SOIL CARBON SEQUESTRATION POTENTIAL OF GRASS-CLOVER LEYS

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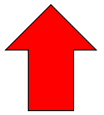
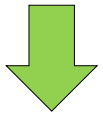
BACKGROUND

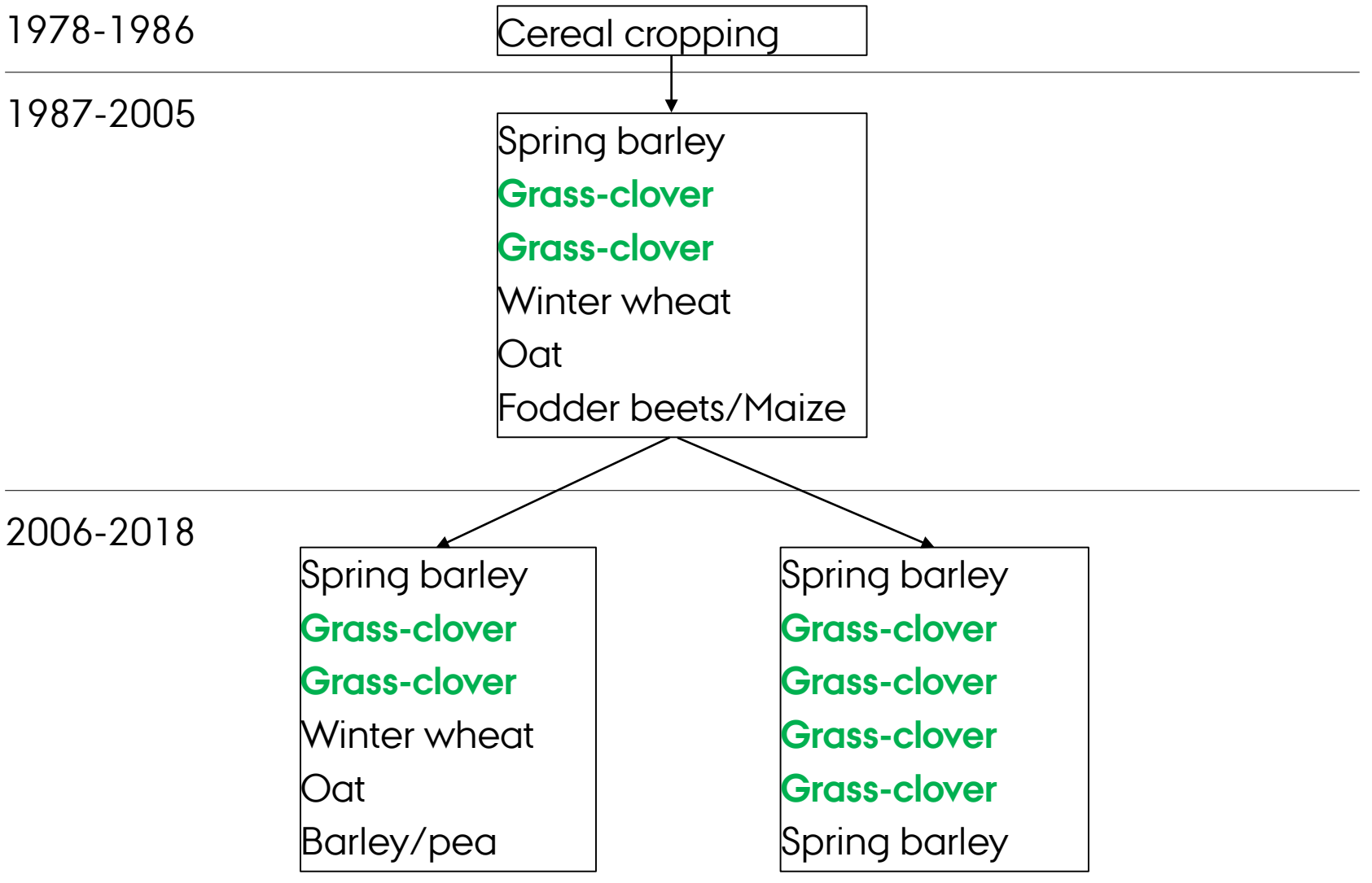
Why?

- Intensive dairy farming → greenhouse gas emissions 
- Grass-clover leys → SOC sequestration → greenhouse gas emissions 

Requirements

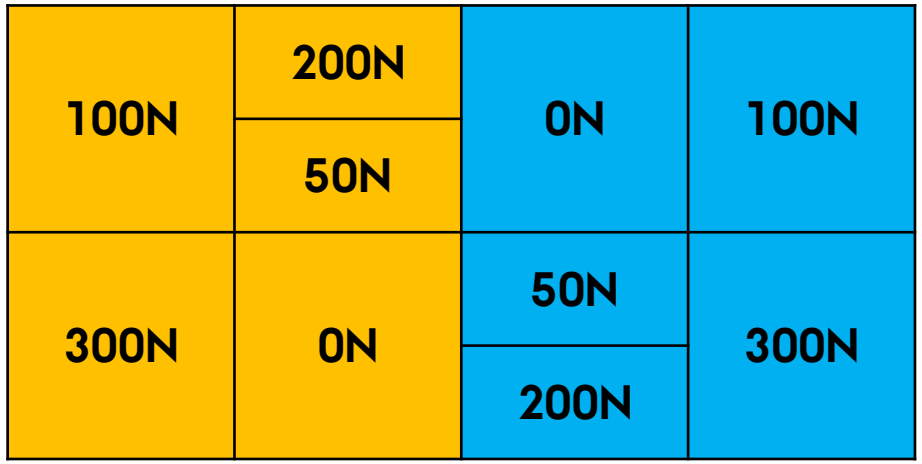
- Long-term experiments with frequent soil sampling and with crop rotations varying in grassland proportion

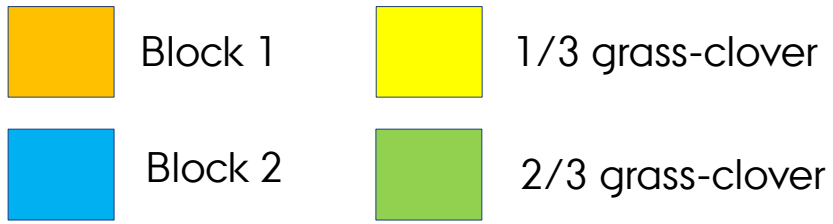
ORGANIC DAIRY CROP ROTATION EXPERIMENT



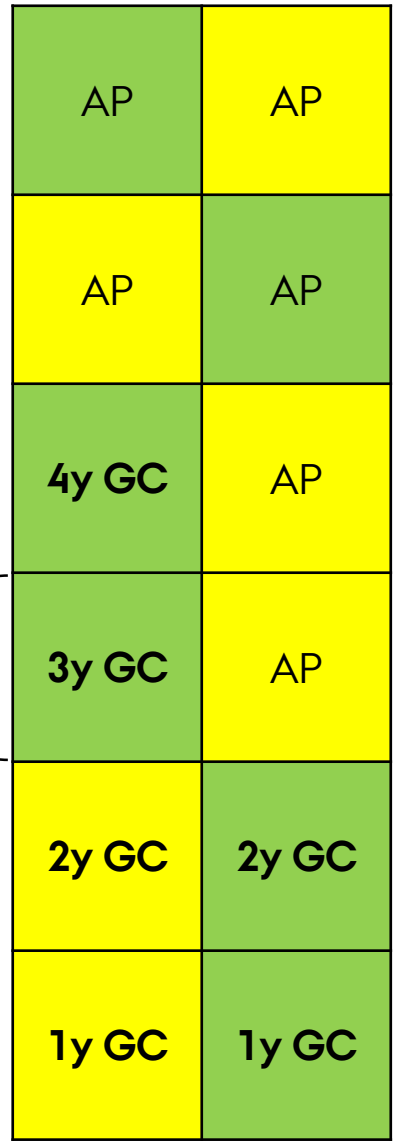
EXPERIMENTAL DESIGN

Cattle slurry N application (kg total-N ha^{-1}) in grasslands:



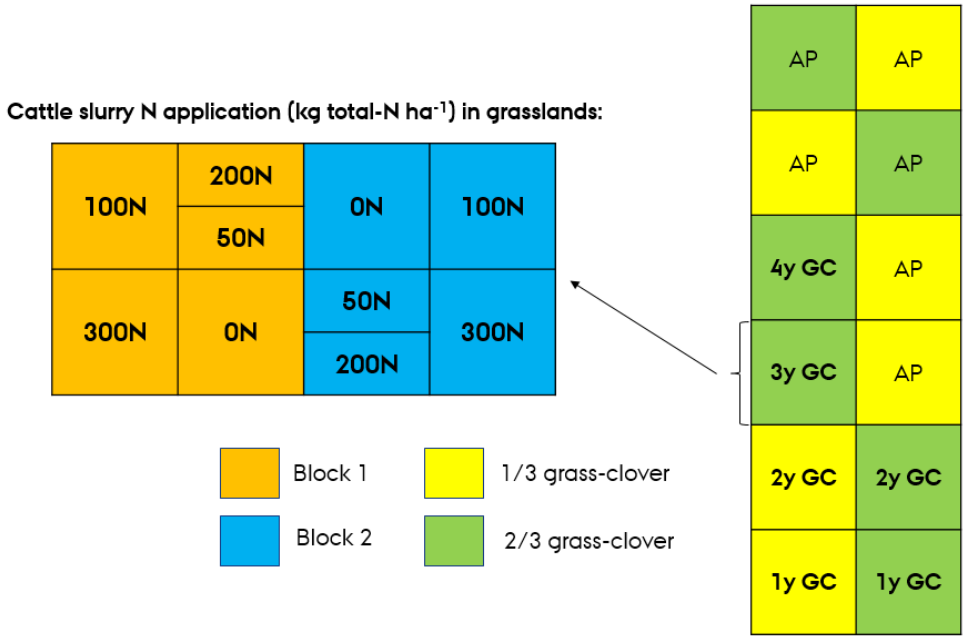


During 2006 to 2018:



GC=Grass-clover; AP=Arable phase

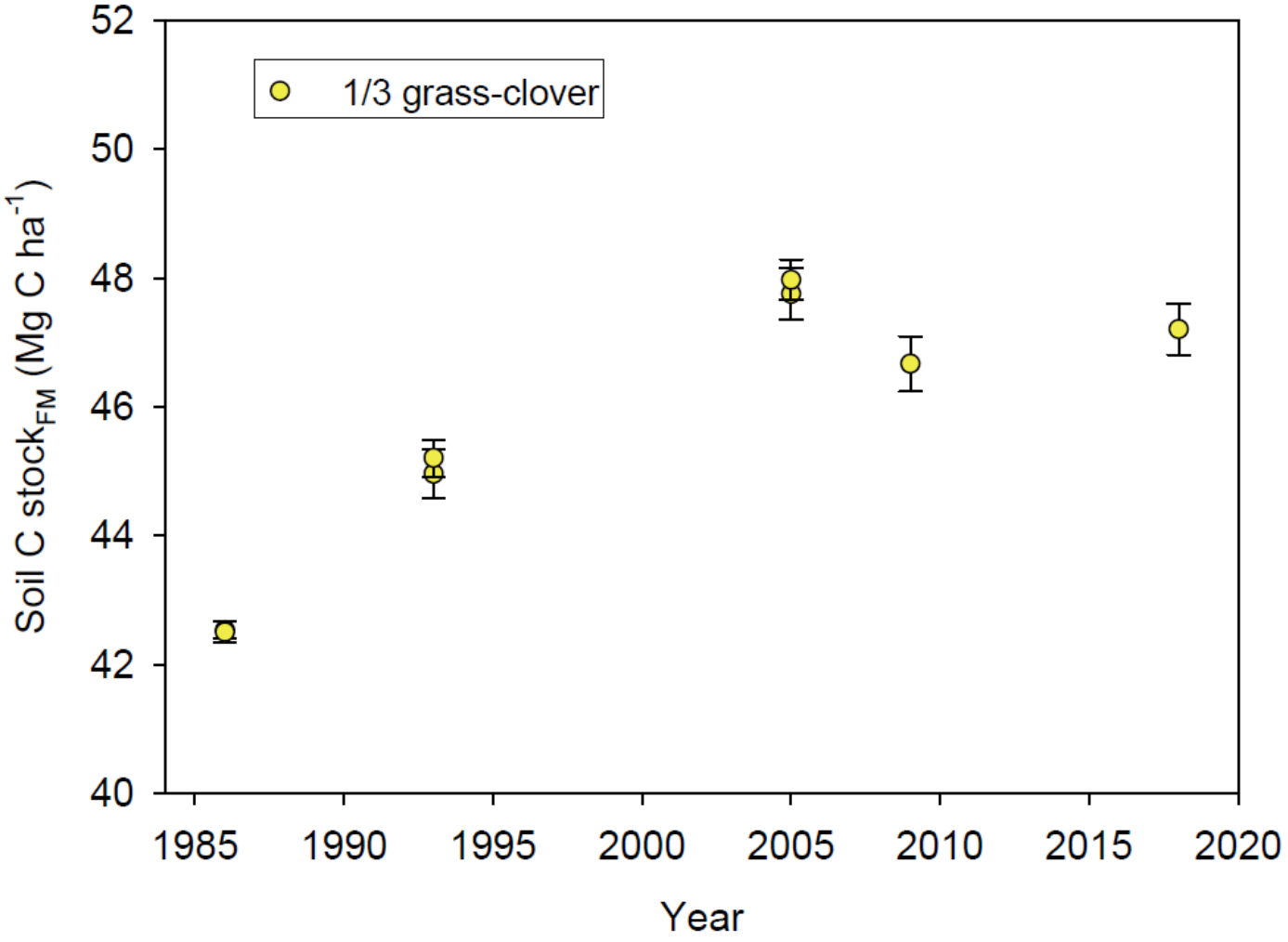
ORGANIC DAIRY CROP ROTATION EXPERIMENT



SAMPLING AND MEASUREMENTS

- SOC-analysis of archived soil samples sampled in the 0-20 cm soil layer during 1986-2018
- Determination of bulk density on soil cores (100 cm^3) sampled in the 6-10 cm soil layer in 2020

SOIL CARBON SEQUESTRATION POTENTIAL FOLLOWING CHANGES IN MANAGEMENT



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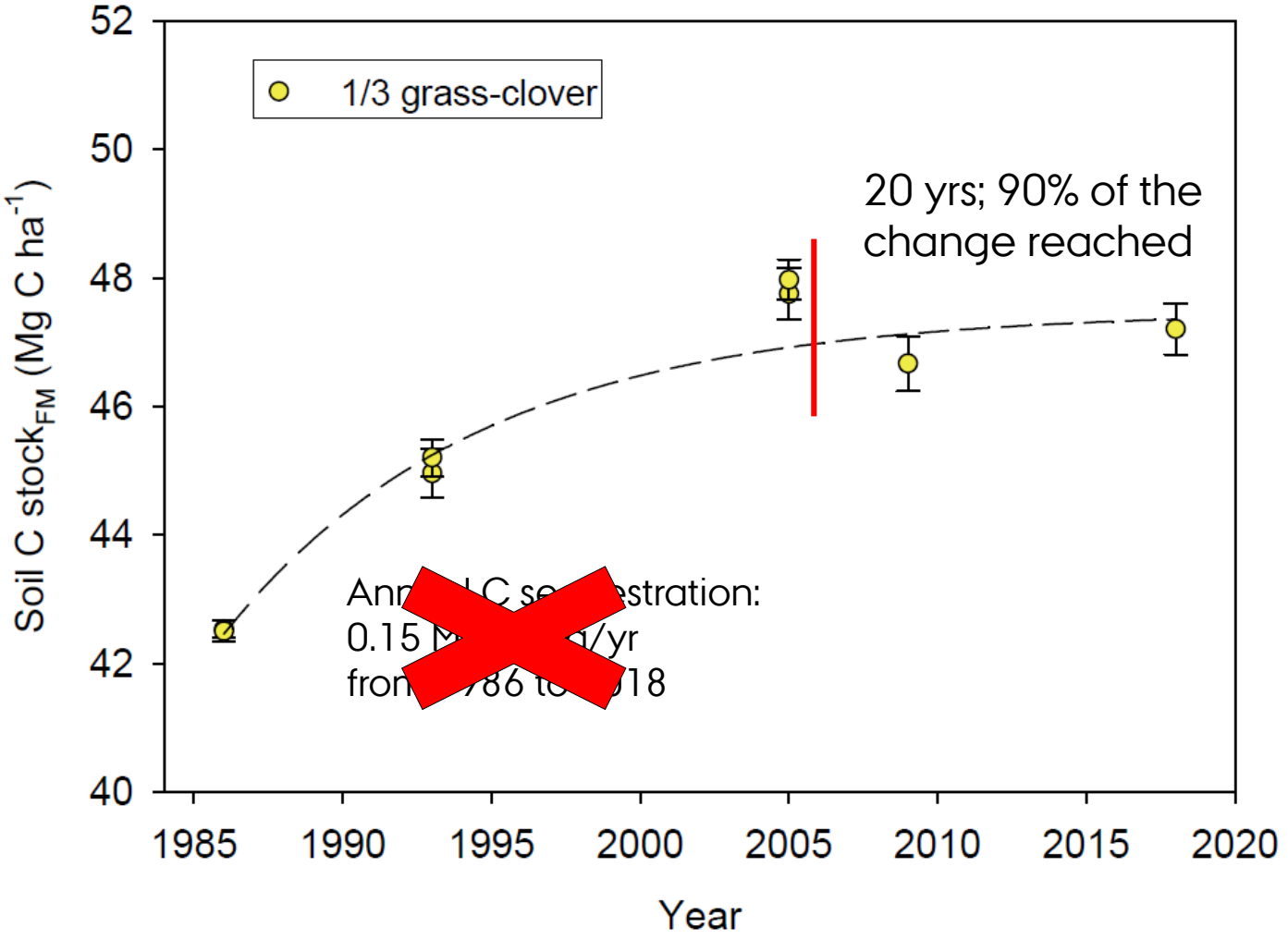

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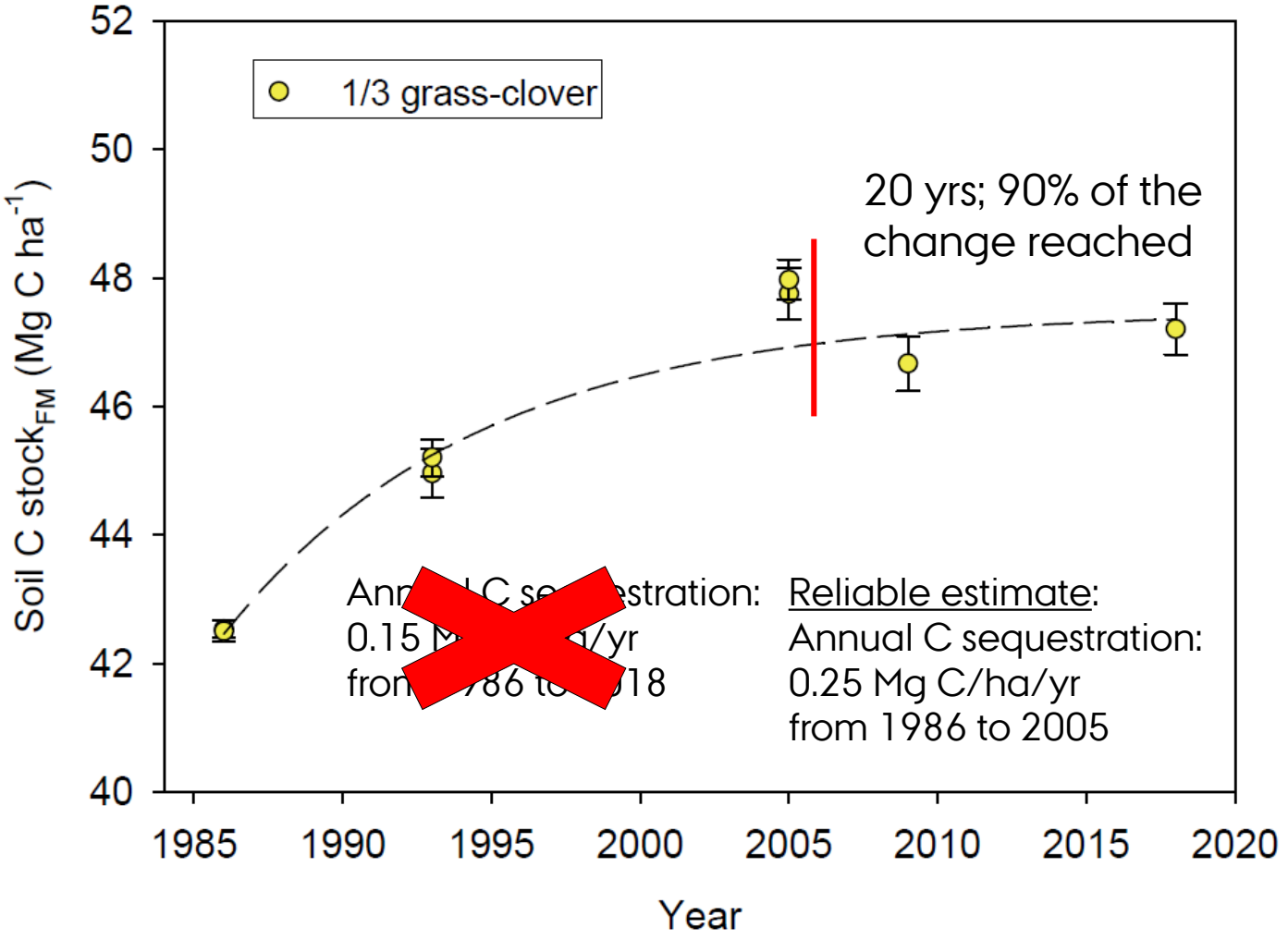

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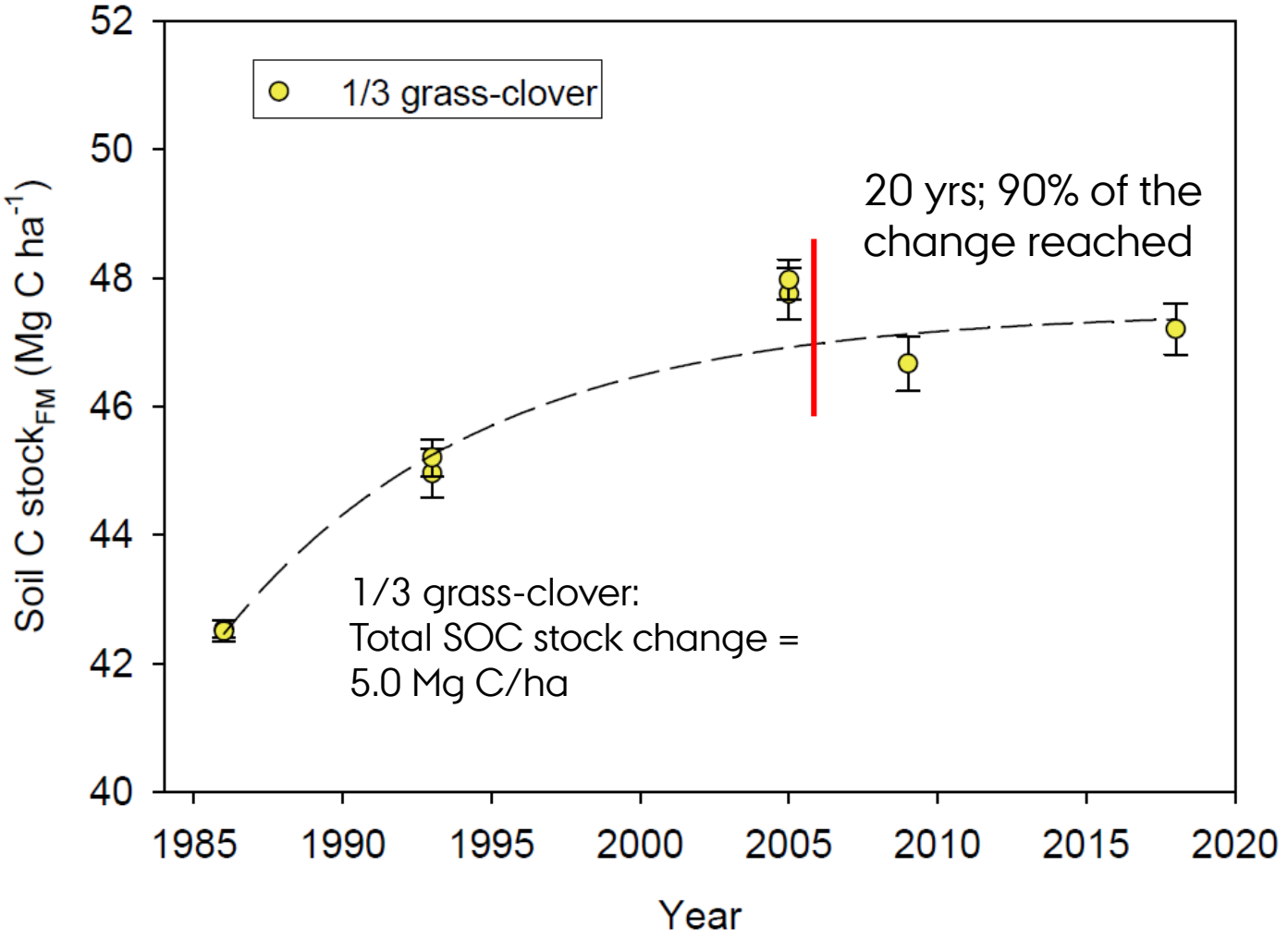

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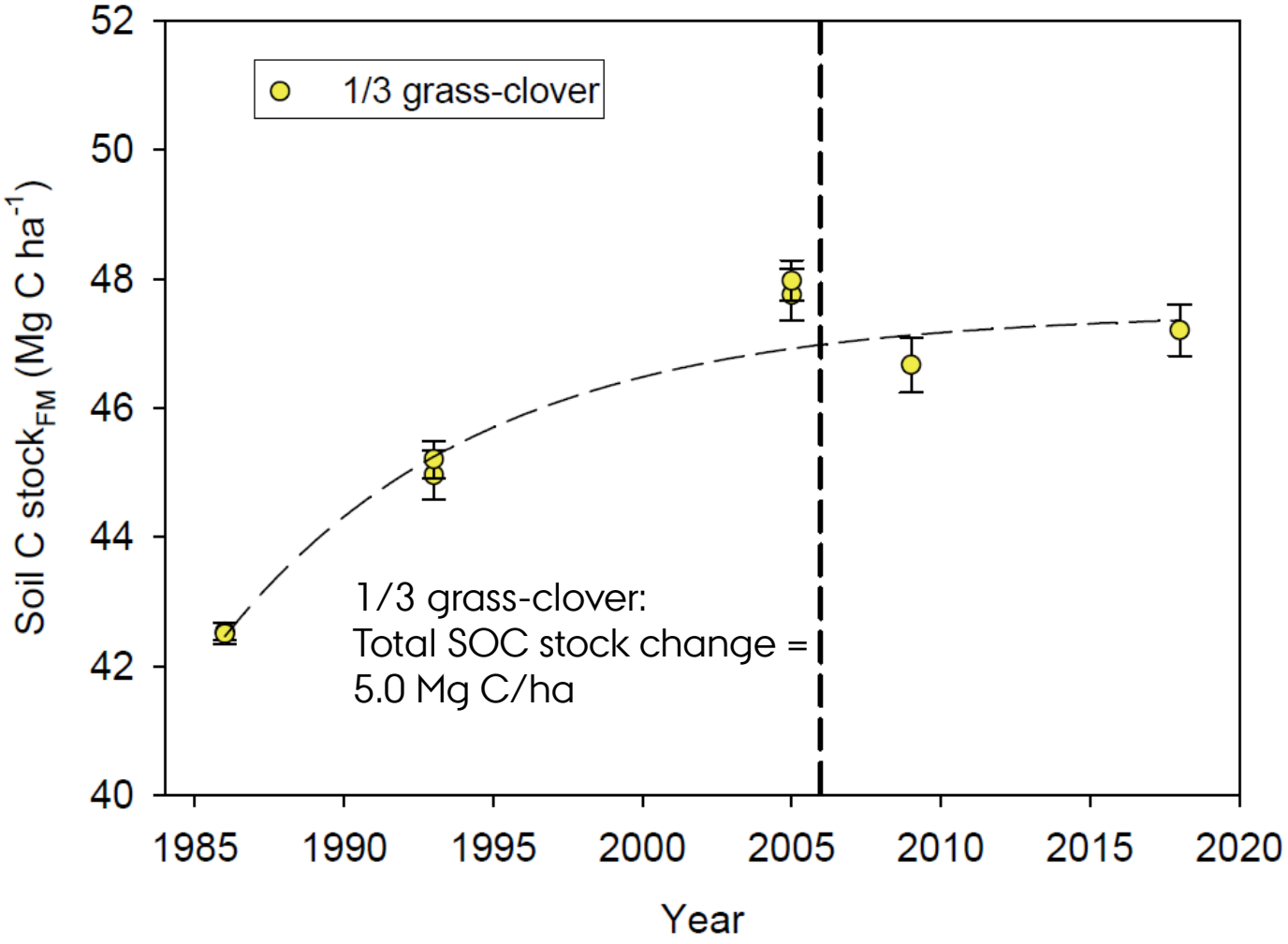

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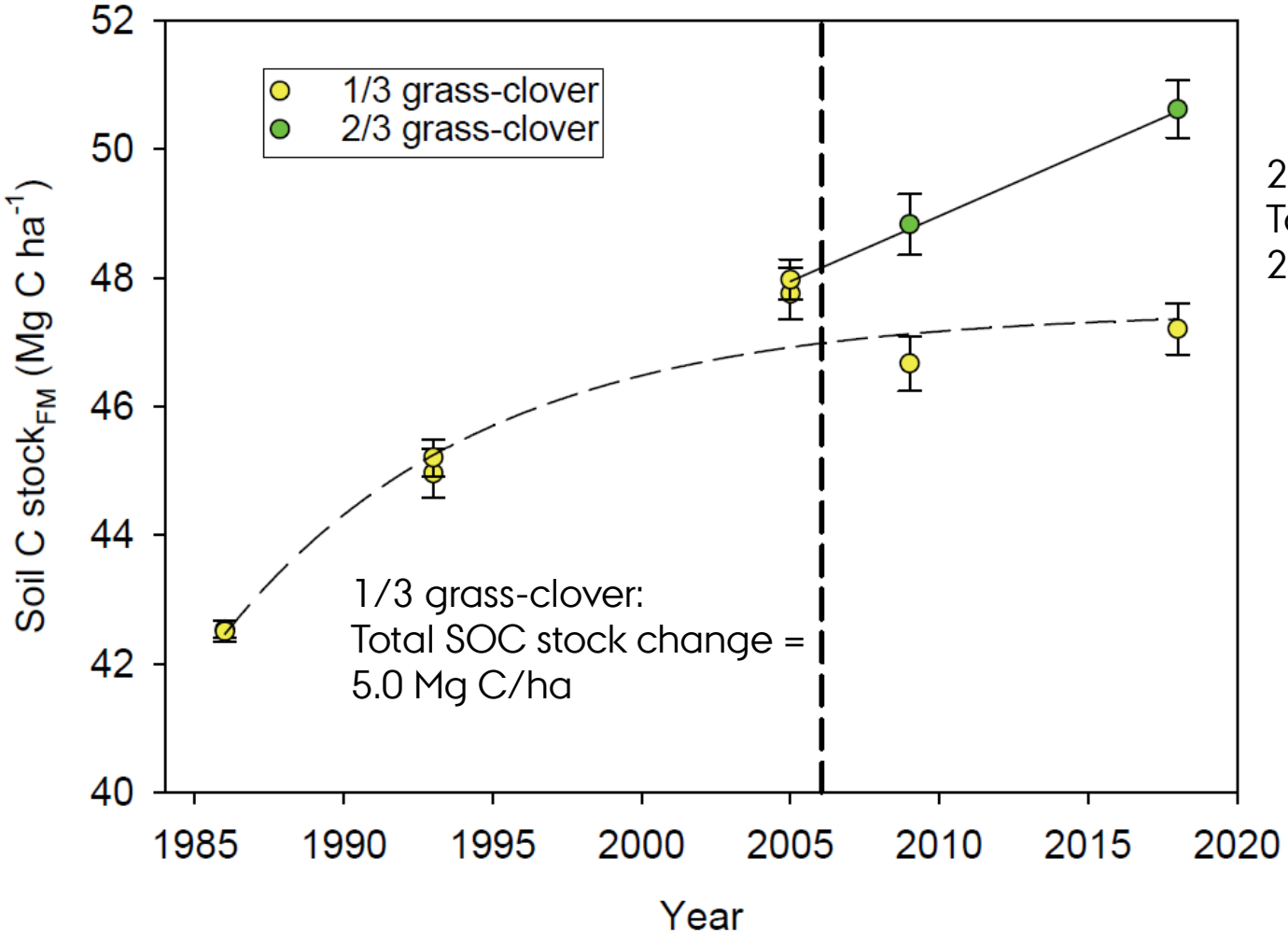
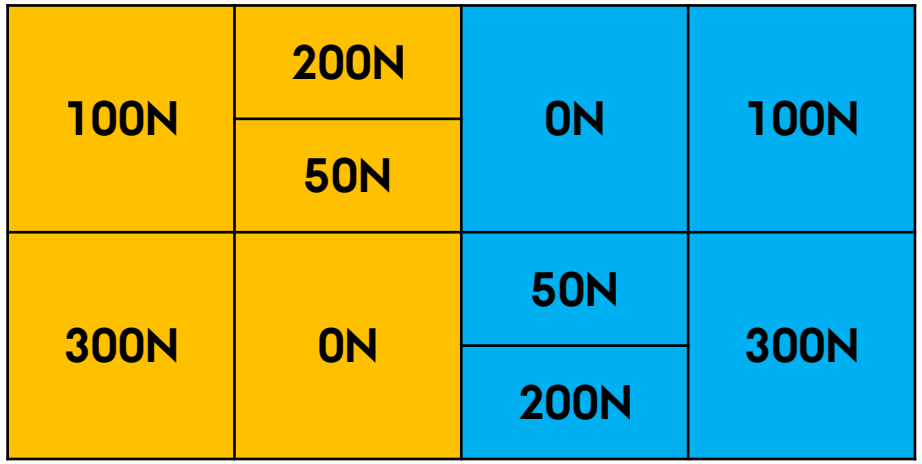
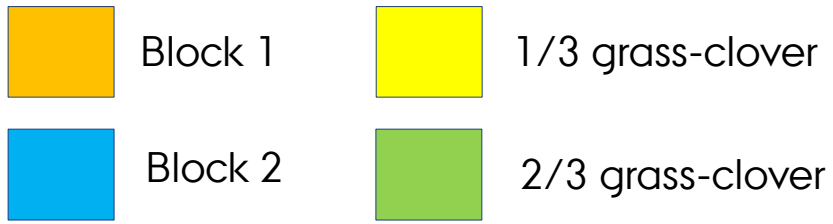


2/3 grass-clover:
Total SOC stock change =
2.7 Mg C/ha

MODELLING: CHANGES IN SOC STOCKS FROM 2005 TO 2018

Cattle slurry N application (kg total-N ha^{-1}) in grasslands:





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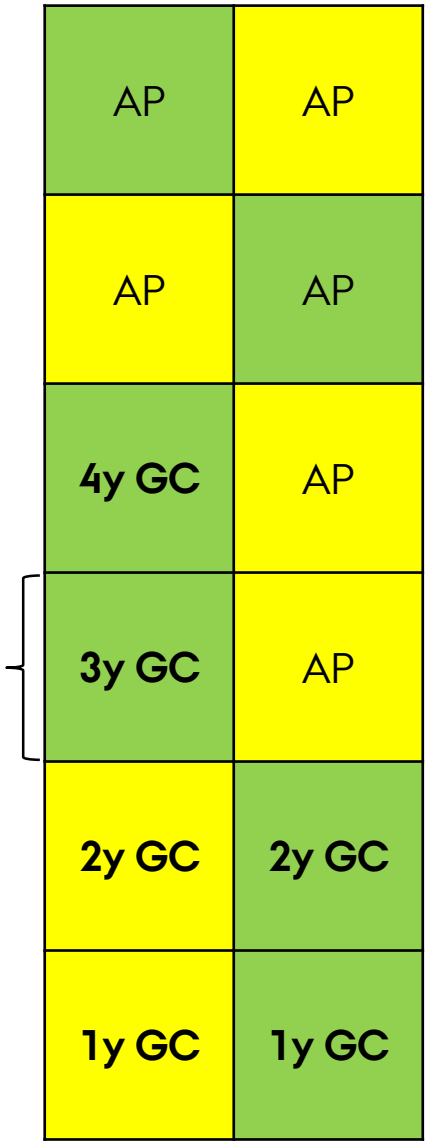

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MODELLING: CHANGES IN SOC STOCKS FROM 2005 TO 2018

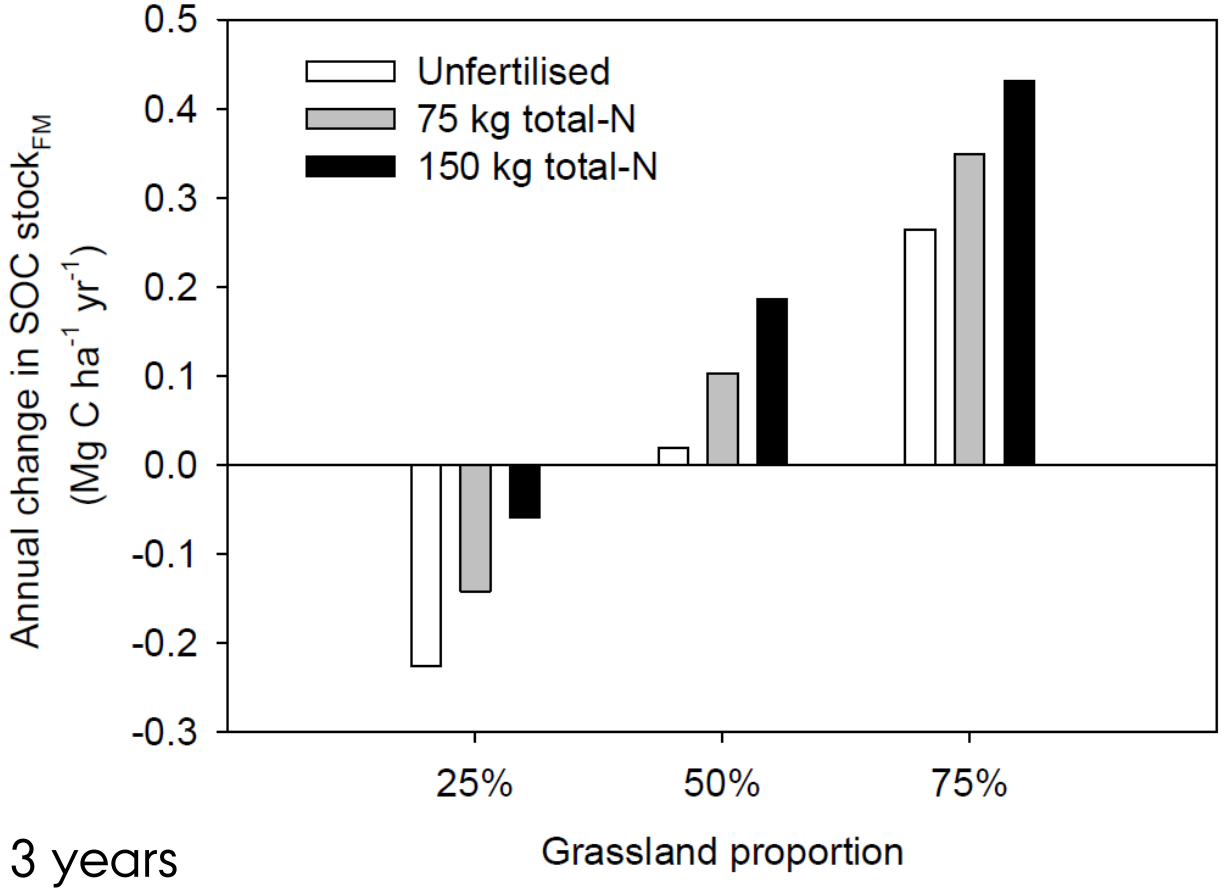
SOC stock change:

Grassland proportion (31-69%) +

Slurry C-input (0-1.45 Mg C/ha/yr) +

SOC stock in 2005,

R^2=0.47

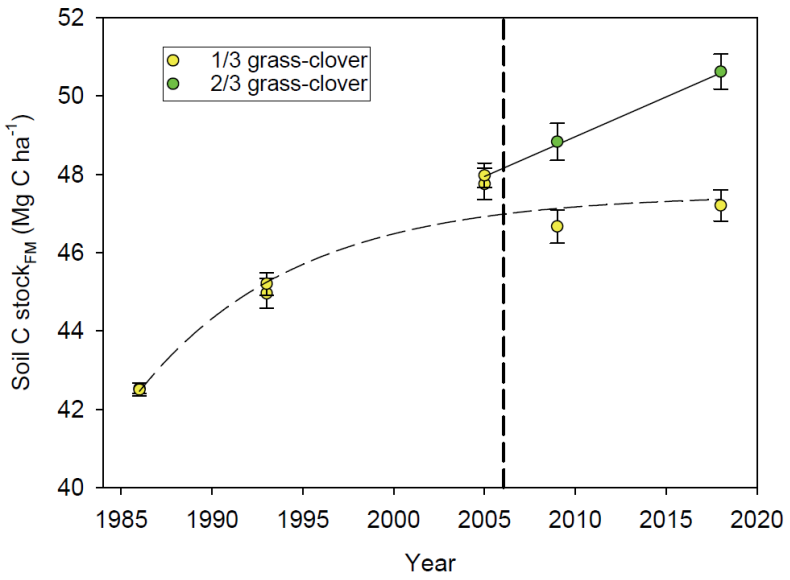


Results:

- Increasing the grassland proportion by 25% will increase SOC sequestration with 3.2 Mg C/ha (0.25 Mg C/ha/yr) during the 13 years
- 11% of the applied slurry-C was retained in the soil

CONCLUSIONS

- SOC stocks increased with an increasing share of grass-clover in the crop rotation
- Of applied slurry-C, 11% was retained in soil
- Reliable assessments require the initial SOC content and frequent soil sampling until reaching steady-state conditions



ACKNOWLEDGEMENTS

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