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# GRASSLANDS FOR SOIL ORGANIC MATTER STORAGE IN CROP-LIVESTOCK SYSTEMS

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Intensively managed crop-livestock systems combine a diversity of cropping systems differing in i) grass proportion and duration in ley-arable rotations, ii) carbon and nitrogen inputs to soil via plant residues + manure, iii) local soil and climate conditions.

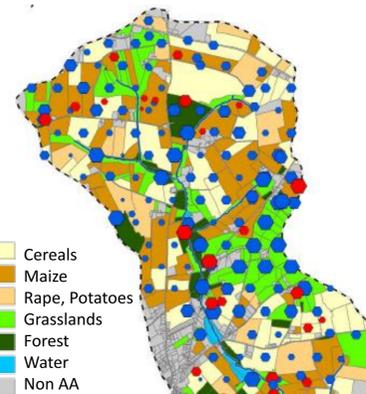
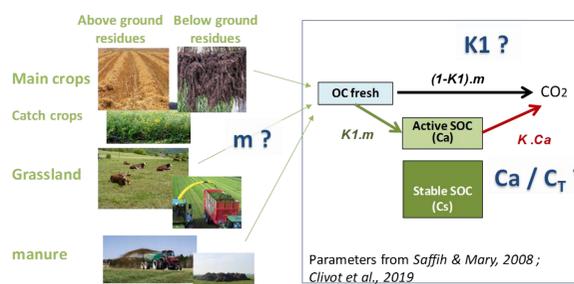
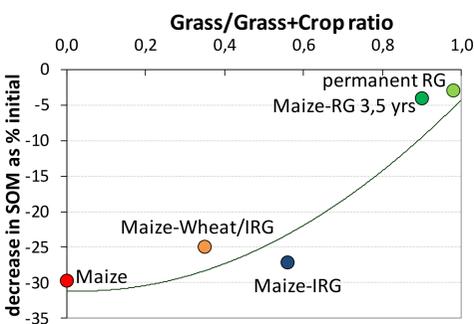
## We aimed to identify main drivers of SOC stocks, storage or release comparing 3 types of crop rotations

- Crops : Maize monoculture with or without Italian Ryegrass as catch crop, Maize-Wheat+IRG as cc
- Ley-arable : Maize – (cereals) – grasslands
- Permanent grasslands



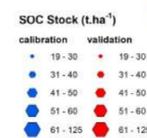
In a long term experiment (Western Brittany, 27 years, initial C stock (0-25 cm)  $\approx 89 \text{ tC}\cdot\text{ha}^{-1}$   $\rightarrow$  measurements + simulation of SOC storage/release with AMG Model (Clivot et al., 2019, *Envir. Model. & Software*, 118, 99-113)

In a fields network (Centre-Brittany, SOERE Agrhys, C stocks  $\approx 40\text{-}60 \text{ tC}\cdot\text{ha}^{-1}$  (0-25 cm)  $\rightarrow$  measurements + soil quality index (Viaud et al., 2018, *AGEE*, 265, 166-177)

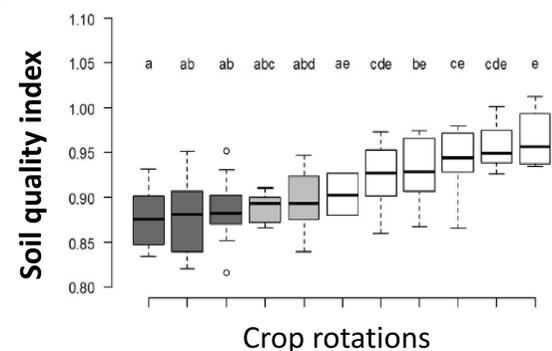


Mean C stocks  $47,7 \text{ t}\cdot\text{ha}^{-1}$  (20-125)

Influenced by crop rotations and management, then silt rate and location along slopes



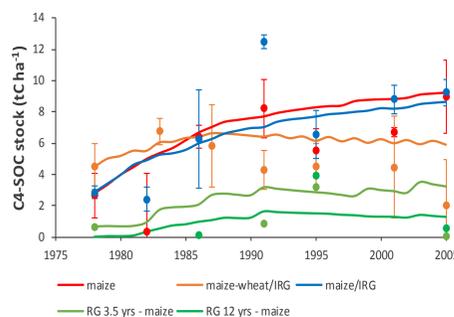
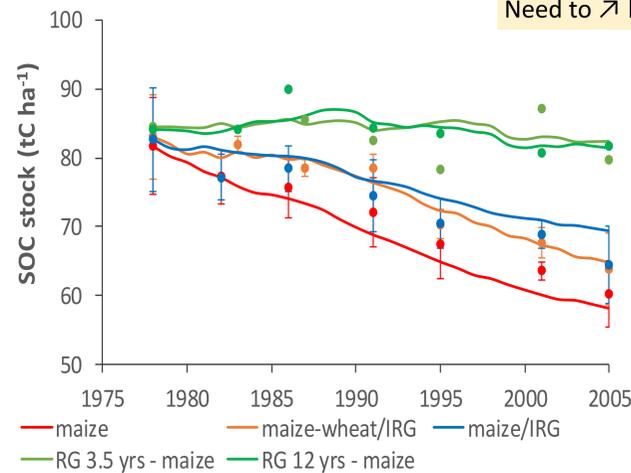
Soil Quality Index integrates physical, chemical and microbiological components (Viaud et al., 2018)



Grain maize – wheat, Silage maize – crops, Ley-arable

Proportion of grassland  $\approx$  good proxy to predict long term SOC evolution

AMG model simulates correct SOC evolution and part of new organized SOC from maize and slurry inputs (C4). Need to  $\nearrow$  knowledge on C inputs in grassland soils



Proportion and duration of grasslands in rotations appeared as the first factor explaining SOC stocks and their evolution in crop-livestock systems. Grasslands also favored higher soil biological diversity (macro-fauna, microorganisms) and activity.

Increased SOC stocks with increasing grassland proportion can be explained by higher C inputs to soil compared to annual crops with straw usually exported. According to AMG simulations, total humified C inputs were more than two fold higher in long-term grassland compared to silage maize monoculture (2 vs.  $0.8 \text{ t C ha}^{-1}\cdot\text{yr}^{-1}$ ).

These results highlight the interest of grasslands for agro-ecological mixed crop-livestock areas.

Further development in CarSolEI