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Microbial communities from different soil types respond differently to different digestate fractions input

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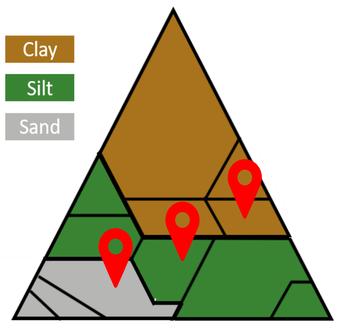
Context: Biogas digestates are more and more used as organic fertilizers. However, their effect on soil microbial quality is still debated. Moreover, little is known on how the response of soil microbial community to a given digestate may depend on the fraction (whole, liquid or solid) of digestate applied.

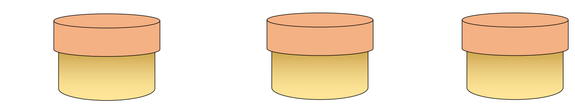
Objective: Assess the effect of different digestat fractions on soil microbial communities

Materials and Methods *(microcosme experiment)*



3 soil types

6 Treatments



Cattle manure CM | Slurry CS | Mineral fertilizer MIN

Digestate from dairy farm

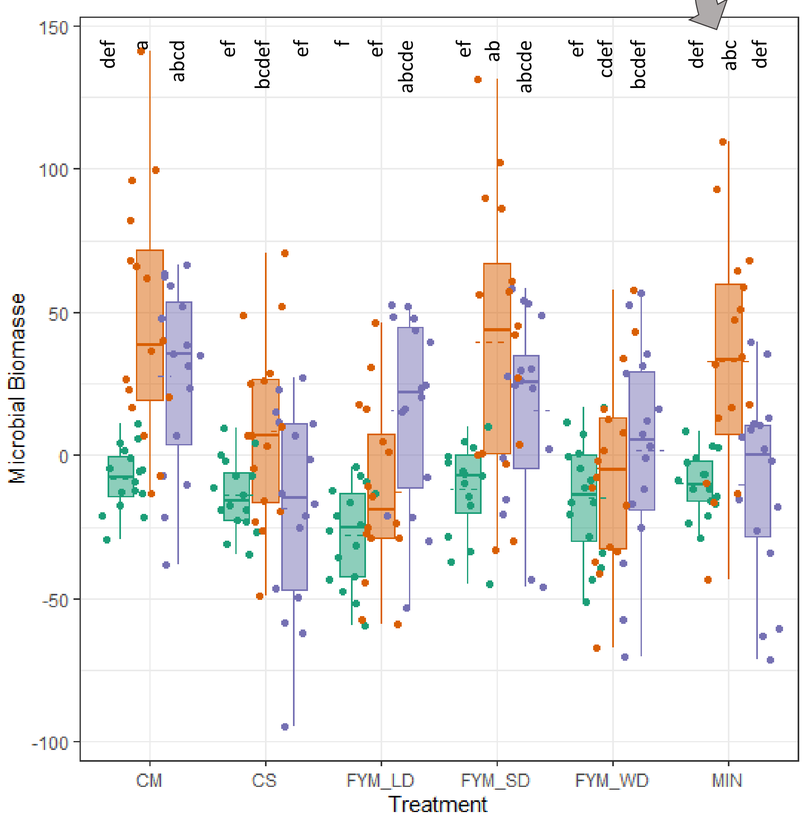
Whole FYM-WD | Solid fraction FYM_SD | Liquid fraction FYM_LD

Organic inputs physico-chemical characteristics

Organic inputs	N_tot	NH_4^+	NO_3^-	N_org	TOC	C/N	pH
	mg/µcosme		µg/µcosme	mg/µcosme			
FYM_LP	3,68	1,78	2,71	1,90	16,37	3,7	8,6
FYM_WD	3,75	1,33	2,75	2,39	26,60	6,3	8,8
FYM_SD	3,21	0,76	2,71	2,47	67,86	22,5	9,3
CM	2,66	0,38	2,76	2,26	42,97	18,3	8,9
CS	1,84	1,25	2,71	0,58	2,66	1,5	7,7

3 soils x 6 treatments → 60g Soil + 25 T/ha of inputs or 120Kg N/ha for mineral fertilizer (NO_3NH_4) → 42 days incubation → DNA extraction → Microbial biomass; DNA extraction → Illumina (16S / 18S) → Microbial Diversity indices / nMDS Taxonomical structure

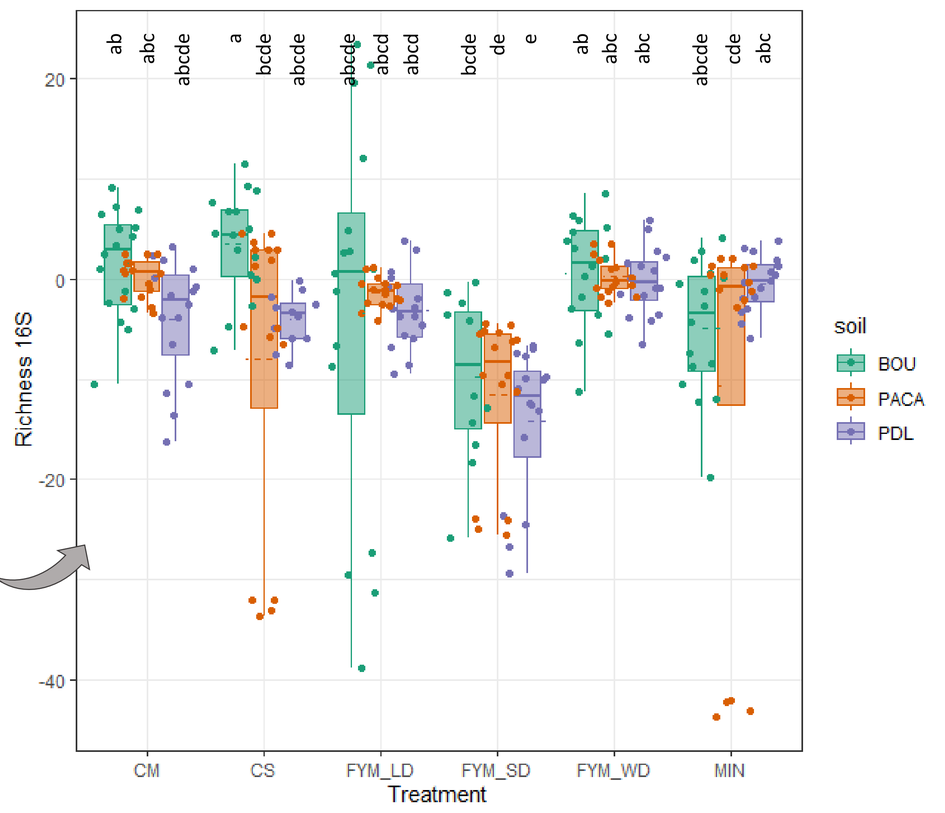
Results



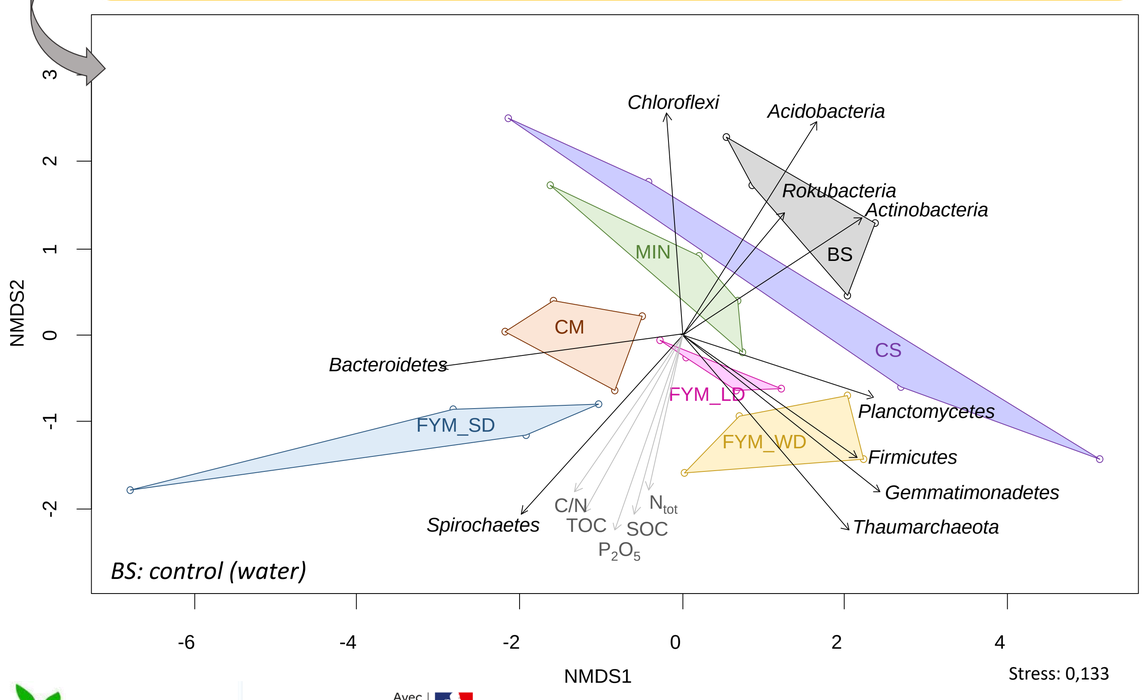
No effect of digestat fractions on the microbial biomass of fine-textured soils (BOU / PDL). In coarse-textured soil (PACA), as cattle slurry, the liquid fraction of digestate (LP) and the whole digestate (WD) induced a decrease of soil microbial biomass.

No effect of digestate fractions on the microbial biomass of BOU soil.
In PDL and PACA soils, the solid fraction of digestate induced a decrease of soil prokaryotic diversity.

No effect of digestat fractions on soil fungal richness (for all soil types) (data not shown).



Prokaryotic community from coarse-textured soil (PACA) was the most impacted by inputs.



Conclusions

Our results highlighted that the effect of digestate fractions on soil microbial community depended on the soil type, where coarse-textured soil was most affected that the finest one. Thus, liquid digestate fraction characterized by low C/N ratio induced considerably greater soil microbial community changes. This suggests that liquid fraction of digestates may be better fertilizers for heavier soils with high clay and C content while solid fraction with higher C/N would be better for lighter, sandier soils, containing less organic carbon. Further research is needed on the fields to confirm these preliminary observations.

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