Microbial communities from different soil types respond differently to digestates inputs

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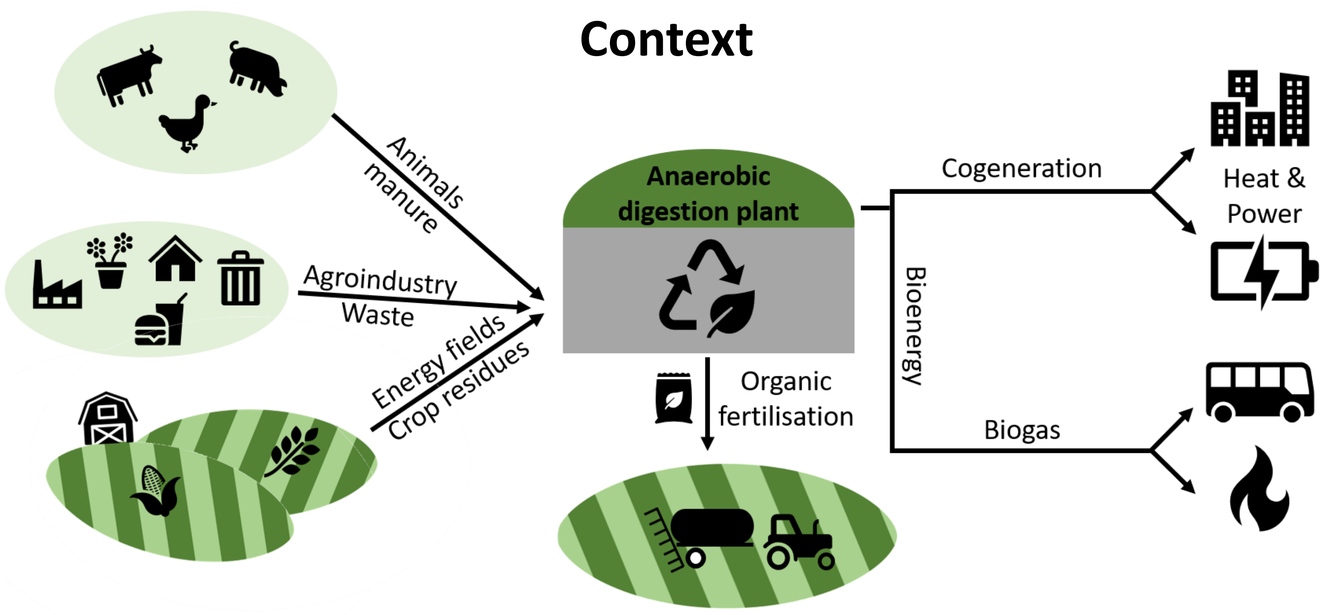
Context

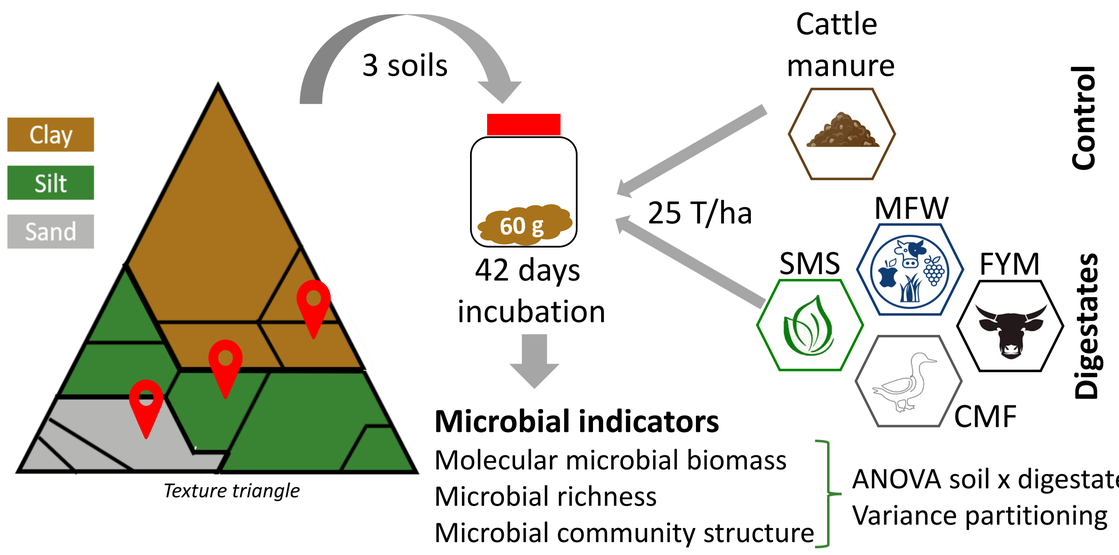


Biogas production is an alternative way to manage farmyard manure or industrial organic waste while producing green energy. Anaerobic digestion provides digestates that increase carbon sequestration, limit greenhouse gas emissions and promote circular economy when used as a fertilizer. However, their use at large scale in agricultural fields still requires to prove their innocuity effects on soil biota, especially microorganisms that play important roles in the soil ecosystem.

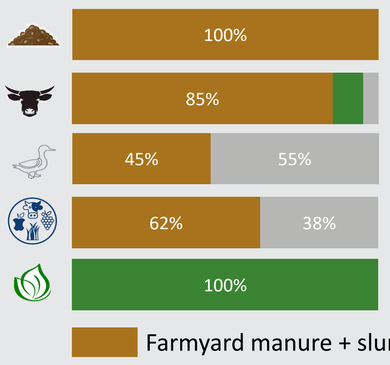
Objective

To assess the microbiological short-term effect of a first application of four contrasted biogas digestates on three different soil types

Materials and Methods



Organic materials composition



	TOC (mg / microcosm)	N_{tot} (mg / microcosm)	C/N	pH
CM	42,97	2,66	18,3	8,9
FYM	26,6	3,75	6,3	8,8
CMF	3,82	4,64	0,8	8,4
MFW	14,32	4,23	2,8	8,3
SMS	13,3	2,52	4,5	8,0

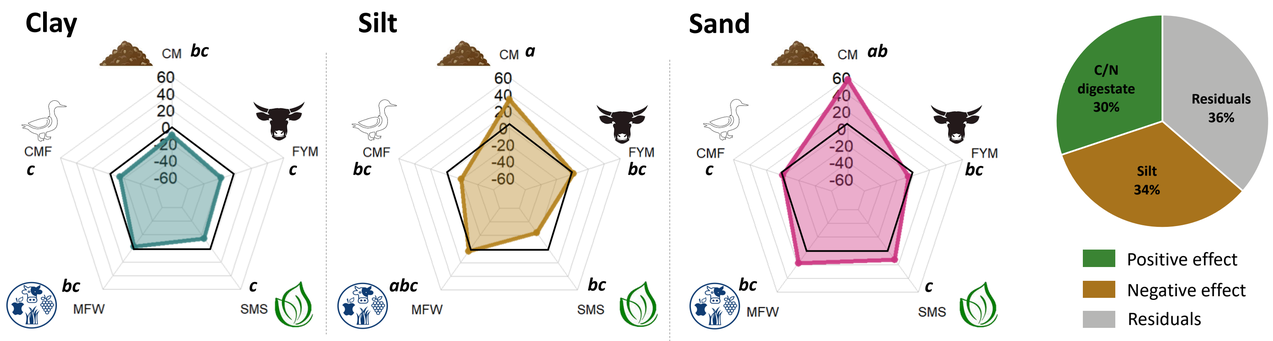
Results

For all microbial indicators => Crossed effect soil type x digestate

Clay — Silt — Sand

Impact on microbial indicators

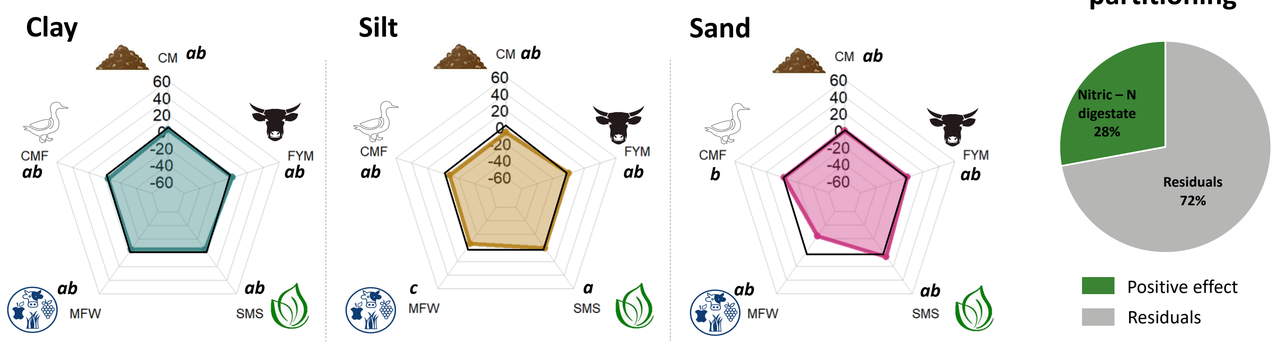
Molecular microbial biomass



Variance partitioning

➡ Clay soil: no effect of digestates / coarse textured soil decrease microbial biomass
Silty-sandy soils: lower microbial biomass after CMF/SMS/FYM digestates application *VS* cattle manure
-> Digestates with higher C/N increases microbial biomass

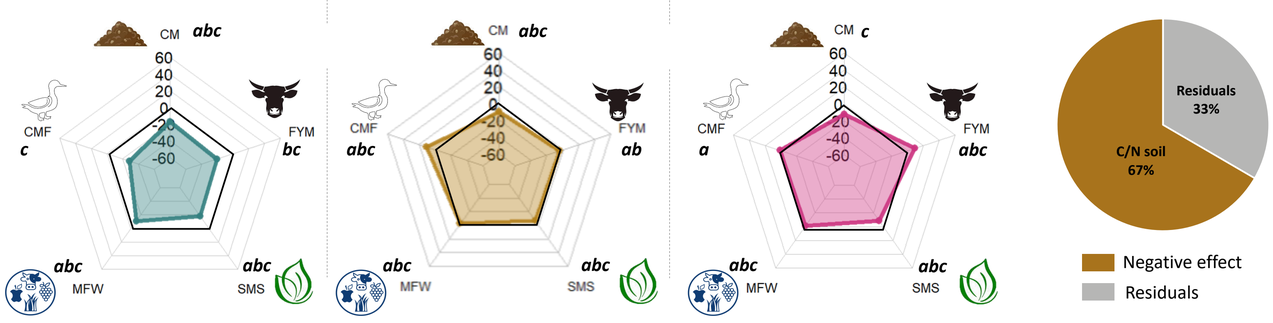
Prokaryotic richness



Variance partitioning

➡ 20% decrease after MFW application *VS* cattle manure amended soil
-> Digestates with higher nitric nitrogen improves prokaryotic richness

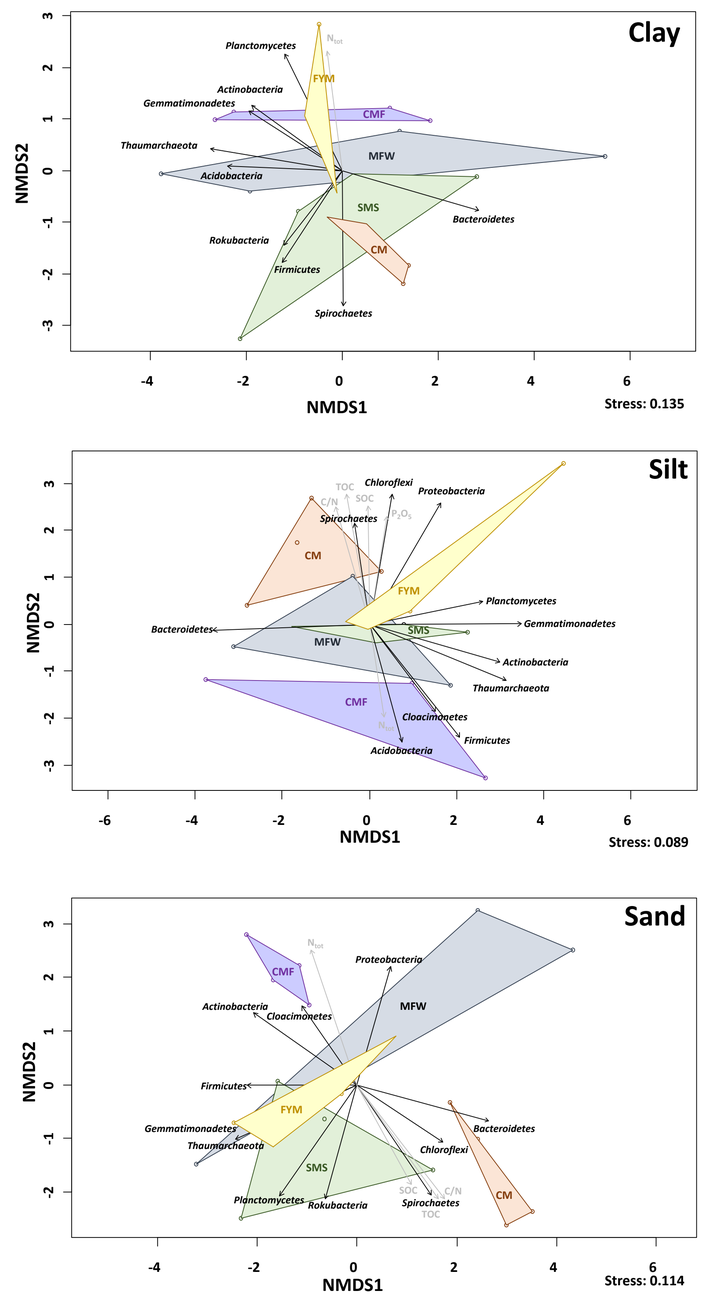
Fungal richness



Variance partitioning

➡ 21% increase after CMF application *VS* cattle manure amended soil
-> Digestates with higher C/N decreases fungal richness

Prokaryotic community structure



- Digestate effect was more pronounced in sandy > silty > clay soil
- Digestates amended soils are closer to each other *VS* cattle manure amended soil
- CMF amended soil (high nitrogen content, low C/N ratio) is the most different *VS* cattle manure amended soils

NH_4^+ — pH

↗ *Actinobacteria*

Favored by acidic conditions

Sand — Clay

Prokaryotic community modifications

Conclusions

- **Different soil types respond differently to contrasted digestates application, depending on the digestate quality - mostly C/N**
- **Microbial biomass and richness are more affected by digestates in sandy-silty soils than clay soil**
- **Microbial community structure is more affected by digestates with high NH_4^+ content**

Funding

Avec la contribution financière du compte d'affectation spéciale développement agricole et rural CASDAR — Ministère de l'Agriculture et de l'Alimentation — République Française — ADEME — GRDF

Partners

L'Institut Agro Dijon — ESA — Agricultures & Territoires Chambres d'Agriculture — Elisol Environnement — INRAE — Université de Rennes 1 — ENS — PSL — ACE Méthanisation