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Impact of energy crops on soil invertebrate communities in contaminated agricultural plains

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Plants with high biomass are increasingly cultivated in the world for energy or biotechnology. Their impacts on soil have been mainly addressed through the input of carbon in soil and consequent impacts on the cycle of nitrogen and other nutrients. Only recently the impacts of these new types of culture on ecosystem diversity were questioned. In particular, because soil communities in contaminated soils are characterized by low density and diversity, cultivating energy crops on contaminated soils would be a “win-win” strategy that could participate to restore their biodiversity in addition of reducing competition between alimentary and energy crops for productive soils. But in contaminated soils, lowering the anthropic perturbation with perennial crops could be balanced by a change in toxic conditions for invertebrate communities so that the resulting effects are badly predictive and could depend on the soil texture. The objective of the present work was to assess the impact of energy crops on soil invertebrate communities in contaminated agricultural plains.

We hypothesized that soils under perennial energy crops host more numerous and diverse invertebrate communities than annual crops because less perturbed and/or less toxic. For this, we selected couples of fields on sandy and loamy soils representing trace metal contaminated areas. All these fields were on LUVISOILs (FAO classification) and were all located in large agricultural plains. All energy crops were 3.5-yrs old Miscanthus x giganteus crops and annual alimentary crops were wheat. From middle March to middle April 2010, two types of invertebrates were sampled by a combination of methods (hand sorting and pitfall trapping). Invertebrates were identified at the lowest taxonomical level as possible. The density of soil and litter dwelling invertebrates was significantly higher in Miscanthus crop than in wheat crops in both sites. Densities were 3 fold higher in loamy soil and 7 fold higher in sandy soil. Miscanthus cropping did not significantly influence surface activity of invertebrate in both site, while a trend appeared in sandy soil, with activity 1.6 fold higher in Miscanthus crop. The number of taxonomic units recorded (OTU) by hand sorting was significantly higher in Miscanthus crops than in wheat crops in both sites. OTU were 2.8 fold higher in loamy soil and 2.6 fold higher in sandy soil. Miscanthus cropping did not significantly influence taxonomic diversity of surface active invertebrates in both sites. The total number of taxonomic units collected was higher in Miscanthus than in wheat crops only in loamy soil.

Our results showed that Miscanthus cropping have beneficial effect on the density and diversity of soil invertebrates and no effect on their surface activity.