The effect of the addition of $^{13}$C labelled artificial root exudates on carbon cycling in intact peat bog mesocosms

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Problem:

• Do root exudates enhance peat decomposition?
• What is the fate of root exudates in acidic bog peat?

Experiment:

• Addition of artificial root exudates (99% $^{13}$C-glucose, amino acid and acetic acid into intact peat cores)
• Monitoring of release of $^{12}$CO$_2$, $^{12}$CH$_4$, $^{13}$CO$_2$, $^{13}$CH$_4$
• Repeated DOC sampling in 5, 15, and 25 cm depth and analysis of DOC and DO$^{13}$C concentration
• Analysis of peat for $^{13}$C content following the experiment
Results Peat:

Strong accumulation of label in depth of injection 3 weeks after labelling: 20.25% of added $^{13}$C

$\delta^{13}$C of peat (mean and SD)
Results CO₂ and CH₄:

Substantial evolution of added 13C as ¹³CO₂ and ¹³CH₄:

31.31% of added ¹³C
Results DOC:

- highest DOC concentration at 15 cm depth (rhizosphere) indicates immobile DOC
- up to 20% $^{13}$DOC in 15 depth! (made further analyses impossible for a while)
Summary:

140 mg of injected $^{13}$DOC did not enhance peat decomposition

After 3 weeks, of injected artificial labelled root exudates...

- probably up to 50% remained in solution in the depth of injection
- 20% were found in peat in the depth of injection
- 30% were released as CO$_2$ and CH$_4$

⇒ DOC in the examined bog peat is remarkably immobile and stable