

### Soil macroaggregates: the hotspots determining emission or mitigation of greenhouse gases according to the management system adopted

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# **Objectives**

We address GHG emissions at the microscale level to identify potential hotspots and determine the influence of tillage and cropping systems on such emissions.

# **Material and Methods**

Soil: clay-loam Acrisol

Two tillage systems : Conventional tillage (CT) vs no-tillage (NT)

Two cropping systems: **oat/maize (O/M)** and **oat+vetch/maize+caupi (OV/MC)** 

Aggregates classes: large macroaggregates, small aggregates and microaggregates

Water content: 40 % and 70 %

Evaluation of emission of  $N_2O$  and  $CH_4$ , and the C concentration



No-tillage (NT) vs Conventional tillage (CT)



Without vs with legume cover crops



# Soil macroaggregates: the hotspots determining emission or mitigation of greenhouse gases according to

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**Incubation of 3 aggregate classes** 

# Cumulative N<sub>2</sub>O-N emission



## <u>Under 40% of water content:</u>

In large macroaggregates, N<sub>2</sub>O-N emission was three times greater under OV/MC compared to O/M, and NT increased two times  $N_2O-N$  emission in relation to CT.

## Under 70% of water content:

In large macroaggregates, N<sub>2</sub>O-N emission increased two times in NT in relation to CT, and it was 80% greater in OV/MC than in O/M.

# **Cumulative CH**<sub>4</sub>-C emission



Under 40% of water content: In large macroaggregates, greater influx in NT and OV/NC compared to CT and O/M.

## <u>Under 70% of water content:</u>

In large macroaggregates, greater CH<sub>4</sub>–C emission in NT and OV/MC compared to CT and O/M.

# Net cumulative emission by kg of C

Tillage	Crops	$NCEC_{agg}^2$ (mg CO <sub>2</sub> -Ceq. kg <sup>-1</sup> SOC)			
		> 2mm	2 - 0.25  mm	< 0.25 mm	Whole
40 %					
CT	O/M	-13.49 Bb	-63.34 Ab	-49.47 Aa	-727.19
	OV/MC	- 40.81 Aa	-96.41 Ba	-43.12 Aa	-
NT	O/M	- 40.33 Aa	- 91.83 Ab	-49.43 Aa	- 874.92
	OV/MC	-45.08 Aa	-155.93 Aa	-26.88 Aa	-
70 %					
<b>OT</b>		252672			10007 00
CI	0/M	3536.73	2696.46 Ab	232.54 Aa	18237.98
	OV/MC	4992.69	5892.90 Aa	222.52 Aa	47039.49
NT	O/M	3236.48	2520.42 Aa	210.30 Aa	29724.77
	OV/MC	3314.01	3296.47 Ba	257.21 Aa	44482.12

Uppercase letters compare averages of tillage systems within cropping systems in each class of aggregate. Lowercase letters compare averages of crop systems within tillage systems in each class of aggregate.

## Under 40% of water content

- 53.51 mg CO<sub>2</sub>-Ceq. kg<sup>-1</sup> SOC, on average)

Under 70% of water content

# Conclusions

- Soil macroaggregates can be considered as a key element to
- emission/mitigation.
- accumulation in soil macroaggregates.

![](_page_1_Picture_44.jpeg)

For each kg of C accumulated in macroaggregates: • greater C from atmosphere was up taken by NT than CT (83.29 vs. • greater C from atmosphere was up taken with than without (84.56 vs. 52.24 mg CO<sub>2</sub>-Ceq. kg<sup>-1</sup> SOC, on average) legume cover crops.

• Only positive NCE was observed under 70% of water content In large and small macroaggregates under OV/MC, lower emission in NT compared to CT (3305.3 vs 5442.8 mg CO<sub>2</sub>-C kg<sup>-1</sup> SOC).

a better understanding of GHG dynamic in the soil. • By containing labile organic forms, soil macroaggregates are

considered the hotspot of soil greenhouse

Despite favoring N<sub>2</sub>O emission, NT and legume cover crop lead to GHG mitigation by promoting CH<sub>4</sub> influx and C