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

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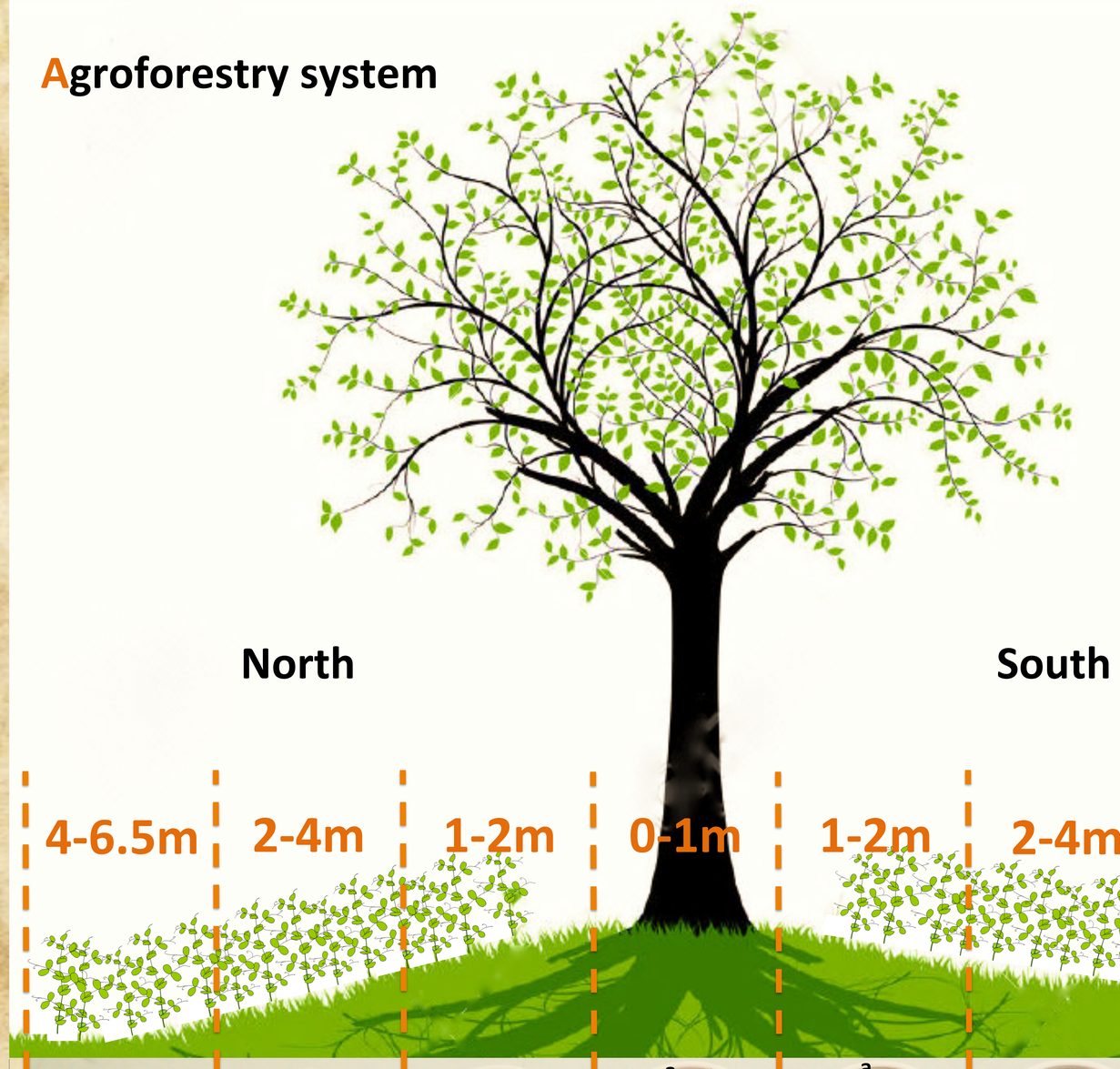
- **A**groforestry systems are known to limit soil degradation, deeply store carbon and have positive impact on different indicators of soil quality.
- **W**hat is the functionnal impact of tree-crop associations on soil microbial functions involved in carbon, nitrogen and phosphorus recycling? Is there a spatial and temporal gradient of the soil fertility, linked to microbial activity, in this kind of system?
- **O**ur 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.

Agroforestry system



Experimental design

- Restinclières 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 FungiResp method (Sassi et al. 2012), using antibiotic (bronopol and streptomycine).

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

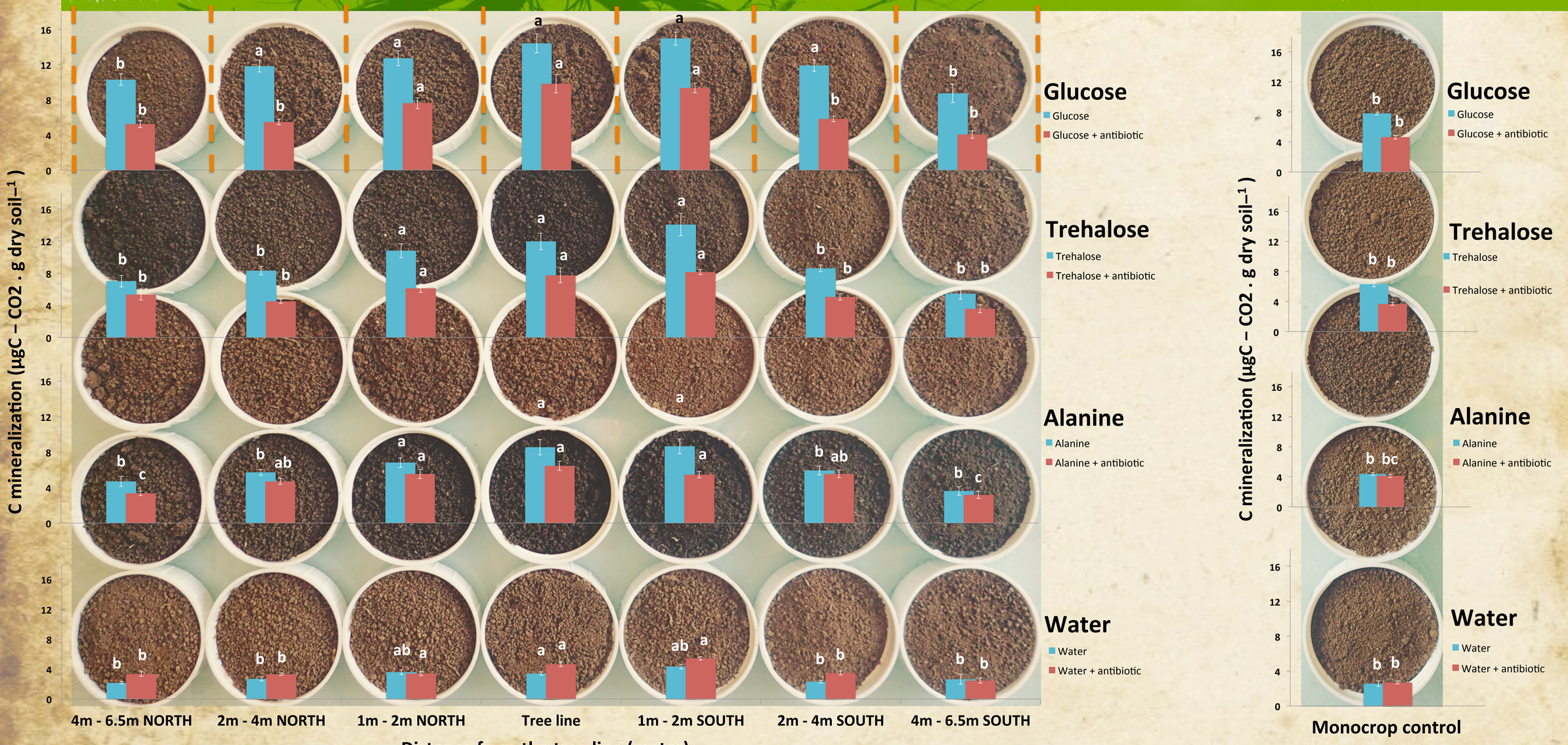


Figure 2 : Carbon mineralization after 6h of incubation with soil and water or carbon and nitrogen substrate (glucose, trehalose, alanine), with antibiotic (red) or without (blue). Error bars indicate standard error, letters indicate significant difference of CO2 degradation between different intervals,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

- **O**ur 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.
- **M**icrobial communities seems to degrade more easily carbon substrate than nitrogen substrate.
- **R**atio substrate / substrate + antibiotic doesn't seem to change depending on the distance to the tree line.

References :
- Campbell CD *et al*. (2003) A rapid microtiter plate method to measure carbon dioxide evolved from carbon substrate amendments so as to determine the physiological profiles of soil microbial communities by using whole soil. Appl Environ Microbiol 69:3593–3599
- Sassi MB *et al.* (2012) The FungiResp method: An application of the MicroRespTM method to assess fungi in microbial communities as soil biological indicators. Ecological Indicators 23 (2012) 482–490