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Contribution of cover crop species to soil organic matter fractions

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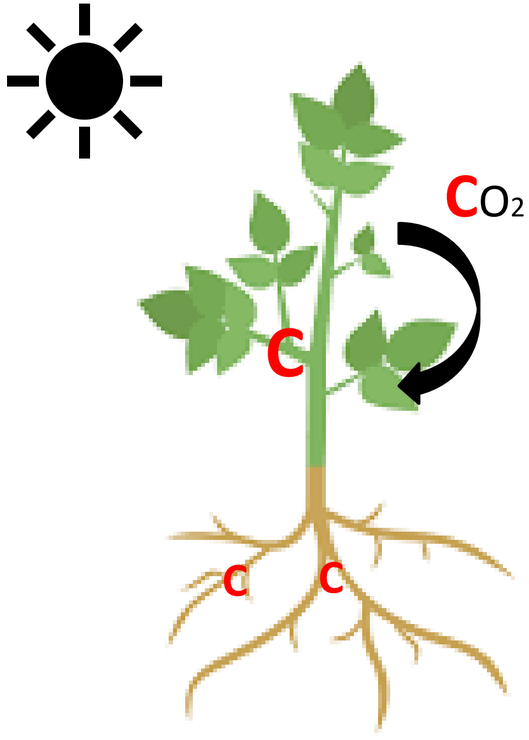
NIBIO

Cover crop carbon inputs and stabilisation in soil
NKJ Cover Crops Nordic. 30.01.2024 14:00-16:00

Carbon sequestration, storage and persistence

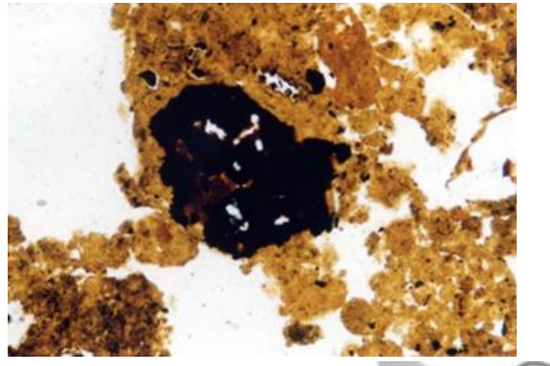
Soil C sequestration

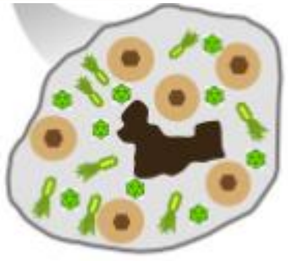


Soil C storage

Soil C persistence

(> 100 years)





Microaggregate

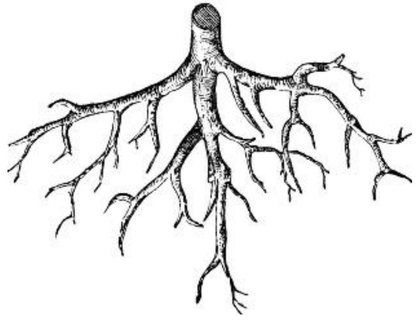
Carbon dilemma

- Labile C – fast cycling (short life in the soil)

- Stable C–slow cycling (long life in the soil)

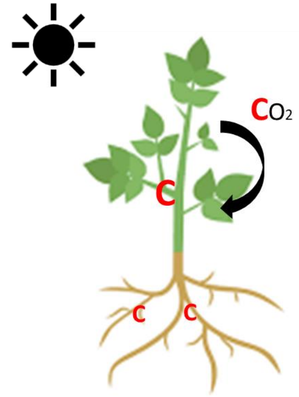
Soil health

High potential for soil C storage



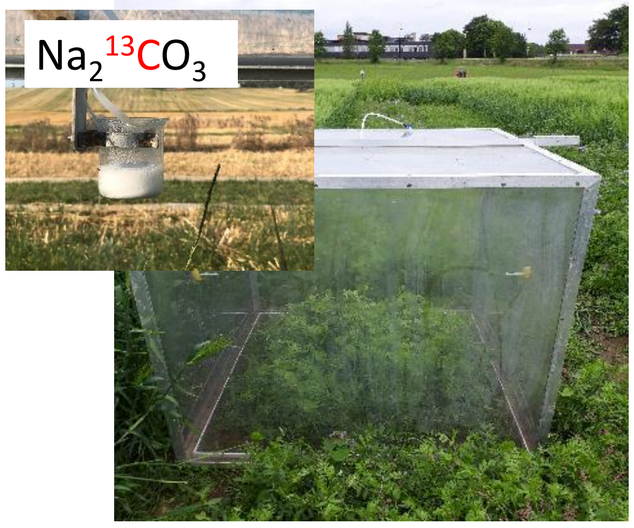
CAPTURE: cover crop in cereals

(2021-2025)



- ***What is the C input from different cover crop species?***
- ***What is the contribution of roots and shoots for soil C storage?***
- ***How long is the persistence of above- and below ground C-biomass in the soil ?***

Summer Vetch (SV)



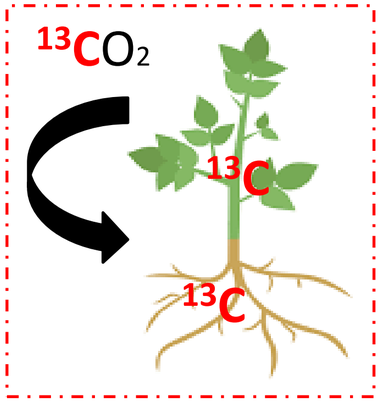
Italian ryegrass (IR)

Phaselia (PH)

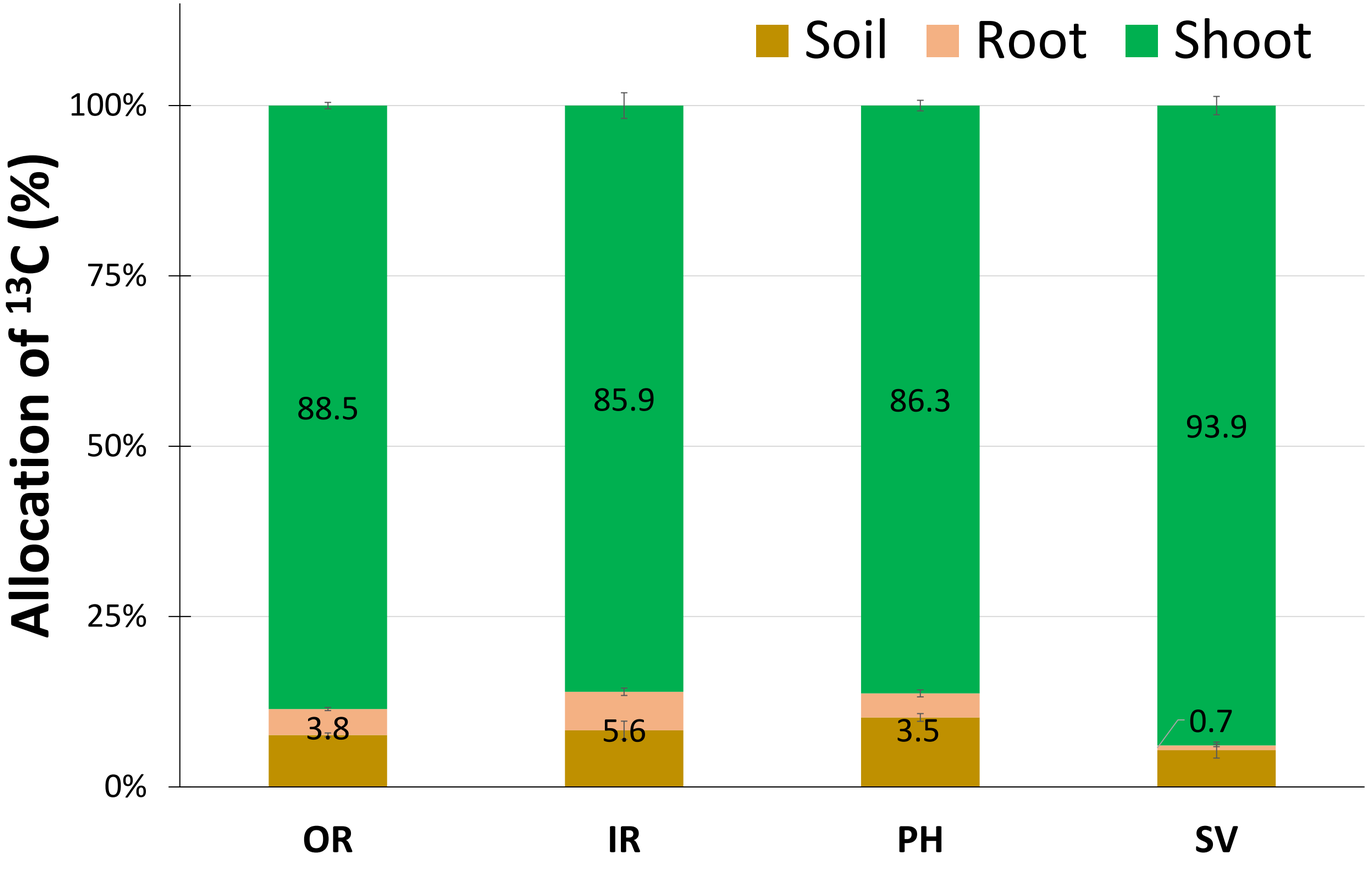
Oilseed radish (OR)

https://www.norsok.no/en/projects/2021/assessment-of-cover-cropping-as-climate-action-in-cereal-production-in-norway-capture

Where did the ^{13}C go?

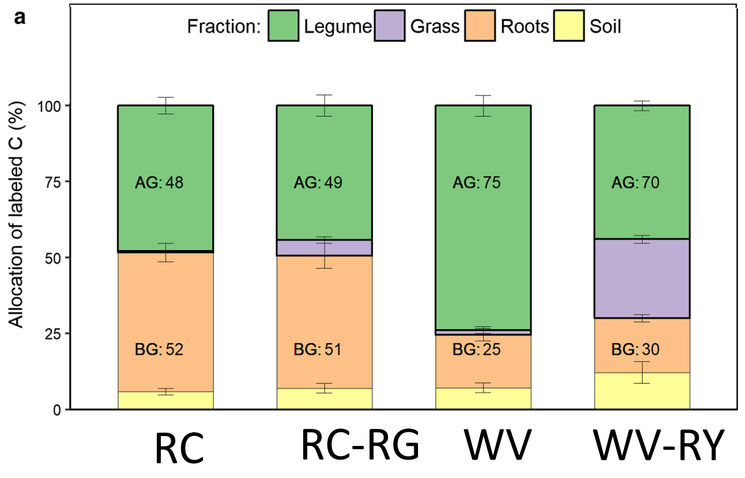


September 2021

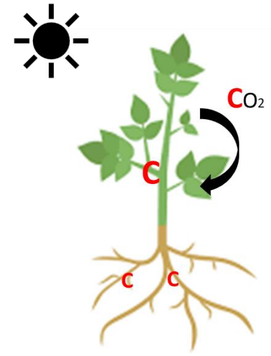


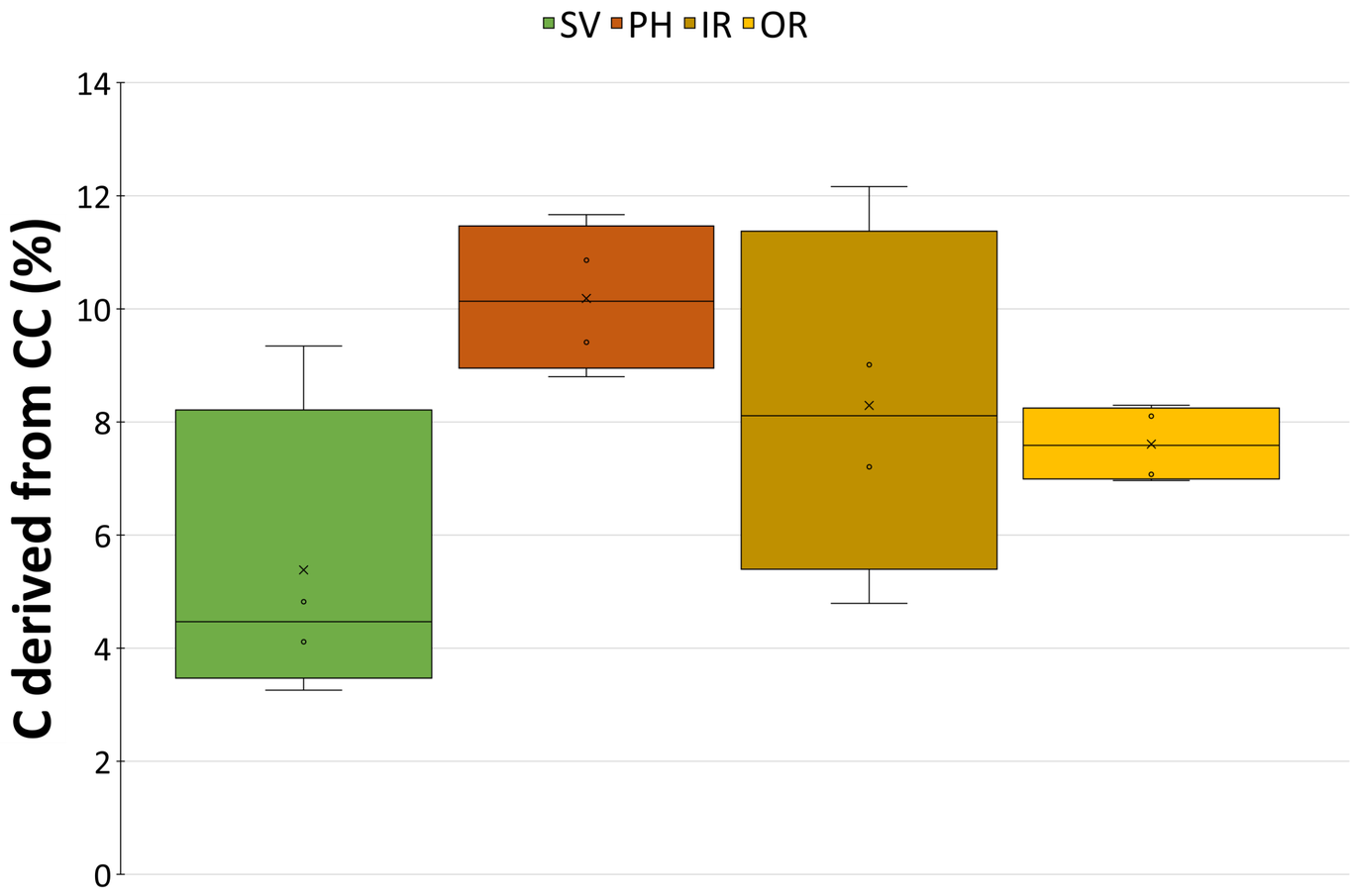
Allocation of labbeled C in different pools, calculated as percentages of the total amount of labeled C:

Labeled C allocation pool (%) = (^{13}C pool / ^{13}C total) *100

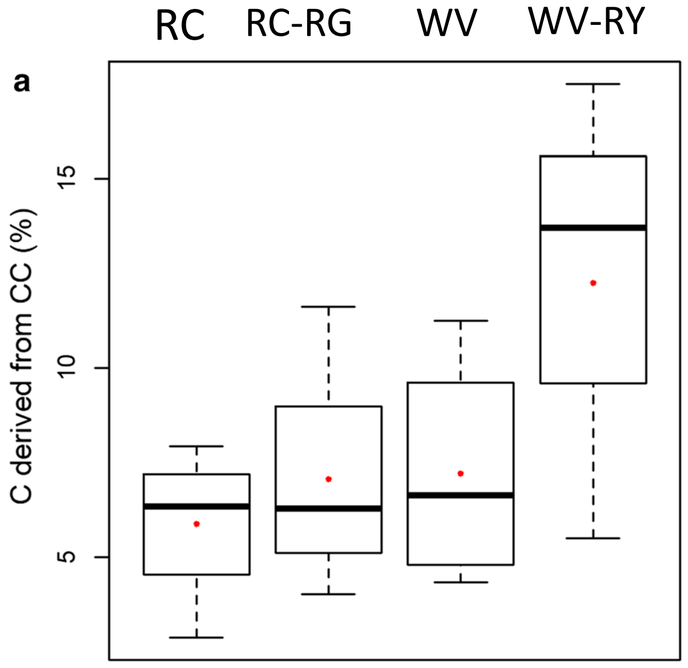


C derived from CC in 0-20 cm soil (%)





$$\text{Cdfcc } (\%) = \left({}^{13}C_{soil} / {}^{13}C_{total}\right) \times 100$$

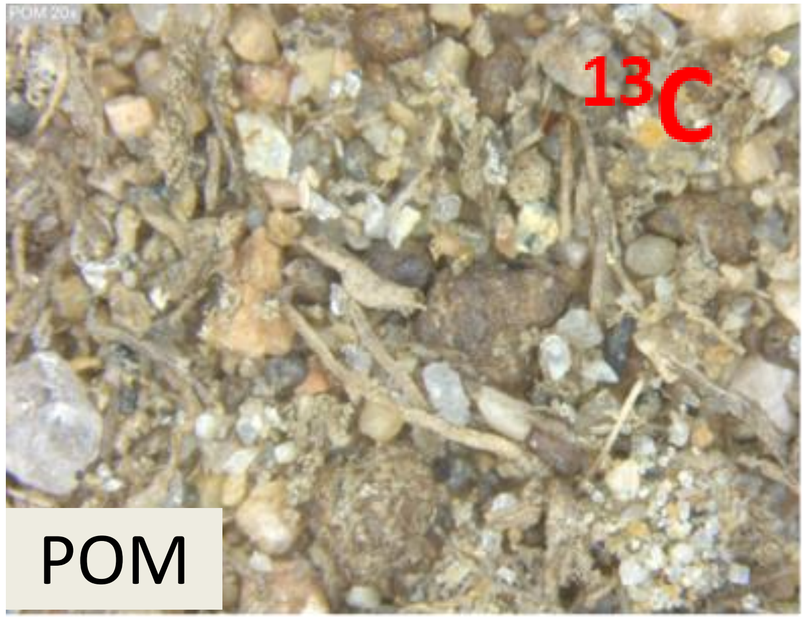


September 2021

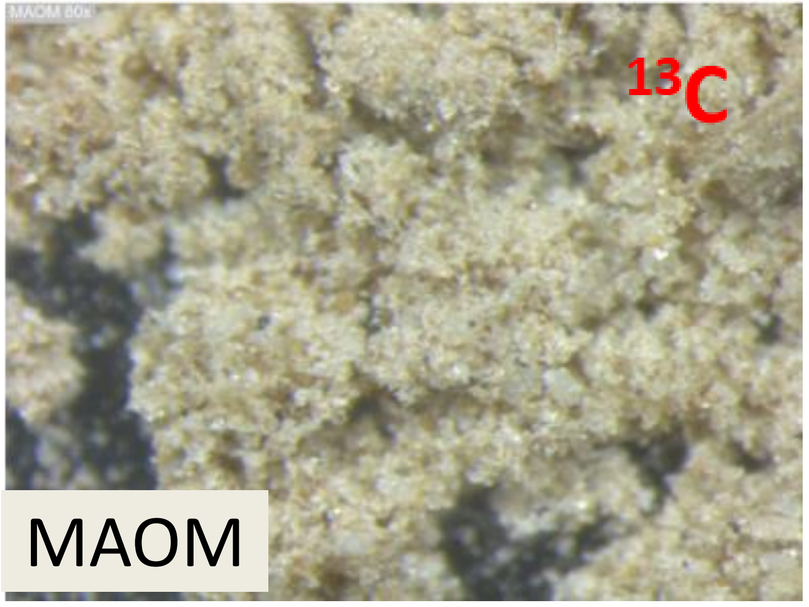
De Notaris, et al. Nutr Cycl Agroecosyst (2020) 116:1–18

How long does the C derived from the CC persist in the soil?

Soil fractions



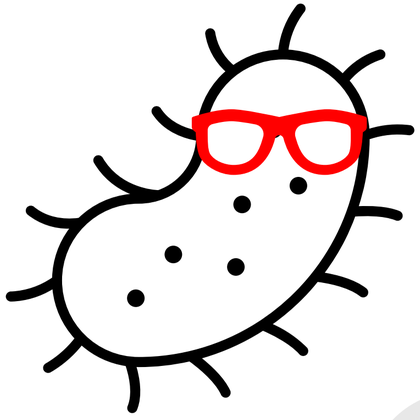
POM: **P**articulate **O**rganic **M**atter



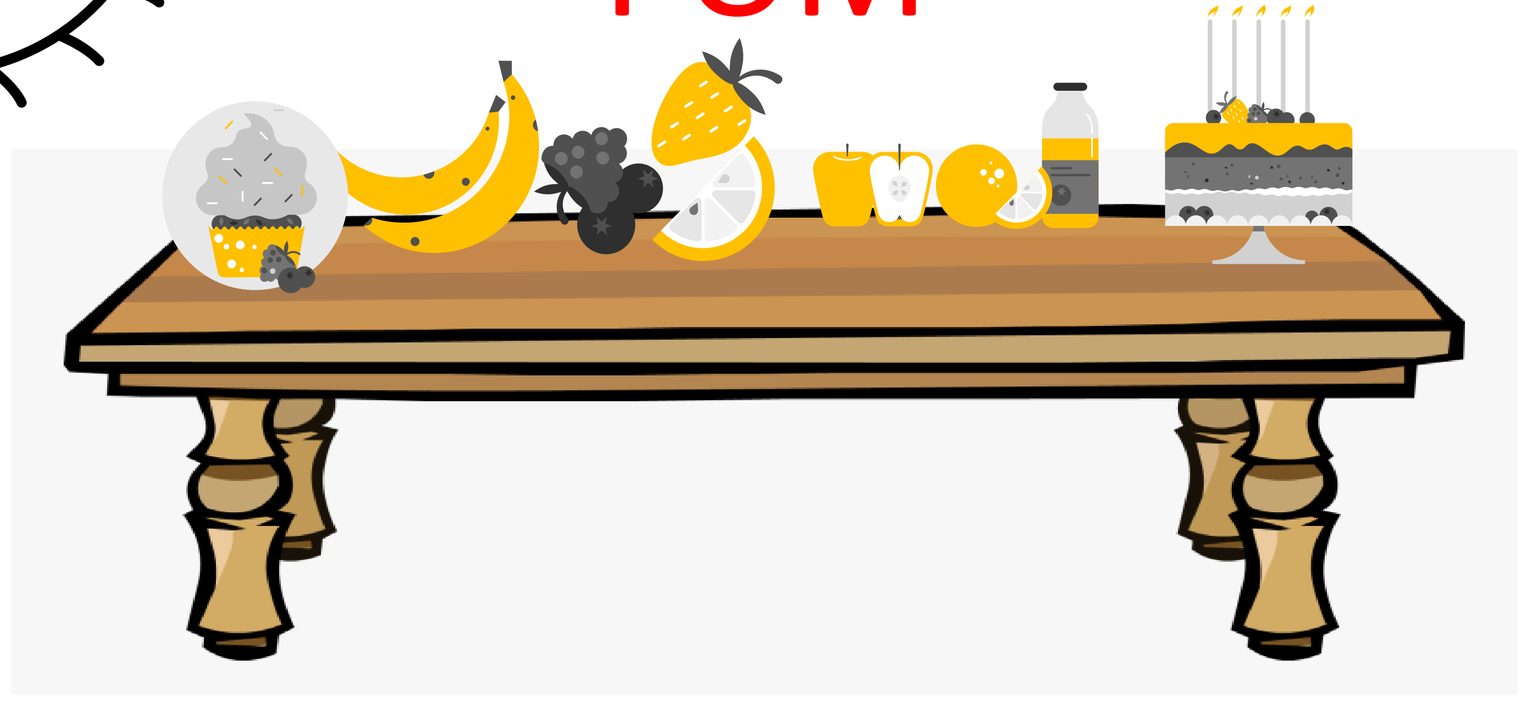
MAOM: **M**ineral-Associated **O**rganic **M**atter

https://www.nibio.no/prosjekter/fangvekster-som-klimatiltak-i-norsk-kornproduksjon

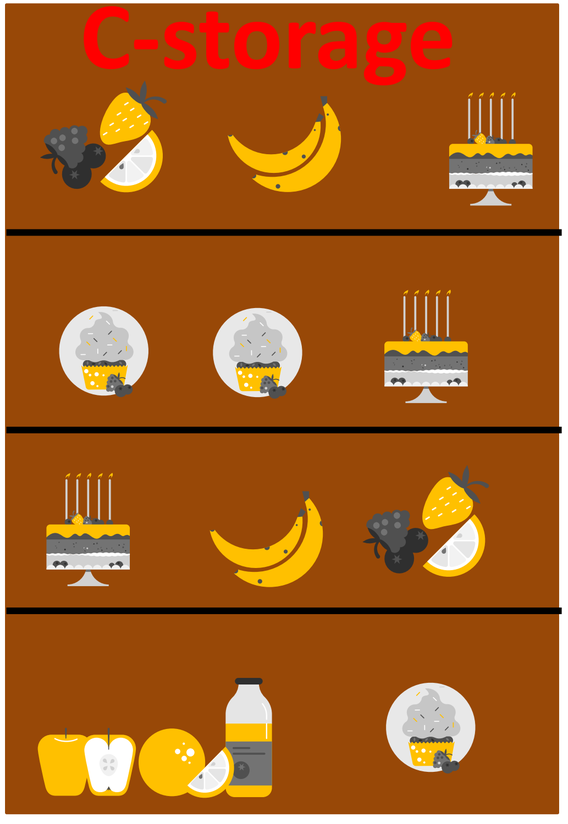
Soil fractions



POM

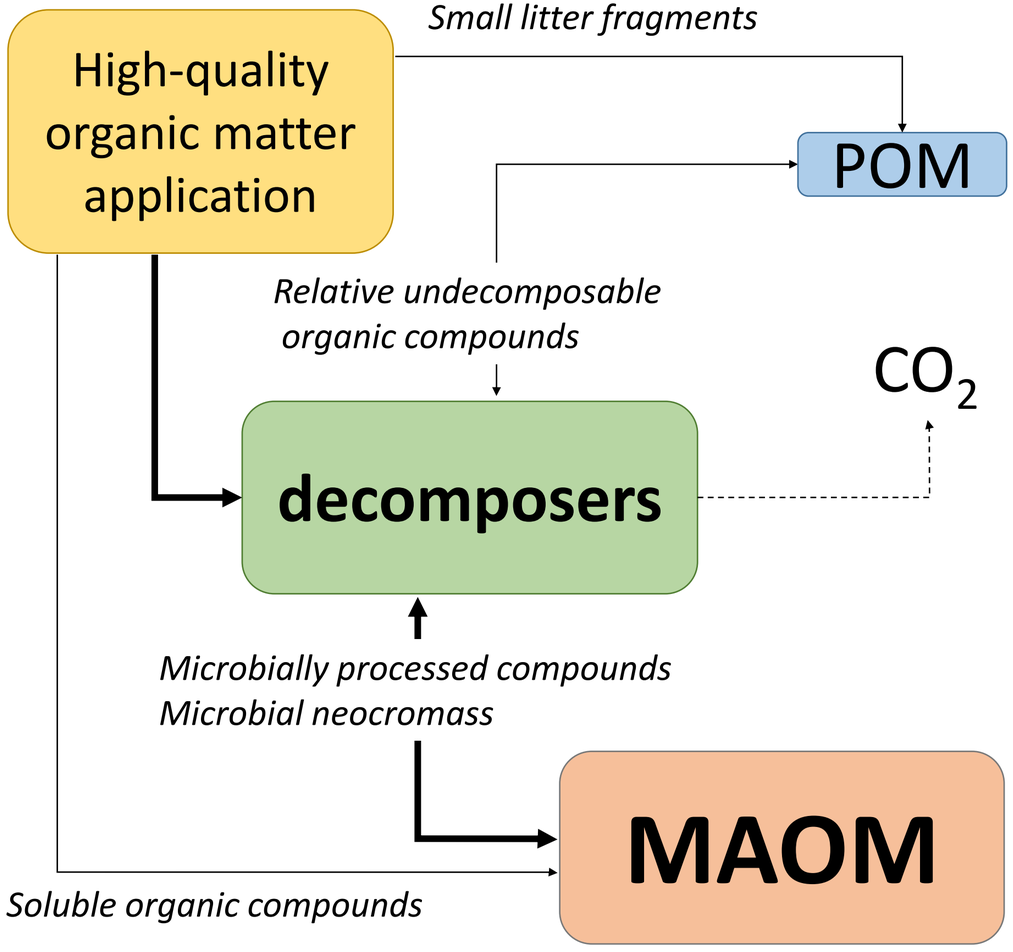


MAOM

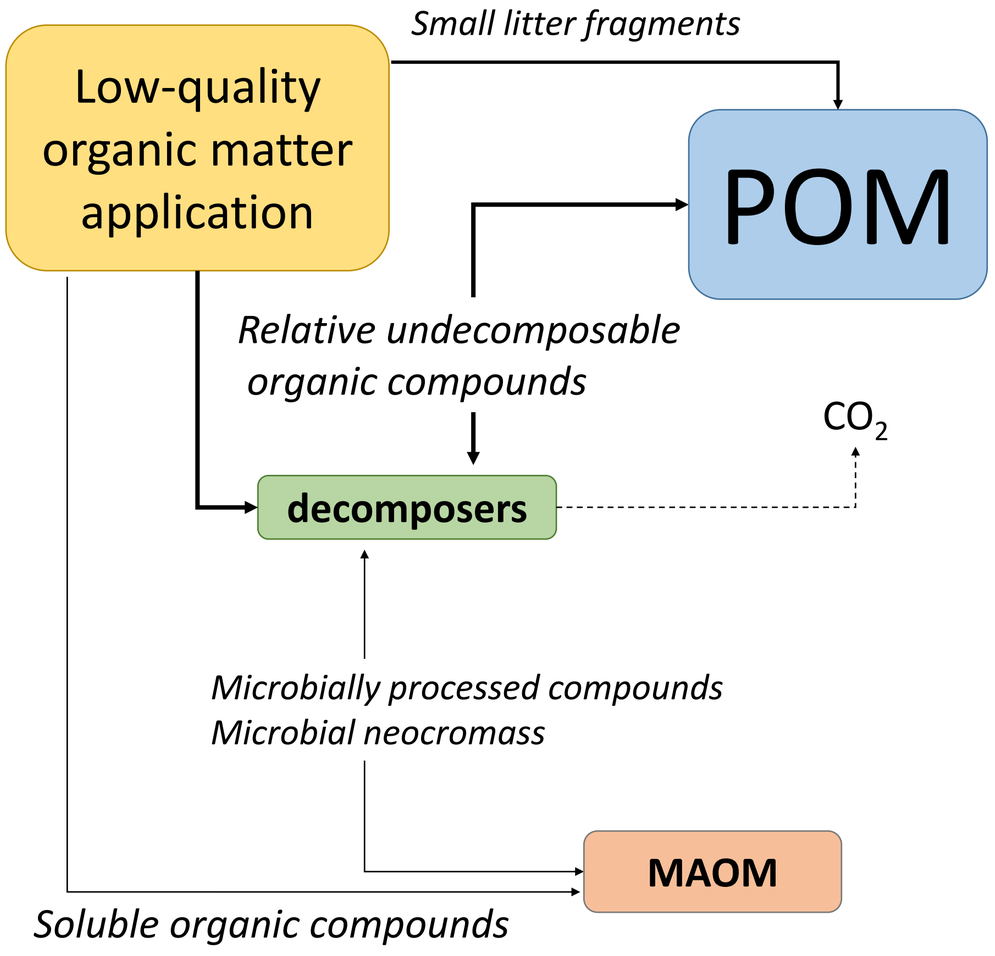


https://www.nibio.no/prosjekter/fangvekster-som-klimatiltak-i-norsk-kornproduksjon

Conditions that increase MAOM:

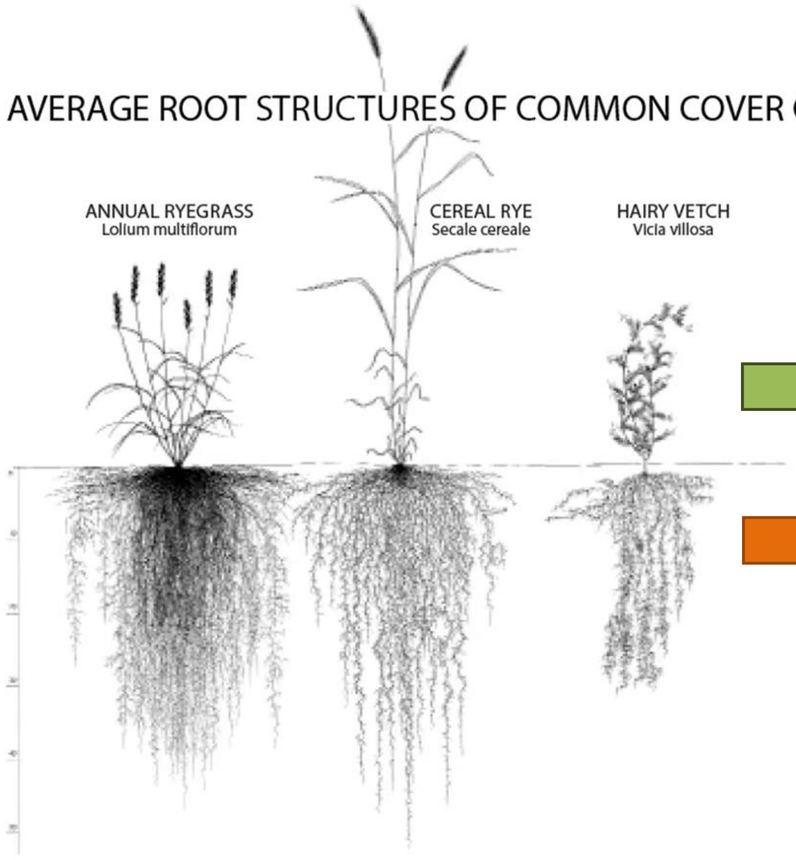


Conditions that increase POM:



Soil texture

Soil C after 1 y of residue incorporation



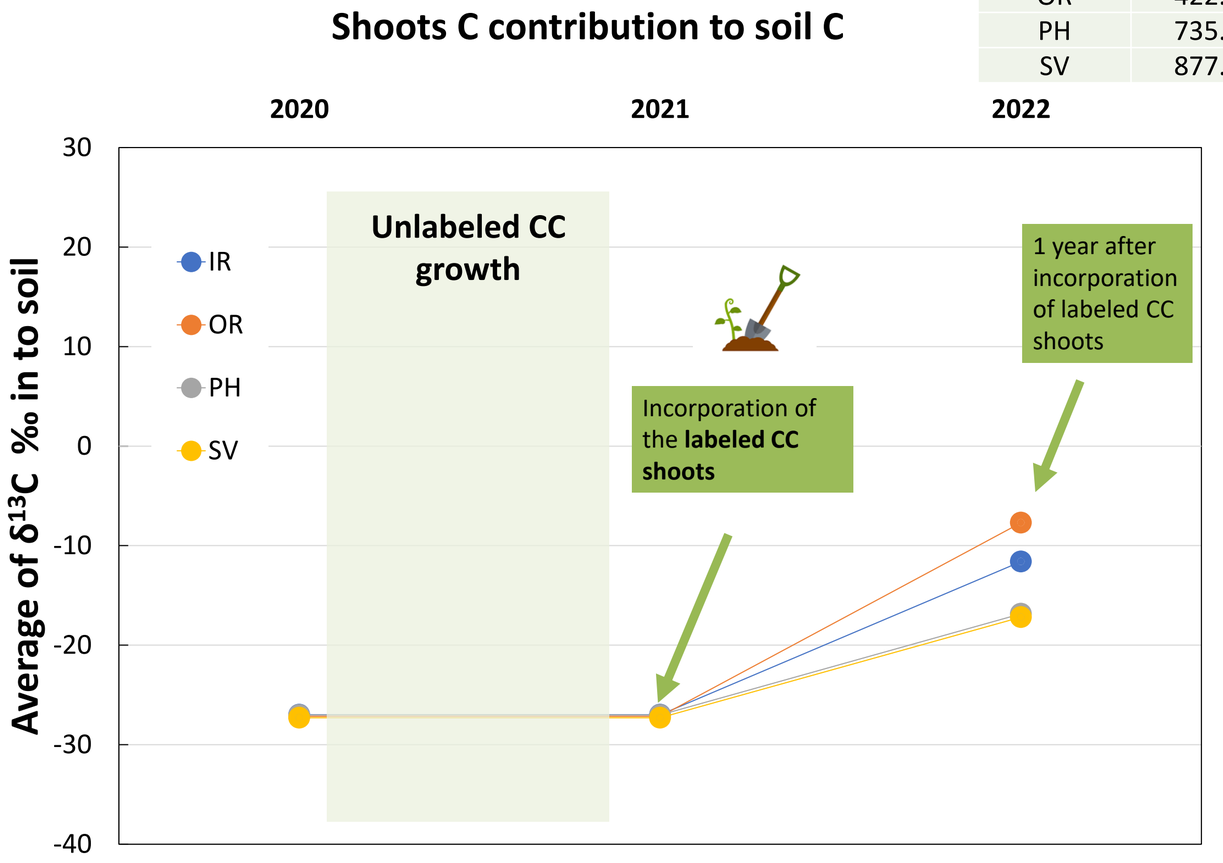
Above ground biomass

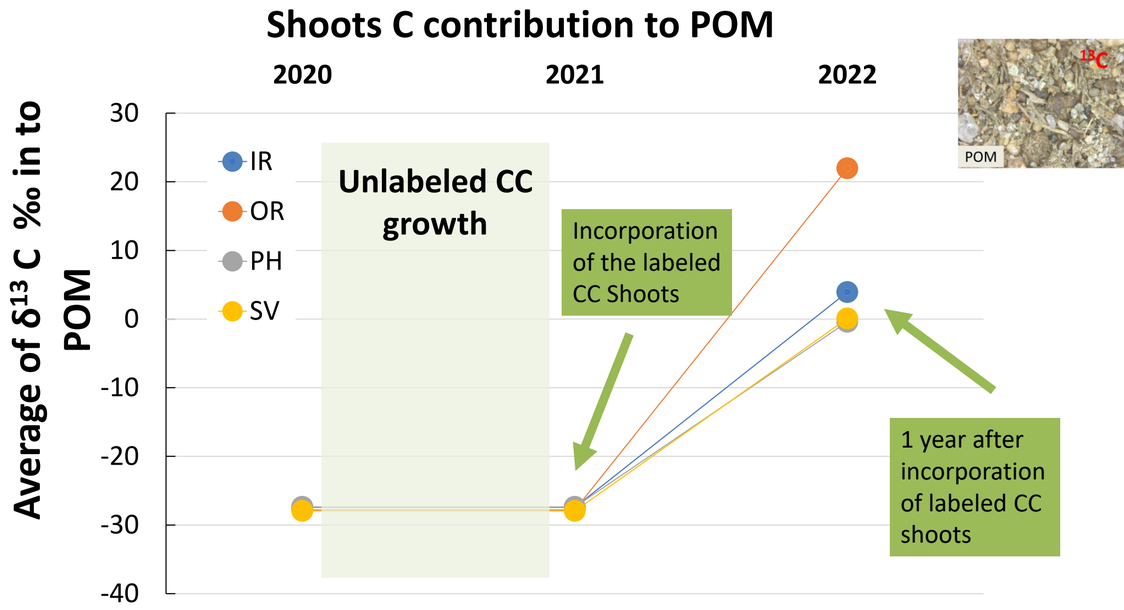
Below ground biomass

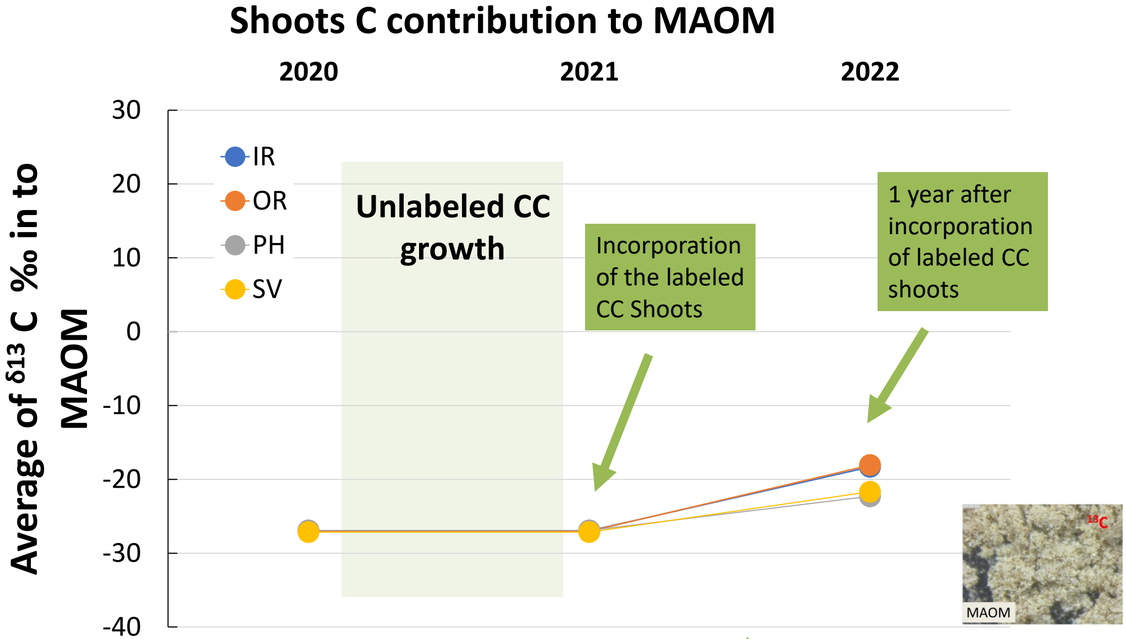
https://www.deere.com/en/publications/the-furrow/2021/sept-fall-2021/the-root-project/

Shoots contribution to soil and soil fractions carbon

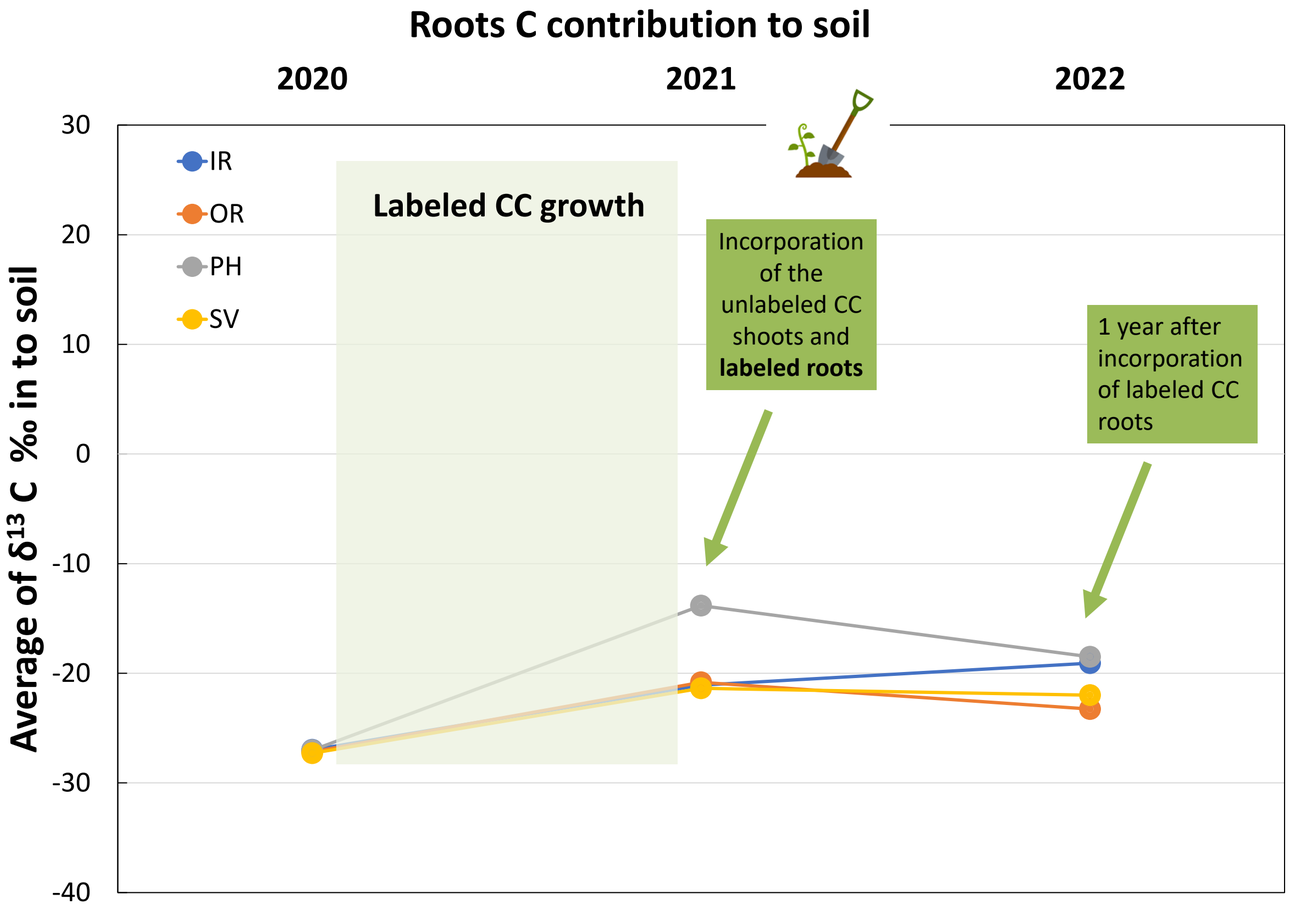
Shoots	δ¹³C ‰
IR	367. 5
OR	422.5
PH	735.5
SV	877.0

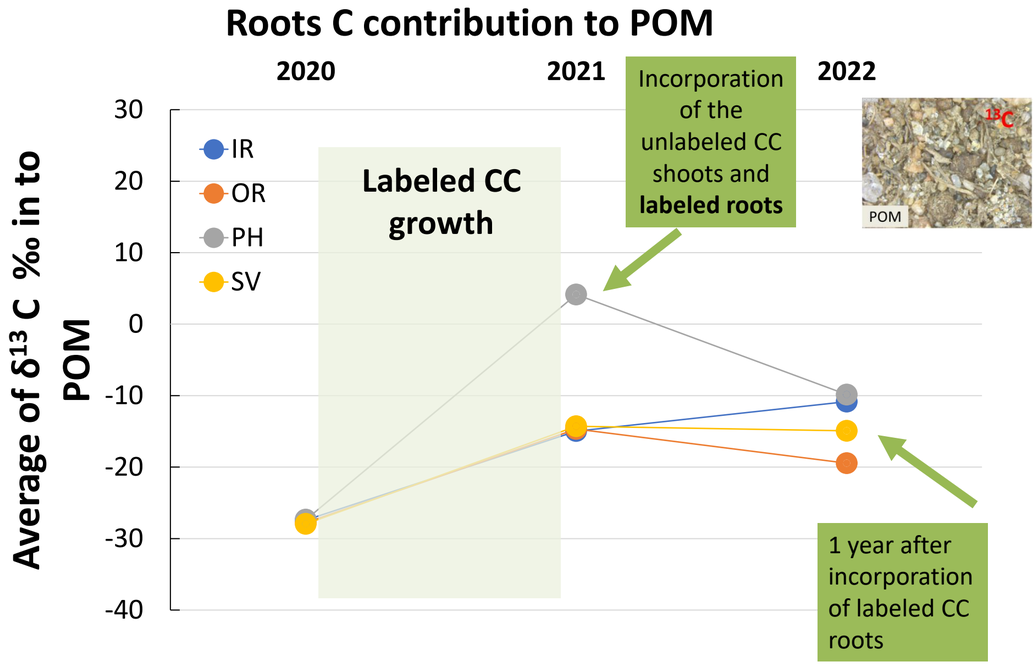


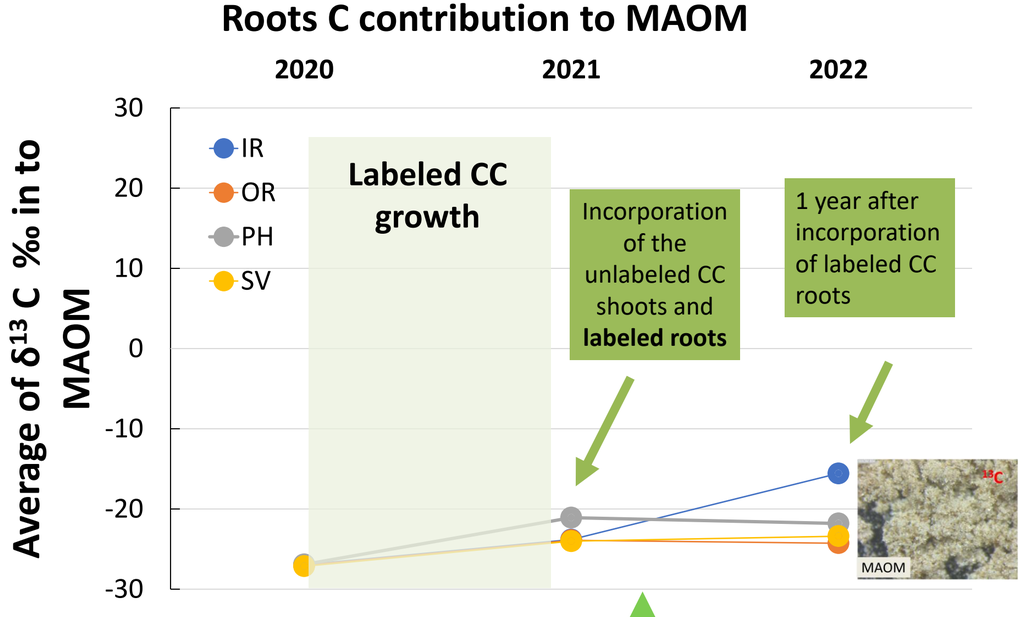




Roots contribution to soil and soil fractions carbon







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Take home message

- Cover crop species have different soil C storage potential
- Green shoots have a high potential to route C to MAOM fraction
- Root exudates enriched both POM and MAOM fractions with C during the growing season

www.norsok.no