Carbon dioxide emission from organic soil amended with straw and wood chips

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RE3 CONFERENCE 2023 — RECLAIM RESTORE REWILD — June 11-15, 2023 • QUEBEC CITY • CANADA

1. INTRODUCTION

- In North America, a large proportion of vegetables is grown on drained **organic soils**.
- Drainage of these soils favors peat mineralization and contribute in part to annual **soil losses of 1 to 5 cm** and **CO_2 emissions**.
- One potential conservation strategy is addition of **plant-based amendments** to **compensate for carbon losses**.

Objective

Quantify the effect of different types and rates of biomass amendments to organic soils on CO_2 emissions.

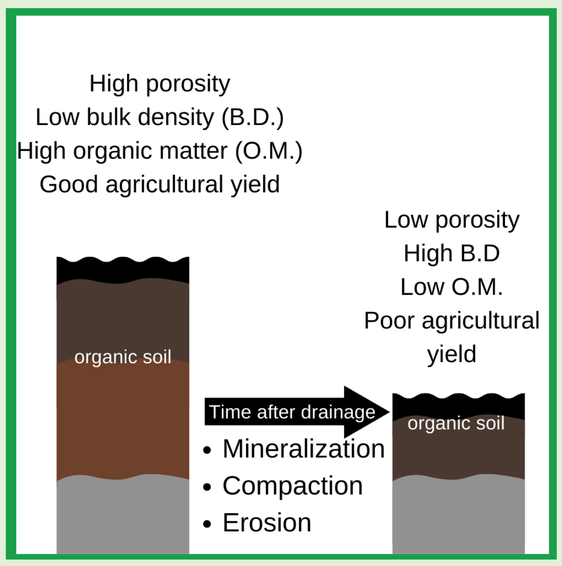

Figure 1. Degradation of cultivated organic soils

2. MATERIALS AND METHODS

- Experiments took place in a **greenhouse** (Québec).
- Organic soils sampled using PVC pipes (h : 65 cm, Ø : 25 cm).
- Closed static chambers with infrared gas analyzers used to measure **CO_2 fluxes** over a **9-week** period .
- Factorial design : four different biomass species (**birch, willow, miscanthus and switchgrass**), two different amendment rates (**6% and 20 % v/v**), two controls without amendment **(intact and disturbed).**

Figure 2. Wood chip (birch or willow)

Figure 3. Columns in greenhouse

Figure 4. Straw (miscanthus or switchgrass)

3. RESULTS

Figure 5. CO_2 fluxes over the 9-week sampling period for different treatments (means ± standard deviation, n = 3). The statistical results for each factor were: Bloc p = 0.031, Treatment p = 0.003, Week p = 5.06E-10, Treatment : Week p = 0.689.

Table 1 . Annual carbon loss by linear extrapolation according to degree-days (standard deviation in parenthesis) and balance

TREATMENTS	Carbon loss (Mg C-CO_2/ha/yr) • Values followed by the same letter are not significantly different. Holm significant difference at 0.05	Amended biomass (Mg/ha/yr)	Amended carbon (MgC/ha/yr)	Carbon balance (MgC/ha/yr)
Without amendment				
Intact	4.9 (0.3) a	0	0	- 4.9
disturbed	5.2 (0.7) a	0	0	- 5.2
6% amendment				
Birch	7.2 (0.4) bcd	12.4	6.0	- 1.2
Willow	6.5 (0.5) bef	11.4	5.3	- 1.2
Miscanthus	6.0 (2.0) ab	4.7	2.1	- 3.8
Panicum	6.3 (2.2) a	5.5	2.5	- 3.8
20 % amendment				
Birch	8.4 (1.1) a	28.9	13.9	**+ 5.5**
Willow	7.4 (1.0) de	26.8	12.5	**+ 5.1**
Miscanthus	6.2 (0.7) ace	11.1	5.0	- 1.2
Panicum	5.9 (1.1) af	13.0	5.8	**0.0**

4. CONCLUSION

- Amendment of around **13 Mg per hectare per year** of either straw or wood chips would be sufficient to **compensate carbon losses** caused by organic matter mineralization.
- Results show that this strategy can **contribute to soil conservation** and thus, **sustaining valuable land resources** for vegetable production in Québec.

Acknowledgements

- Jean Caron
- Diane Bulot
- CRSNG
- And all assistants and JDR-lab teams