Effect on earthworm's communities of different organic fraction of municipal solid waste treatments applied on field

Vincent Ducasse [a, b*] ; Yvan Capowiez [b] ; Joséphine Peigné [a]

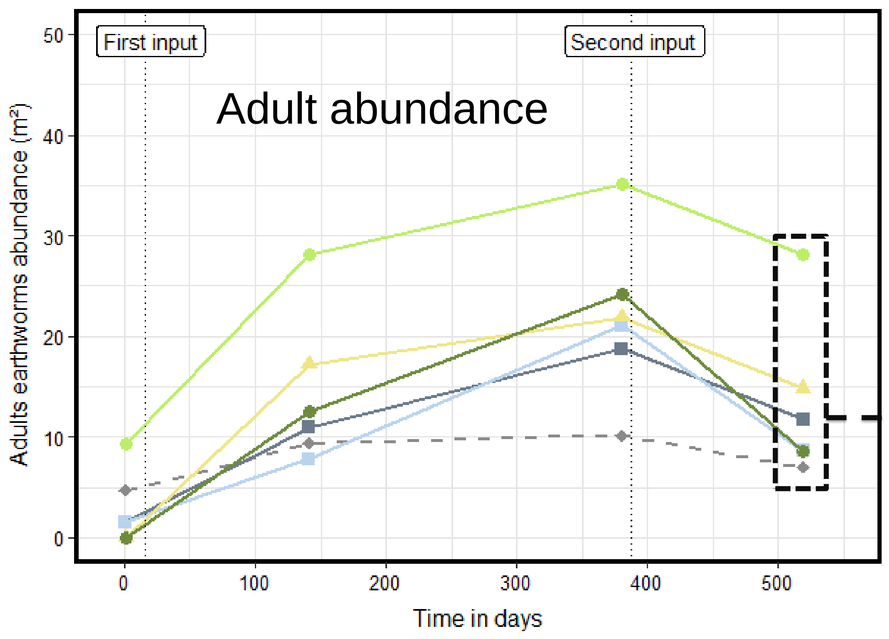
[a] Department of Agroecology and Environment, ISARA (member of the University of Lyon), 23 rue Jean Baldassini, 69364, Lyon cedex 07, France
[b] INRAE, EMMAH, UMR 1114 INRAE-Avignon University, Domaine Saint Paul, F-84914 Avignon cedex 09, France
* Corresponding author: vducasse@isara.fr

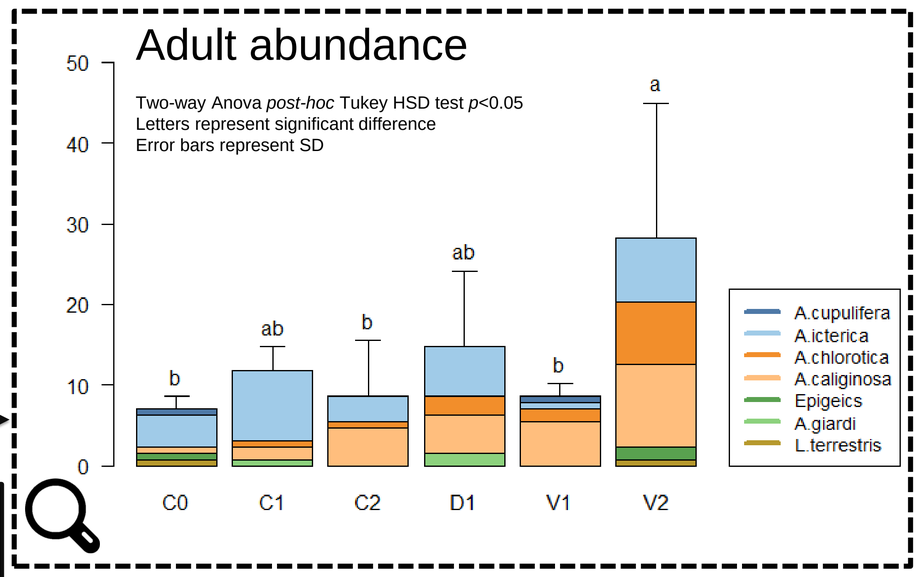
The recycling of organic fraction of municipal waste (OFMSW) is potentially a solution to the reduction of waste and chemical inputs in agriculture. Organic matter from different OFMSW treatments was applied to a field crop under no-tillage organic farming (based on equivalent N per ha) for two consecutive years on a randomized block design with 4 replicates :

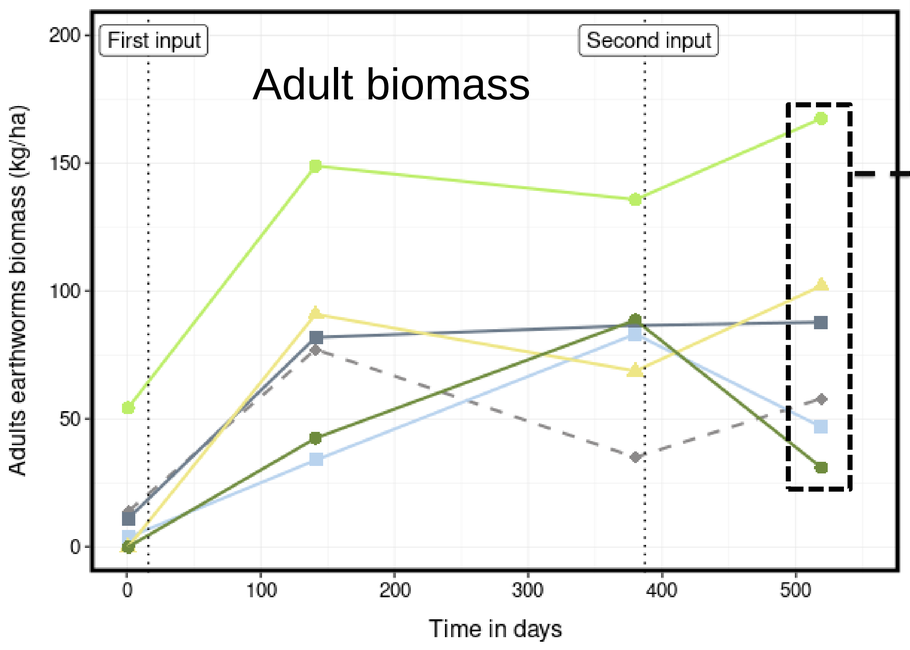
- Compost made from an electro-mechanical composter (OFMSW + shredded wood),
- Vermicompost from a collective vermicomposter (OFMSW + cardboard),
- Digestate from anaerobic digestion without phase separation (OFMSW + agricultural waste).

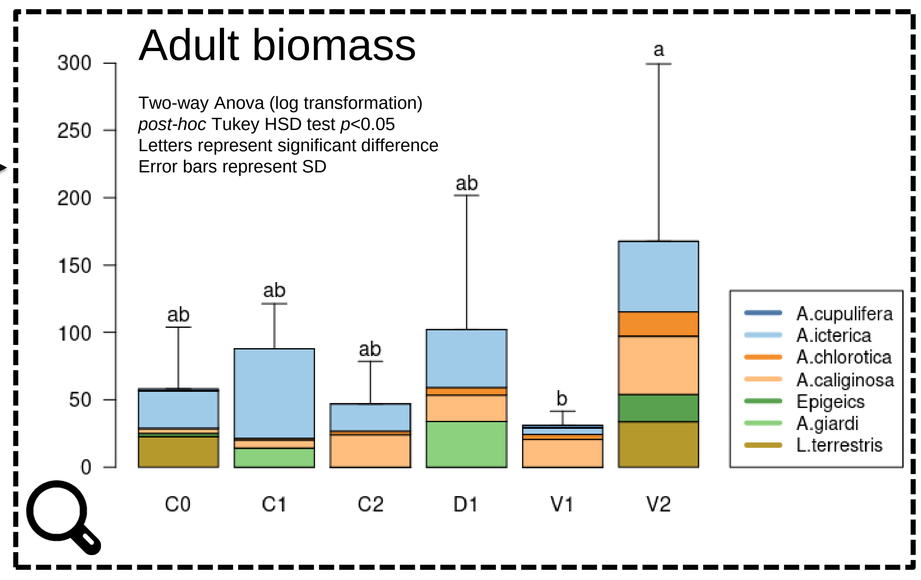
These products were applied at 60 and 120 kg/N/ha on barley and 80 and 160 kg/ha on wheat for compost and vermicompost, and only 60 and 80 kg/N/ha for digestate. We followed every 6 months the evolution of the biomass and abundance of earthworms by identifying the species.

Repeated high dose of vermicompost (V2) increased the total abundance and biomass of the adult earthworm population in the time (GLMs models)









Generalized linear models (GLMs) show that vermicompost at high dose (120 and 160 kg/N/ha) allows the development of a perennial adults population (abundance and biomass). This treatment is significantly superior to the compost (both dose), digestate and control.

The Two-way anova applied on the last sampling date show that high dose vermicompost is significantly superior to control, high dose compost and low dose vermicompost in terms of abundance and significantly superior to low dose vermicompost in terms of biomass.

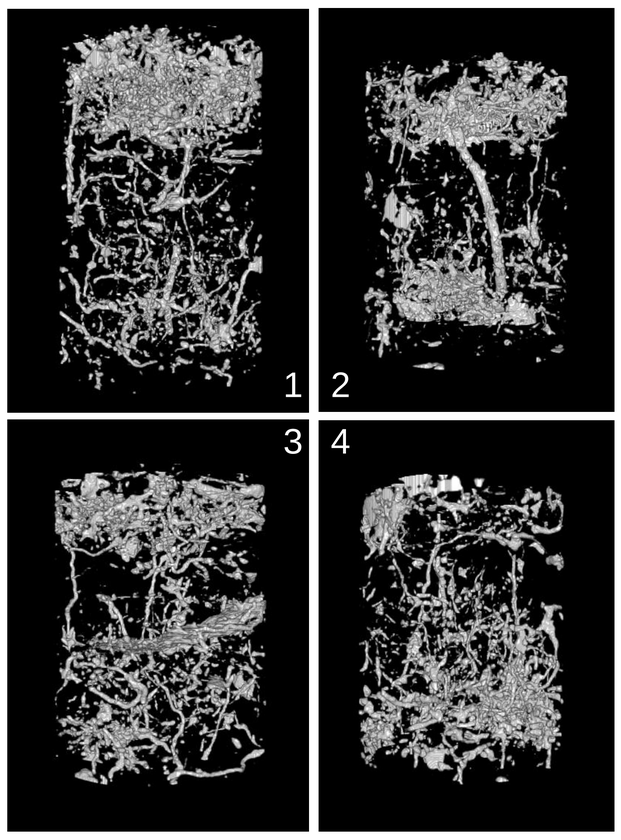
Low-dose digestate and two-dose compost had more limited effects on adult earthworm abundance and biomass (GLMs models and Two-way Anova)

Conclusion

- ✓ High-dose vermicompost was the only organic product that significantly increased the biomass and abundance of adult earthworms compared to the control during 2 years.
- ✓ Digestate and compost had an initial positive impact on earthworm populations but the duration of the experiment did not show a significant difference.
- ✓ Since composts have low C/N ratios, supplying N on a two-year basis reduces the amount of C supplied to the soil compared to farmers' practices (a large amount about every 3 years). This could explain the absence of significant effect on the compost treatments.

Perspectives

- ✓ Increase the duration of the experiments to have long-term results and potentially more significant differences.
- ✓ Develop methods to quantify the impact of earthworms following the application of soil amendments (e.g. estimation of burrows using tomography).
- ✓ To carry out small-scale comparative studies under controlled environment to evaluate whether the earthworms really prefer the vermicompost to other products.



Preliminary results of columns collected on the field and analyzed by the technique of X-ray tomography. 1 : vermicompost high dose ; 2 : compost high dose ; 3 : digestate low dose ; 4 : control.