Brassica spp cover crop affects soil microbial activity, carbon and nitrogen nutrient dynamics

WP 5 – Soil Ecological Impact

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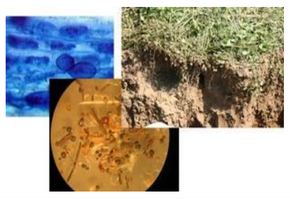


Aim

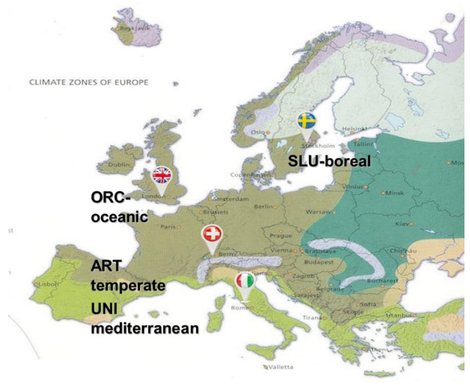
Assessment of Brassica spp. cover crop effect on soil microbial activity, C and N dynamics in three European climatic zones

Brassica may prevent erosion, suppress weeds and soilborne pests, alleviate soil compaction and scavenge nutrients. Brassica are known for their rapid fall growth, great biomass production and nutrient scavenging ability.

Materials and Methods

The experimental field MEE1 of three European countries (ART, SLU, ORC) have four replications for two tillage levels. Changes of biochemical properties of soil after Brassica spp. suppression (t1) and at the following main crop harvesting (t2) were assessed as percentage of variation with respect to control soil. All biochemical assays were made on soil left to equilibrate at room temperature with moisture at 60% of water holding capacity.

Figure 1: Location of MEE1 and climatic zones



Soil microbial biomass and enzyme activities

Soil biochemical properties: soil microbial biomass carbon was determined according to the methods of fumigation-extraction (Vance et al. 1987). Soil enzyme activities involved in C,N,S,P cycles were determined using microplate-fluorogenic assay (Marx et al. 2001; Vepsäläinen et al. 2001). Soil microbial biomass (Cmic) and synthetic enzyme index (SEI) were expressed as following:

(1)Cmic= microbial biomass carbon

I. mg Cmic g^{-1} of soil;
II. Percentage of Cmic: with respect to total organic C

(2)SEI= sum of all soil enzyme activitie

I. nmol MUF g^{-1} soil h
II. nmol MUF mg Corg h^{-1}

Results and discussion

Figure 2: Effect of Brassica spp on soil extractable carbon expressed on total organic carbon base at t1 - t2

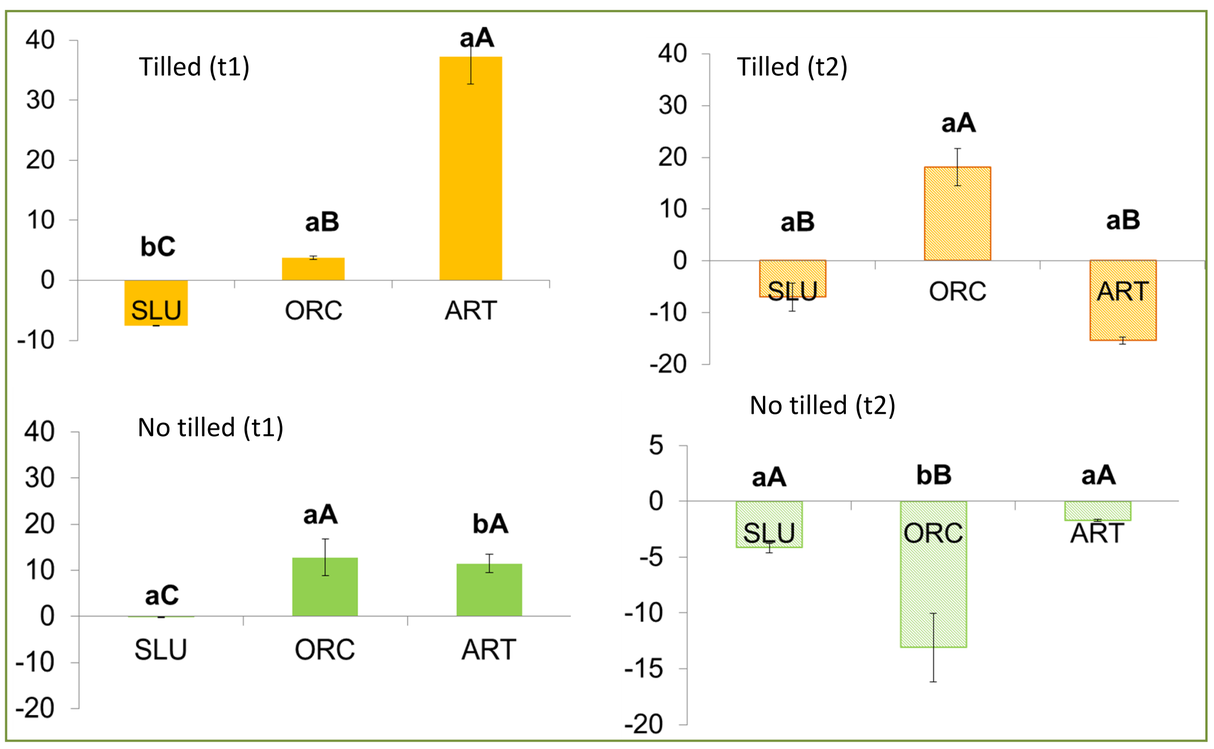


Figure 4: Effect of Brassica spp on soil microbial biomass carbon expressed as percentage with respect to organic carbon at t1 - t2

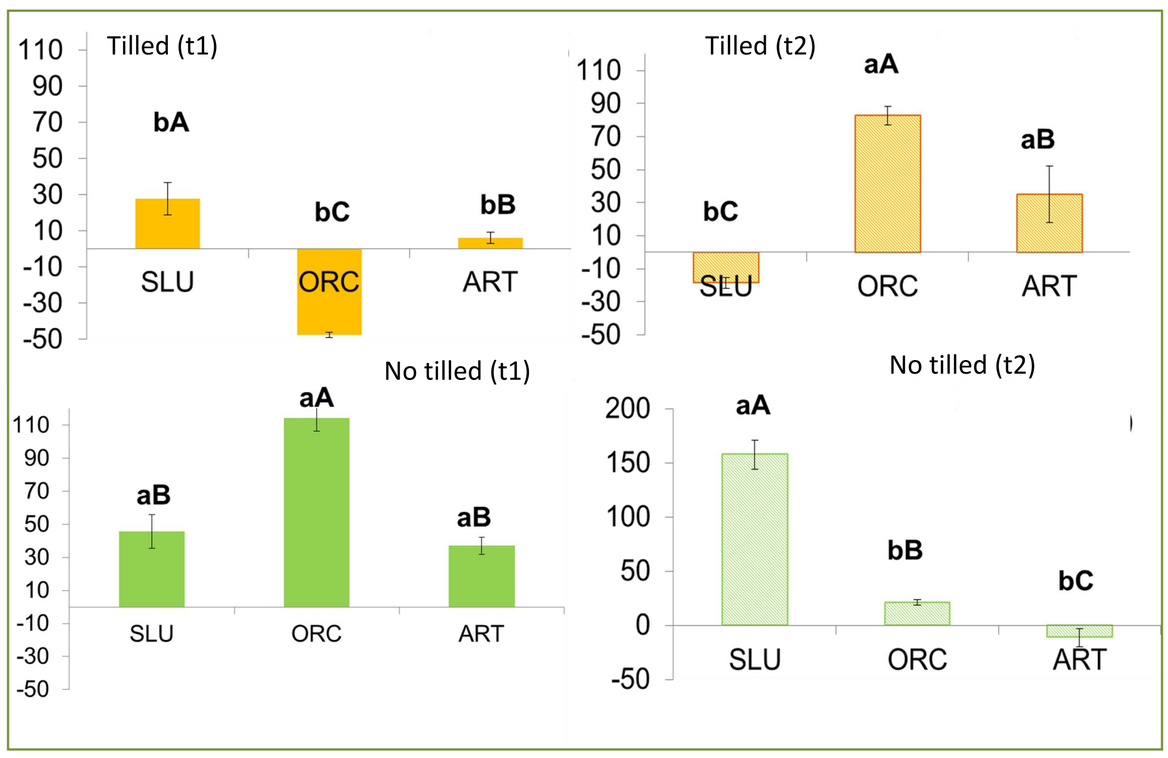


Figure 3: Effect of Brassica spp on soil extractable nitrogen expressed on total nitrogen base at t1 - t2

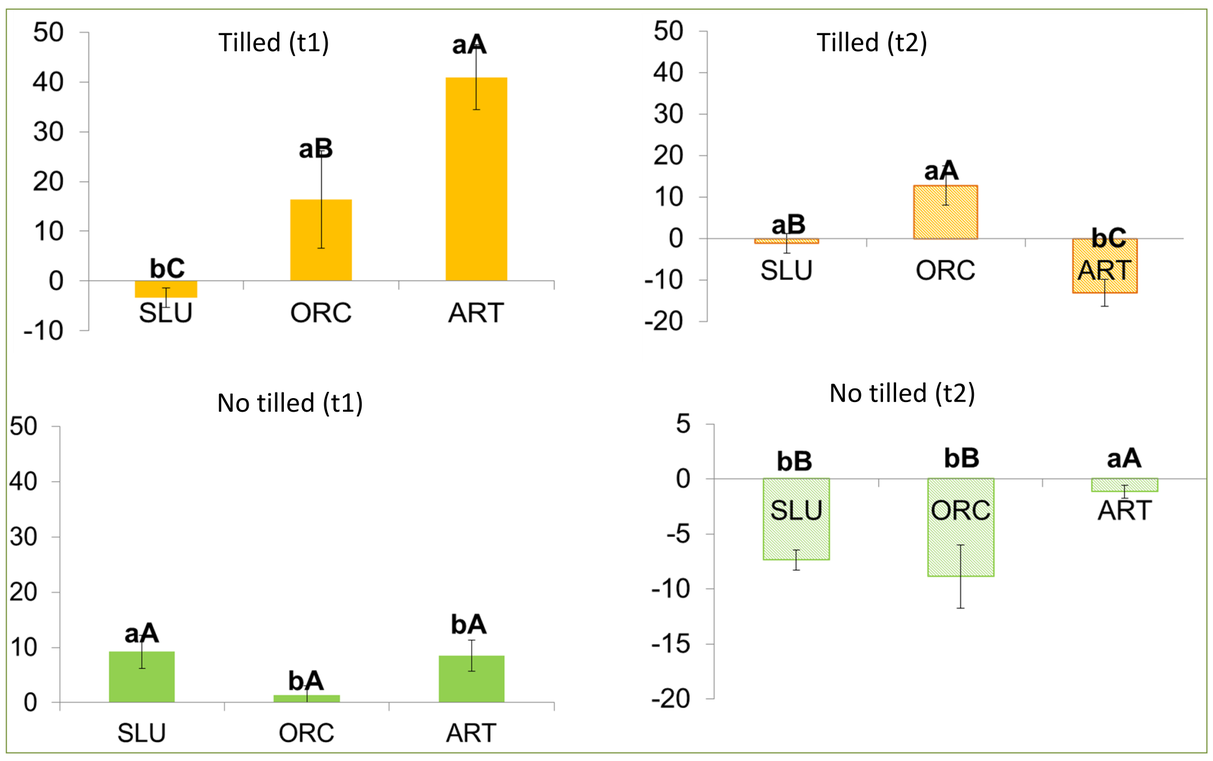
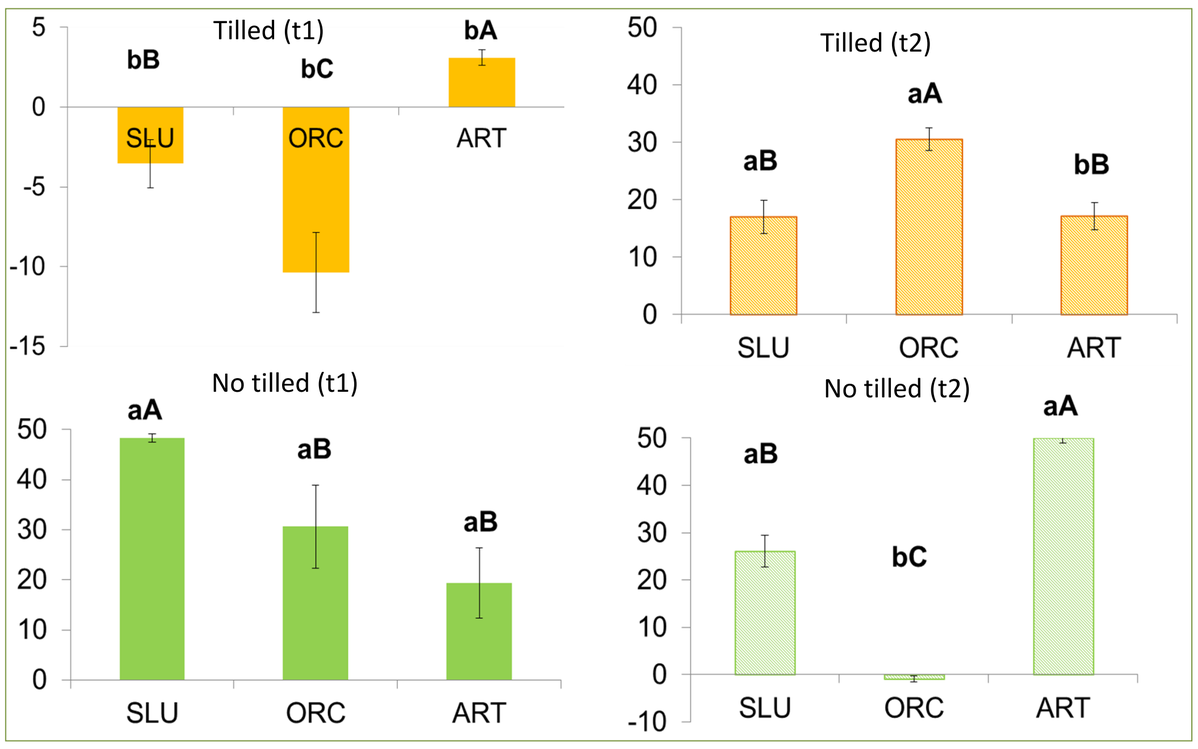


Figure 5: Effect of Brassica spp on Synthetic Enzymatic Index I expressed on organic carbon base at t1 - t2



Brassica spp. caused as cover crop a positive effect on soil extractable C and N at t1 in tilled soil of ART site (Figures 2 and 3). At t2 the positive effect on nutrients dynamics was still evident in tilled soil of ORC site. Conversely at t2 a negative effect was observed in no tilled soil in all MEE sites. The soil microbial biomass, expressed as percentage with respect to organic carbon, was negatively affected by Brassica CC at ORC and at SLU at t2 in tilled soil (Figure 4). In all other cases the effect of Brassica on microbial pool was positive. Finally, Brassica in tilled soils produced at t1 a negative effect on soil enzyme activity per unit of organic carbon at SLU and ORC, while a positive effect was observed in no tilled soils at SLU, ORC and ART (Figure 5).

Conclusions

A general positive effect of Brassica on soil microbial biomass and its activity was observed at all European sites in no tilled soil at both sampling date. Conversely, Brassica under tillage may produce a negative effect on biochemical properties after CC suppression. The effect of Brassica on C and N dynamics differed among the european sites when soil was tilled. These preliminary results establish the bases for the evaluation of the interaction between the pedoclimatic conditions and Brassica spp effect on soil properties.

BIBLIOGRAPHY:

Marx, M., Wood, M., & Jarvis, S. C. (2001). A microplate fluorimetric assay for the study of enzyme diversity in soils, 33.

Vepsalainen, M., Kukkonen, S., Vestberg, M., Sirvio, H., Niemi, R.M., 2001. Application of soil enzyme activity test kit in a field experiment. Soil Biology and Biochemistry 33, 1665–1672.

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