



Decomposition of peat in lab experiments simulating summer drought

[Faculty of Science
Biology]

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Summary

During dry summers, anaerobic peat layers can become aerobic. The effect of aerobic periods on normally anaerobic *Sphagnum* and *Carex* peat samples was studied in a lab experiment. It became evident that anaerobic peat samples from different peat types respond differently to aerobic periods varying in length. *Carex* peat from agricultural and natural areas released considerable sulphate and pH dropped. No changes in [phenolics] were detected.

Introduction

Peatlands are associated with high GHG emission and soil subsidence. Dry summers, which become more frequent due to climate change, could deteriorate the situation. A 'concave' water table evolves during dry periods. Pristine, anaerobic peat then becomes exposed to oxygen. Anaerobic peat contains more phenolic substances, like lignin and tannin, than peat that has been exposed to oxygen. Phenolics, normally protecting peat from degradation, are degraded under aerobic conditions. It is unknown in which time frame phenolics are being degraded so that they become unable to perform a latch on peat decomposition.

What is the effect of the occurrence and length of aerobic periods on decomposition of *Sphagnum* and *Carex* peat samples extracted from the anaerobic layers of agricultural and natural peatlands?

Method

Carex and *Sphagnum* peat samples were collected from anaerobic layers in nature reserves and agricultural areas. Peat samples (n=5) were incubated in 300 mL infusion flasks sealed with airtight rubber stoppers. Incubation flasks were purged with nitrogen gas. Incubation lasted 14 weeks and involved different lengths of aerobic periods (0, 1, 2, 4, or 8 weeks). Gas samples for CO₂ and CH₄ analysis were collected of each sample at the end of the aerobic period, 4 weeks afterwards and at the end of the experiment. pH, water extractable NO₃⁻, NH₄⁺, PO₄³⁻, SO₄²⁻, Dissolved Organic Carbon (DOC) and soluble and condensed phenolics were analysed at the end of the experiment.

Results

Preliminary results of t14 extractions are presented in figures 1-4, with an indication of significant differences between peat types. In table 1 significant treatment effects can be found.

For phenolics, no treatment effect was found, [phenolics] was higher in *Sphagnum* peat. *Carex* peat samples from agricultural as well as natural peatlands showed [SO₄]⁻ increases and pH drops during aerobic incubation, associated with pyrite oxidation. In *Sphagnum* peat this was not detected. DOC concentration was not affected by aerobic period. Extractable N(NO₃+NH₄) and PO₄ were not affected by the length of the aerobic period but did differ between peat types and land use. Water extractable N(NO₃+NH₄) was high in natural *Sphagnum* peat samples, probably due to poor immobilisation due to a low microbial activity in this recalcitrant material.

Table 1 Significant treatment effects (ANOVA, p<0.05) for pH, SO₄ and DOC. No significant treatment effects for N(NO₃+NH₄) and PO₄.

	Agriculture <i>Carex</i>	Agriculture <i>Sphagnum</i>	Natural <i>Carex</i>	Natural <i>Sphagnum</i>
pH	0 vs 1,2,4,8	-	0 vs 2,4,8 1 vs 4,8	0 vs 1,2,4,8
SO ₄	0 vs 1,2,4,8	-	0 vs 1,2,4,8 1 vs 4,8	-
DOC	0 vs 2,8	-	-	-

Ongoing and future work

- Analysis of other variables that were measured during this experiment;
- Effect of alternating aerobic/anaerobic periods;
- Role of phenolics in peat decomposition, in relation to pH, NO₃⁻, SO₄²⁻.

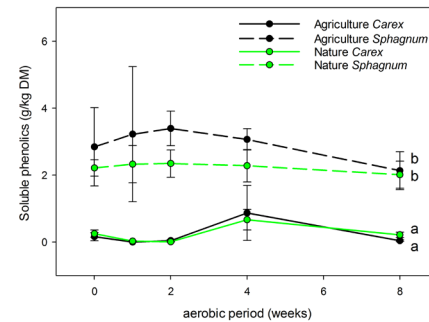


Fig 1 *Sphagnum* peat released more soluble phenolics than *Carex* peat.

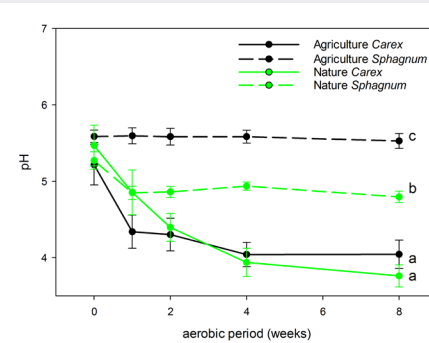


Fig 2 pH of agriculture *Sphagnum* remained stable, others dropped.

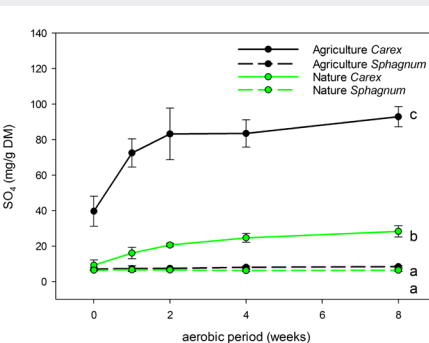


Fig 3 [SO₄]⁻ of *Carex* samples increased with increasing aerobic period and a significant treatment effect was found. [SO₄]⁻ of *Sphagnum* samples remained stable

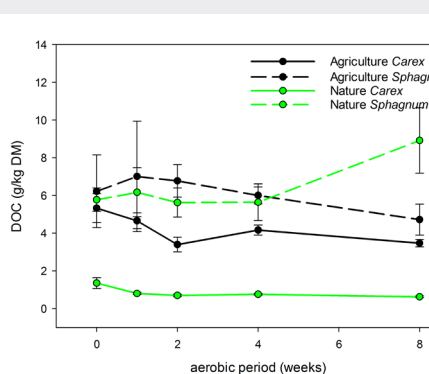


Fig 4 [DOC] concentration showed no treatment effect.