

IMPACT OF ANIMAL MANURES ON THE ORGANIC MATTER POLLUTION OF WATER SUPPLIES IN BRITTANY

Emilie JARDÉ¹, Gérard GRUAU¹, Anne JAFFREZIC², Patrice PETITJEAN¹, Odile HÉNIN¹, Yannick FAUVEL² and Armelle RACAPÉ²

1. CAREN-CNRS, UMR 6118, Geosceines Rennes, University of Rennes, 35042 Rennes, France.

2. UMR Sol Agronomie Spatialisation, 65 Rue de St-Brieuc, CS 84215, 35042 Rennes cedex, France

At the scale of Brittany, 64 of the 118 water masses used for drinkable water production had in 2002 organic matter concentrations higher than the maximum values imposed by the French regulation ($< 10 \text{ mg.L}^{-1}$ of O_2). In the case of rivers, organic matter is dominantly allochthonous in origin, arising from the dissolution and transport of soil organic compounds by drainage waters. Brittany, in the westernmost part of France is one of the first agricultural regions in Europe, where intensive agriculture generates an average of 35 million tonnes of animal manure annually that are spread onto agricultural lands. This practice can strongly increase the amount of soil-water extractable organic matter, thereby leading to an increase of organic matter fluxes in agricultural landscapes and then to a contamination of river waters (Chantigny, 2003; Zsolnay & Görlitz, 1994). In fact, several recent studies have highlighted an increase in organic matter concentrations through time in many western European rivers draining agricultural areas, particularly in the UK and Brittany (Gruau & Jardé, 2005; Worrall & Burt, 2005; Worrall et al., 2003a). Although it is not currently clear whether the observed increases are due to manure over-application, this hypothesis deserves consideration in view of the massive manure fluxes that are disposed on agricultural land in many parts of the world.

Our global project aimed at testing the ability of molecular and spectroscopic (EEM fluorescence) tools to determine the ultimate sources of organic matter in river waters. This present study focuses on the agricultural organic sources entering the surface waters, since Brittany is a region of intensive agriculture. It deals with the chemical composition of soils receiving animal manures in view of i) distinguishing them from non-amended soils and ii) to determine manure-derived fingerprints helping us to track contamination into surface waters. To achieve that, we perform analyses on soils from three experimental fields. In Champ-Noël field, one soil received pig slurry at agronomic dose. In Kerguehennec field, the soils received cow or poultry or pig manures at agronomic dose. The last one, the Solepure field had received a massive pig slurry input (100 times the agronomic dose) between 10 to 14 years ago. The first results on the molecular analyses of raw soils underlines the ability of

coprostanol to be a good marker of pig slurry in the soils amended soils, whatever the dose, as shown on Figure 1.

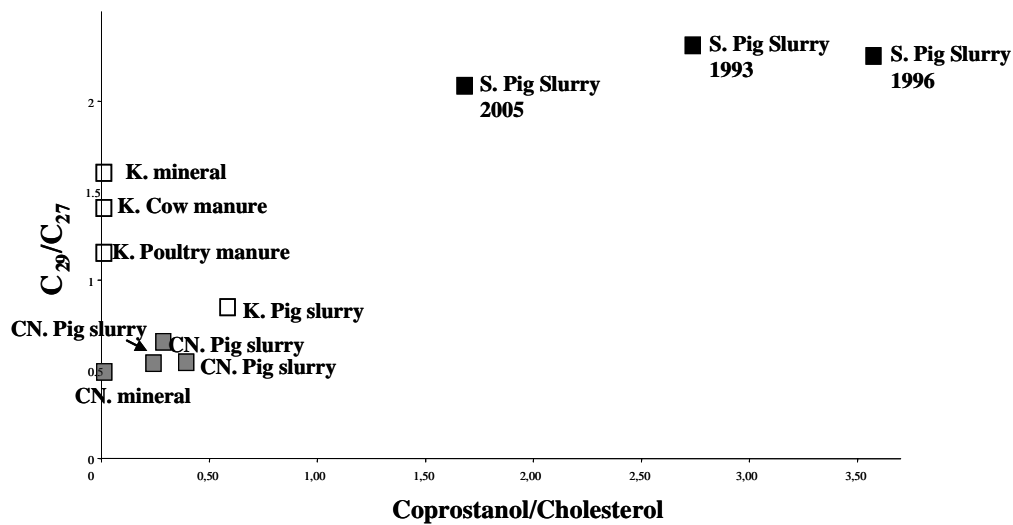


Figure 1. Plot of C₂₉/C₂₇ and Coprostanol/Cholesterol ratios comparing the values obtained for soils from Solepure (S.), Kerguehenec (K.) and Champ Noel (CN) experimental fields.

The second point of the study focuses on the water-soluble fractions of the soils from the experimental fields. The water-extractions were performed during 5 hours and sub-fractions were sampled after 1 and 3 hours to measure several parameters. The production of dissolved organic carbon (DOC), pH, and temperature were measured with time. Moreover, these fractions were also analyzed by spectroscopic tools, such as UV absorbance and EEM fluorescence to determine the nature of the dissolved organic matter from soils receiving different types of animal manures. The preliminary results show that the soils can be distinguished with EEM fluorescence fingerprint but the effect of treatment is only visible on the Kerguehenec soils, after 3h of extraction. Poultry and cow manure amended soils show different relative intensities of fluorescence from soils amended with mineral or pig slurry.

REFERENCES

- Chantigny M.H. (2003) Dissolved and water-extractable organic matter in soils: a review on the influence of land use and management practices. *Geoderma*, **113**, 357-380.
- Gruau, G. & Jardé, E. (2005) Export of DOM by rivers: assessing the relative effects of climate change and human activities using long-term records. In: *Goldschmidt 2005 meeting*, Moscow, Idaho, USA.
- Worrall, F., Burt, T. & Shedden, R. (2003) Long-term records of riverine dissolved organic matter. *Biogeochemistry*, **64**, 165-178.
- Worrall, F. & Burt, T. (2005) Predicting the future DOC flux from upland peat catchments. *Journal of Hydrology*, **300**(1-4), 126-139.