design**
- Restièrèles experimental site, 15 km north of Montpellier, France. Association of 21 year-old walnut trees (Juglans regia x nigra) and wheat/barley/pea crop rotation.
- 5 replicates of agroforestry spot: a 13-m transect, 6.5m on each side of the tree (North and South) divided in 4 sampling intervals of the topsoil (0-15cm): zone 1: 0-1m, zone 2: 1-2m, zone 3: 2-4m, zone 4: 4-6.5m
- 5 replicates of monocrop control

**Soil respiration**
- Basal respiration (water) and substrate-induced respiration (glucose, trehalose and alanine) measured using the MicroResp™ system (Campbell et al. 2003)
- Microbial respiration due to fungi assessed by the FungResp method (Sassi et al. 2012), using antibiotic (bronzopel and streptomycine).

**Figure 1:** Photograph of the Crown Red gel detector CO2 trap microplate after incubation with soil and substrate

**Figure 2:** Carbon mineralisation after 6h of incubation with soil and water or carbon and nitrogen substrate (glucose, trehalose, alanine), with antibiotic (red) or without (blue). Error bars indicate standard error, letters indicate significant difference of CO2 degradation between different intervals, n = 20 for each bar.

- Our data show a significant difference of microbial activity along the spatial gradient, with stronger substrate-induced respiration occurring close to the tree line and decreasing values with increasing distance to it.
- Microbial communities seem to degrade more easily carbon substrate than nitrogen substrate.
- Ratio substrate / substrate + antibiotic doesn’t seem to change depending on the distance to the tree line.

References: