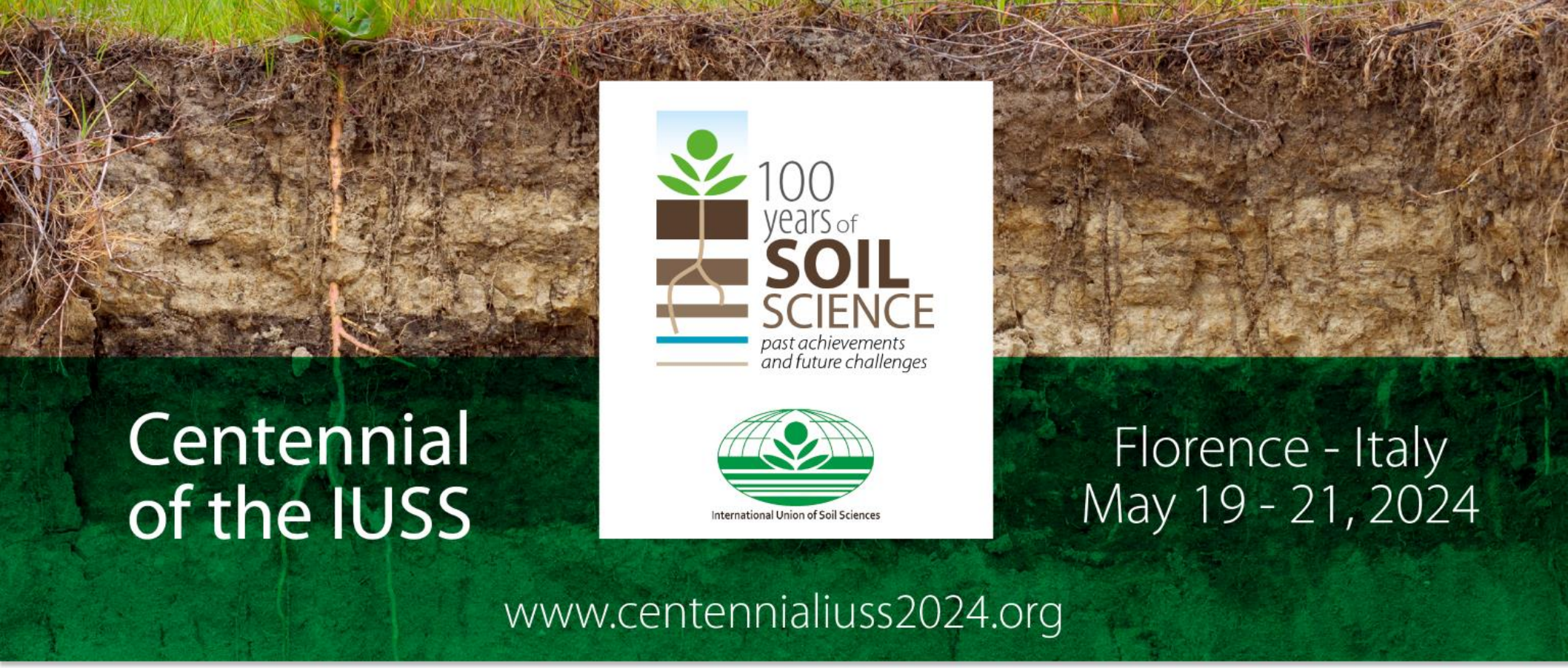
Crop residue management impact N2O emissions: results from 10-years-8-cropping-systems field experiment.

Paul Belleville, Frida Keuper, Fabien Ferchaud, Bruno Mary, Heinesch Bernard, Benjamin Dumont, Joël Léonard



P. Belleville, F. Keuper, F. Ferchaud, B. Heinesch, B. Dumont, J. Léonard

Crop residues managements impacts on N_2O emissions: results from 10-years-8-cropping-systems field experiment

Agenda

Introduction: N_2O and crop residues

M&M: long-term experiment and statistical tools

R&D: dataset and ranking crop residues among other candidate drivers

Conclusion - Q&A

N_2O and crop residues

Problems:

- Greenhouse gas
- Stratospheric ozone depletion
- Waste of resources

Origins:

- Redox; Incomplete reduction
- ~40% Human activities; ~67% Agriculture

Incorporating straw in top soil layer with a disc-harrow

Plowing freshly mowed covercrop

How much do the quantity and quality of restituted crop residue influence N_2O emissions in comparison to other drivers?

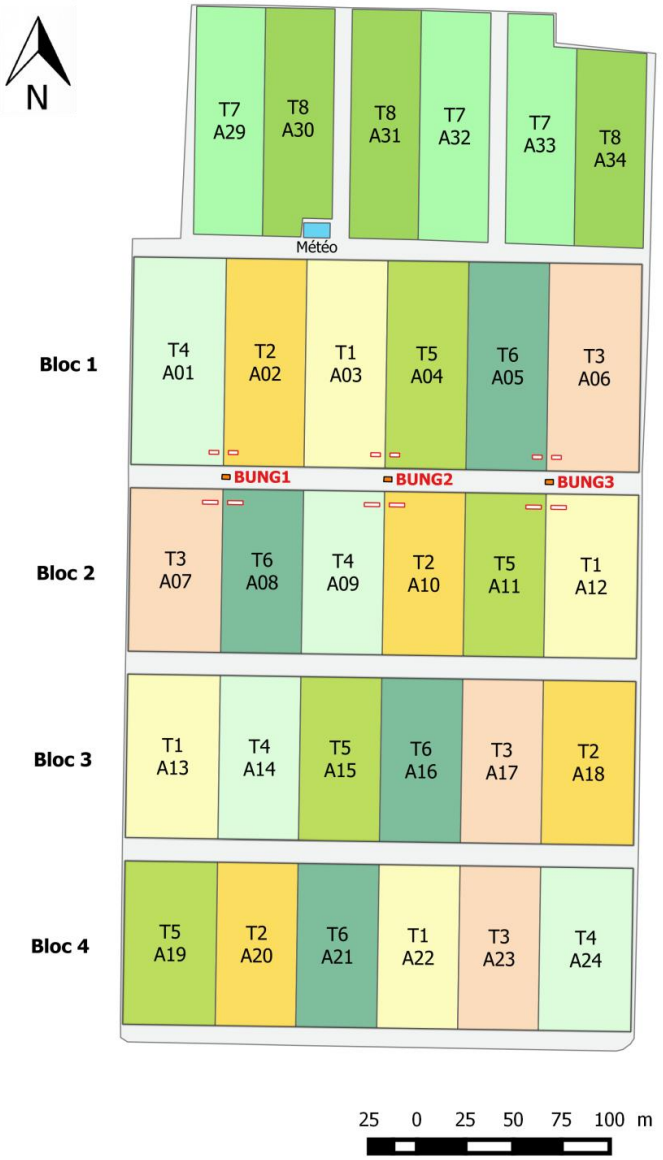
M&M. long-term experiment and statistical tools

M&M. Study site

ACBB long-term experiment in Estrées-Mons (Hauts-de-France)

- 6 treatments in 4 randomized complete blocks design + 2 treatments in 3 randomized complete blocks design
- Soil is deep silt loam, pH is 8.2
- Climate is oceanic with continental influence (avg. air temperature 11°C, avg. Rainfall 638 mm·year^{-1}

https://www.soere-acbb.com/

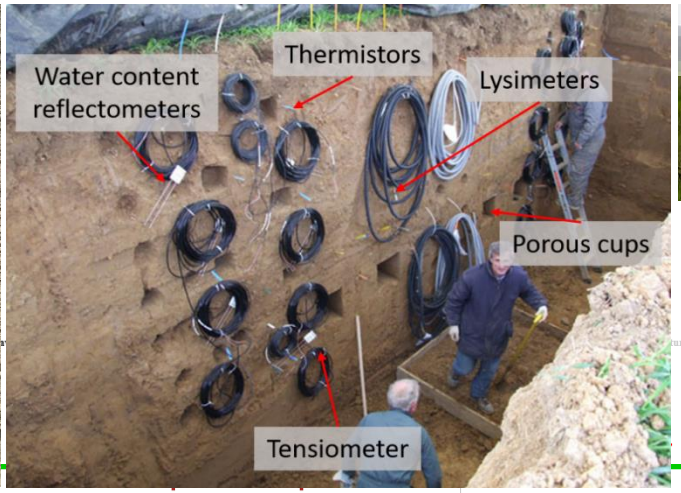


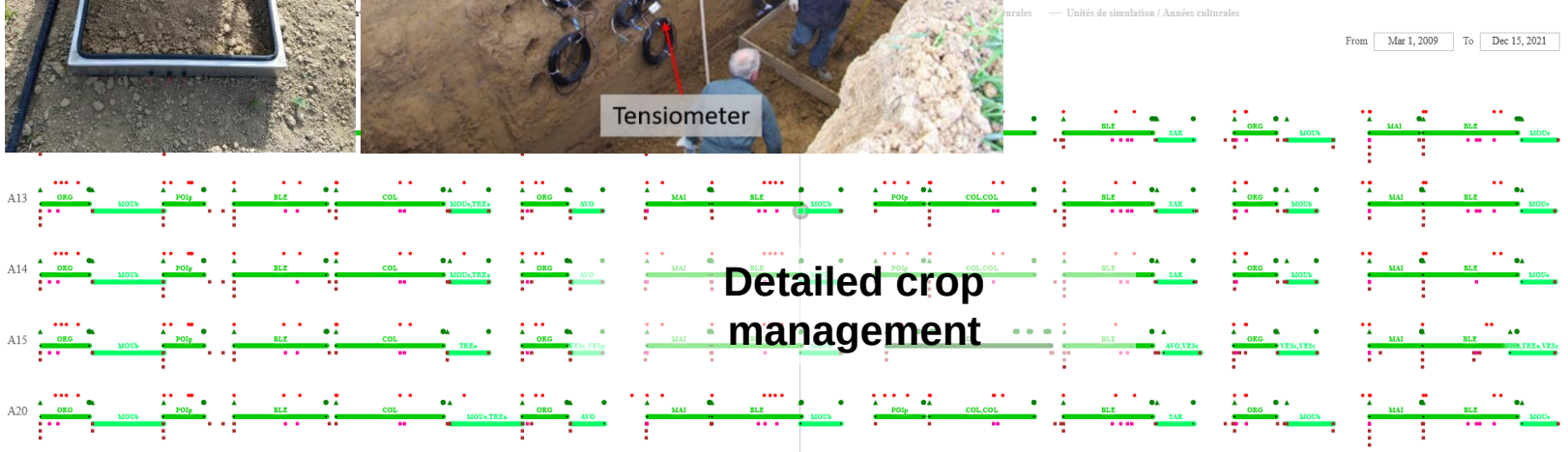
M&M. Experimental treatments

	CONV	RT	RT-RR	RN	RN-LEG	RR-PER	ORG	ORG-LEG
Plowing	✓	×	×	✓	✓	×	✓	✓
Exportation of cash crop residues	×	×	✓	×	×	✓	×	×
Mineral N (% of ref. dose)	100%	100%	100%	35%	35%	100%	0%	0%
Legumes' frequency	low	low	low	low	high	low	low	high
Perennial crops within succession	×	×	×	×	×	✓	×	×
Chemical protection	✓	✓	✓	✓	low	✓	×	×

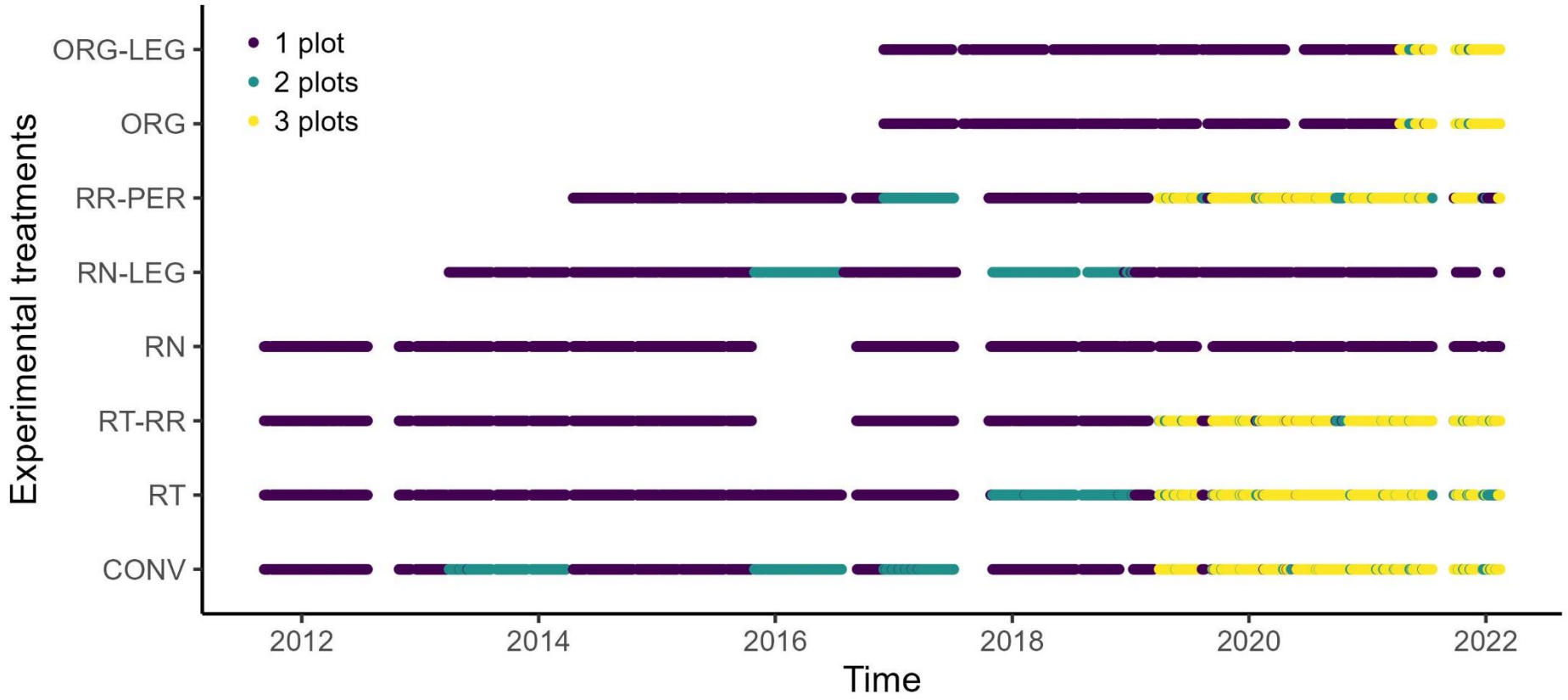
M&M. Equipments

Database

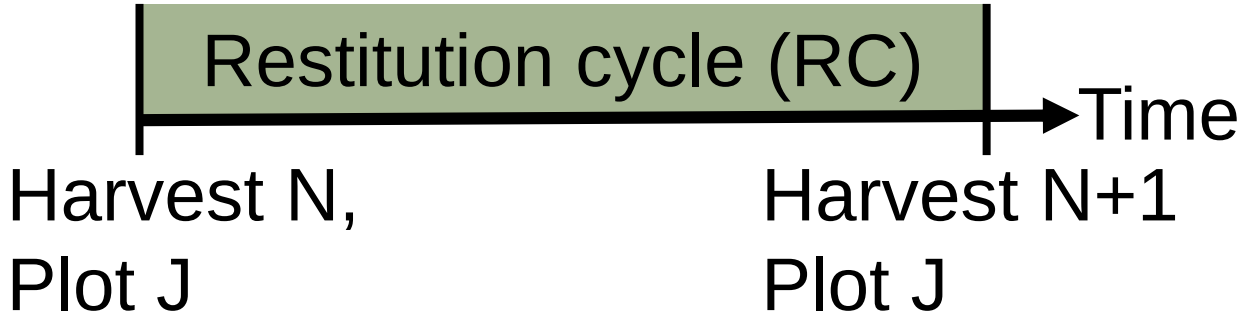




M&M. N_2O sampling



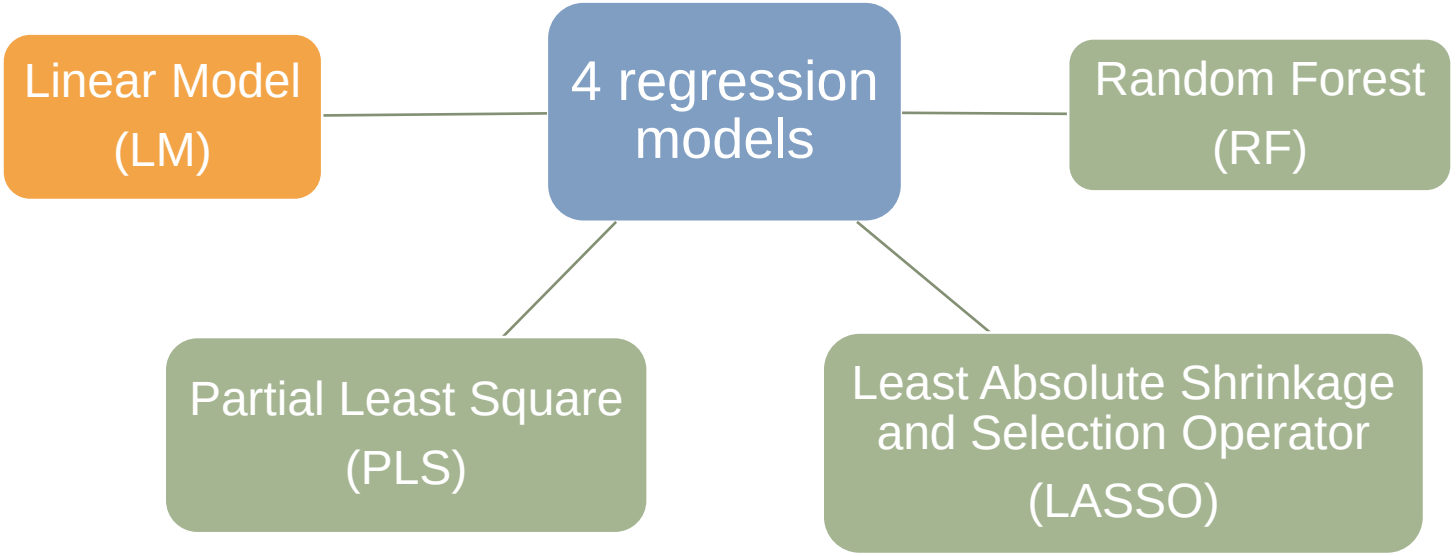
M&M. Restitution cycles



Cumulative N_2O emissions

- Crop residue biomass returned to the soil (C, N, dry matter)
- Weather
- Mineral nitrogen fertilization
- Soil moisture and temperature

M&M. Predict cumulative N_2O emissions in between two crop residues restitutions



R&D. dataset and ranking crop residues among other candidate drivers

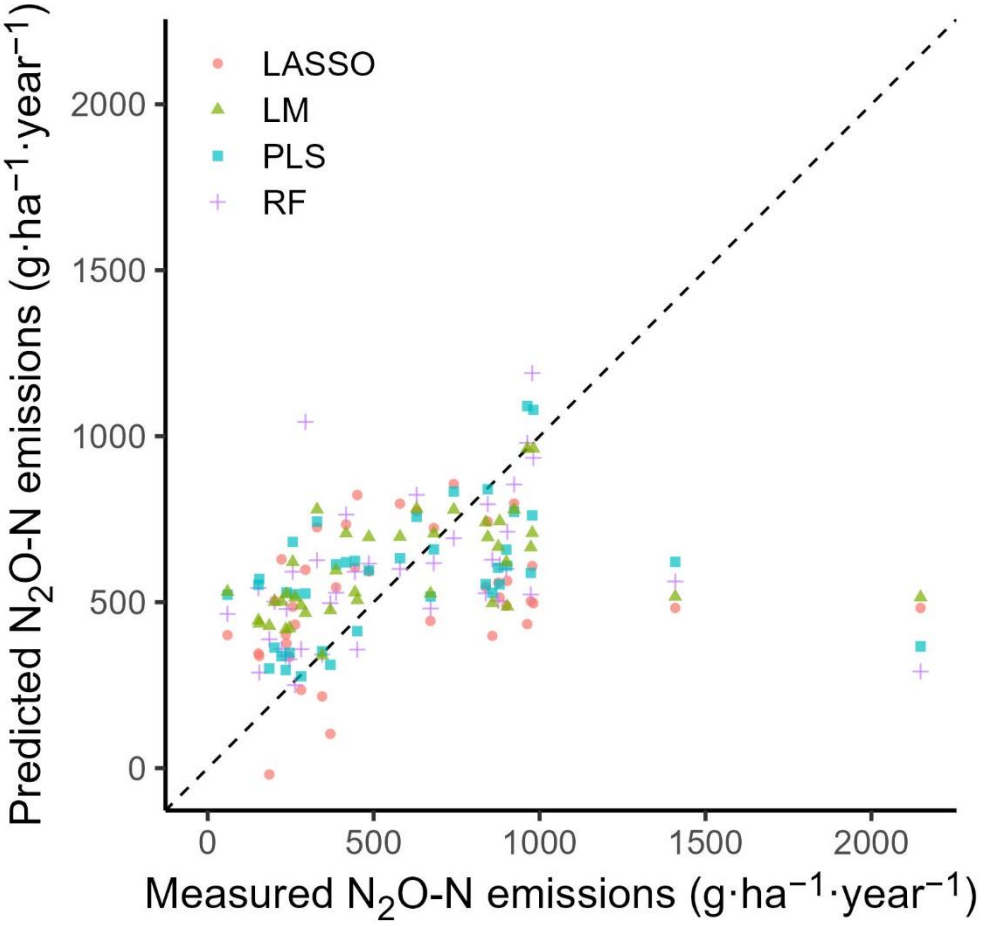
R&D. The dataset of 158 restitution cycles (RC)

25 candidate predictors including:

Variables	Minimum	Median	Max
RC duration (days)	109	253	646
Avg. WFPS (%)	34	63	79
Crop residue dry matter ($kg \cdot ha^{-1}$)	294	3 091	11 316
Avg. Crop residue C:N ratio	8	53	157
Mineral N ferti. ($kg \cdot ha^{-1}$)	0	15	220
N_2O-N emissions ($g \cdot ha^{-1}$)	**0**	**355**	**1584**

R&D. Models

- 158 restitution cycles (118 used for training and 40 for testing)
- N-fertilizer-rate and RC duration are the main predictors
- C:N ratio of crop residues is the only other variable consistently showing up in the top 10 predictors for each model



Conclusion

- Modelling techniques used here performed similarly
- N-fertilizer-rate and RC duration are undisputed
- Crop residue management is not likely to lead to a significant change in N_2O emissions from arable cropping systems in Northern France