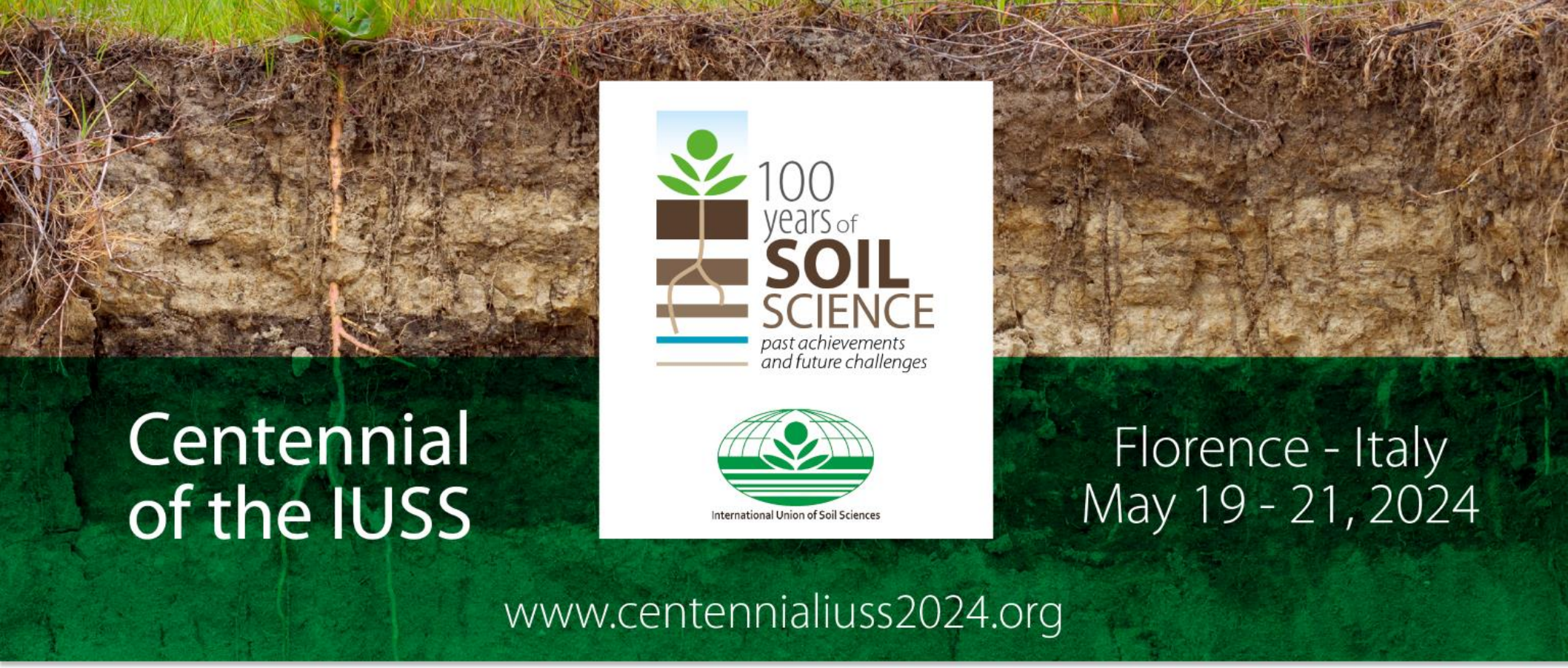
Crop residue management impact N2O emissions: results from 10-years-8-cropping-systems field experiment.

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



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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?

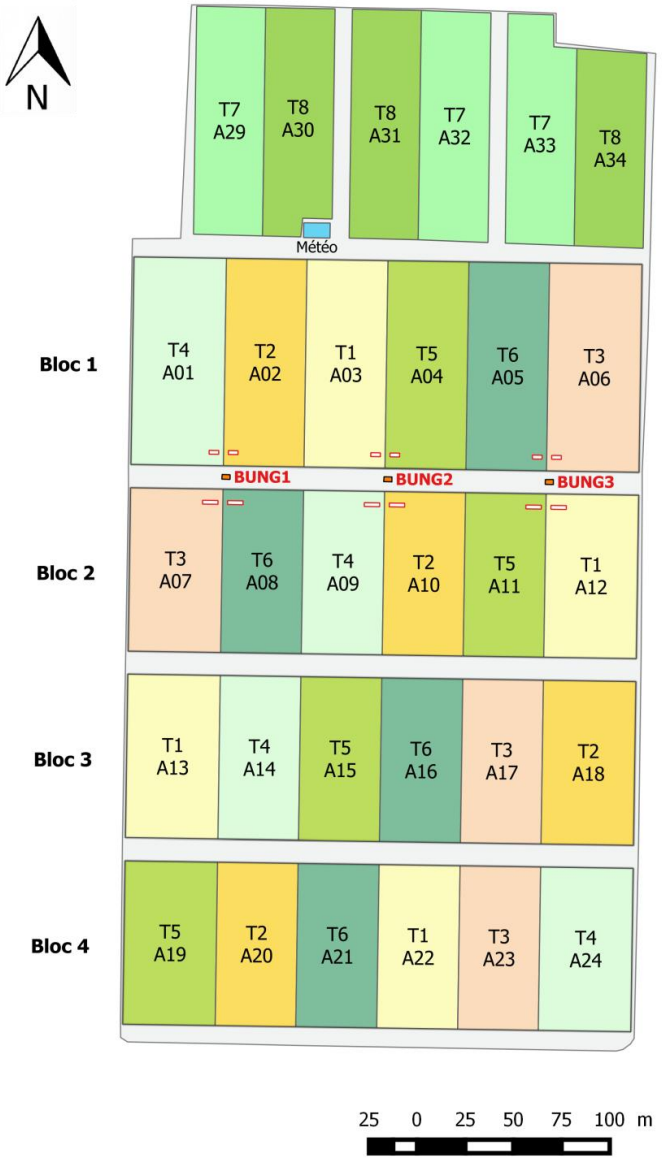
M&M. long-term experiment and statistical tools

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/

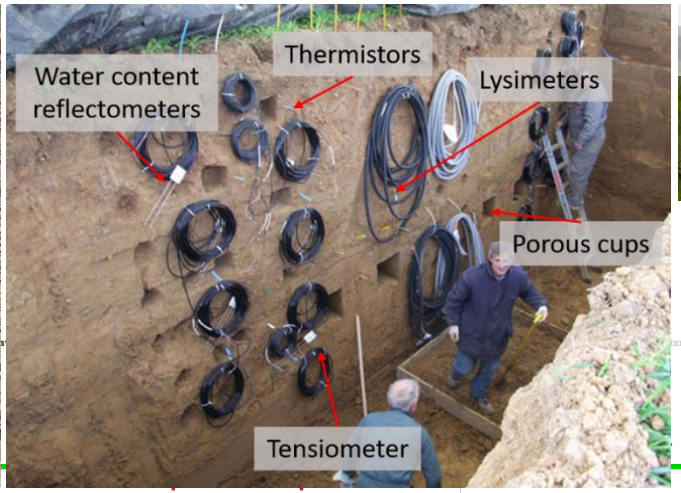


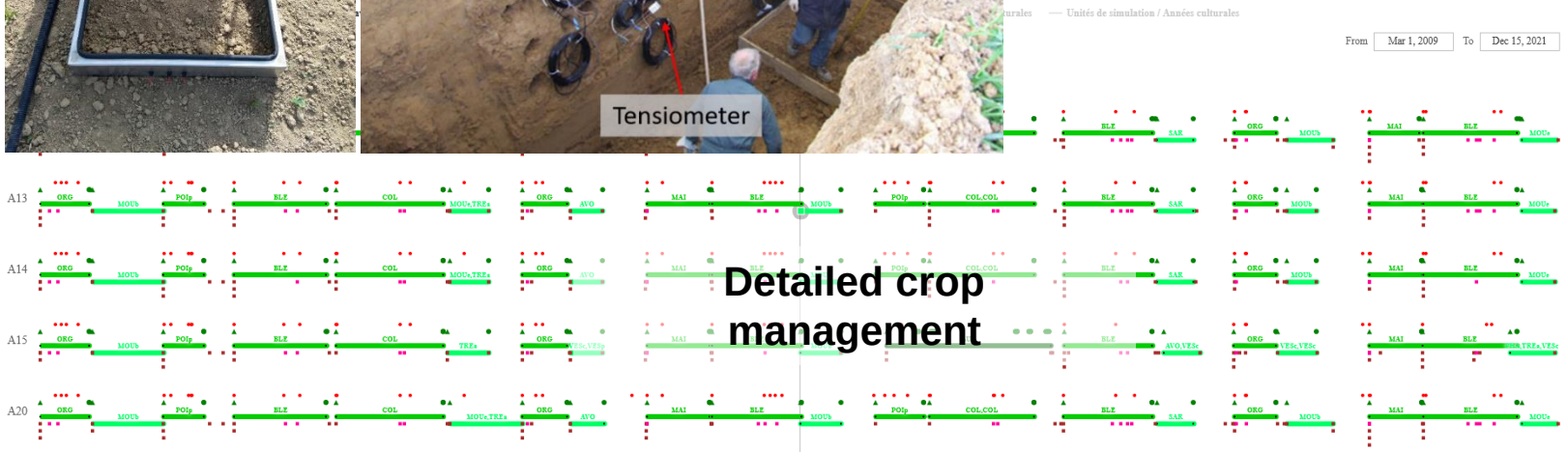
M&M. Experimental treatments

	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	✓	×	×

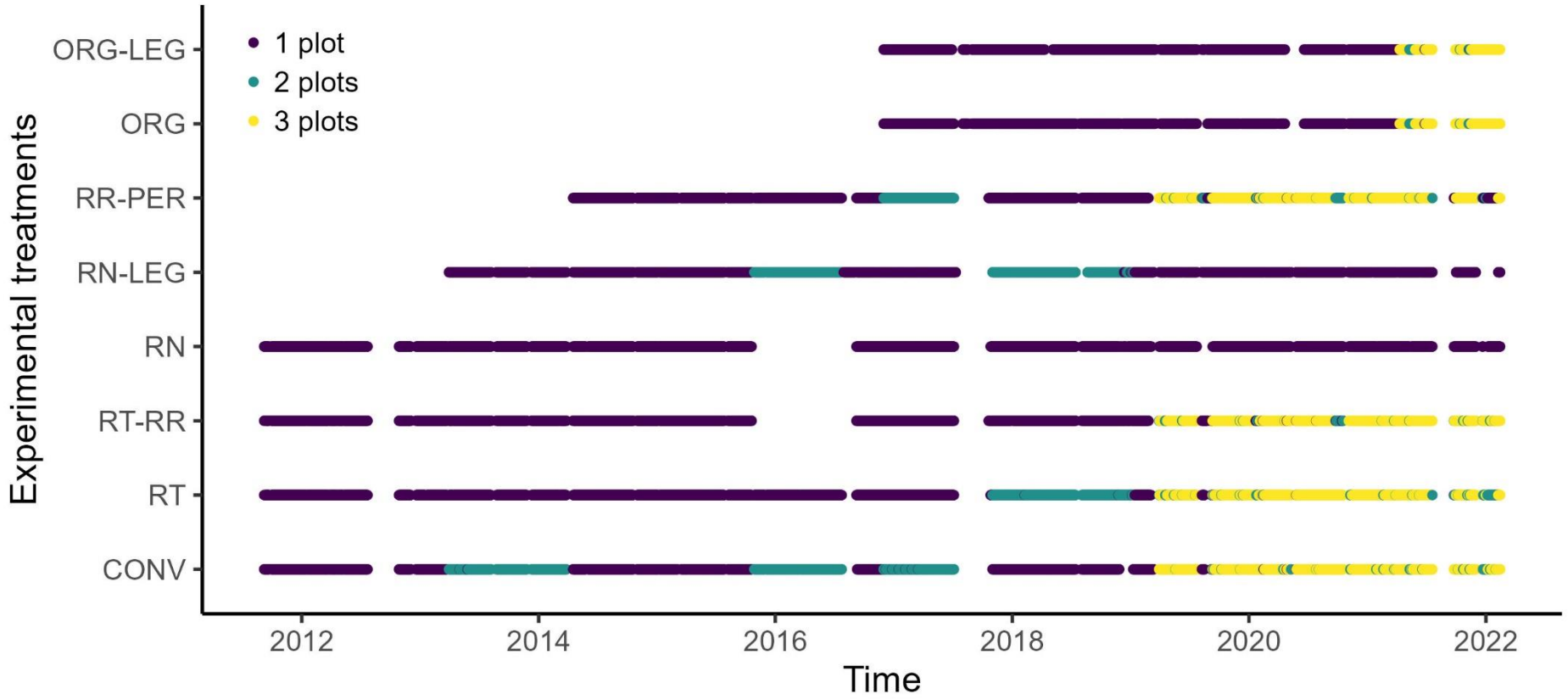
M&M. Equipments

Database

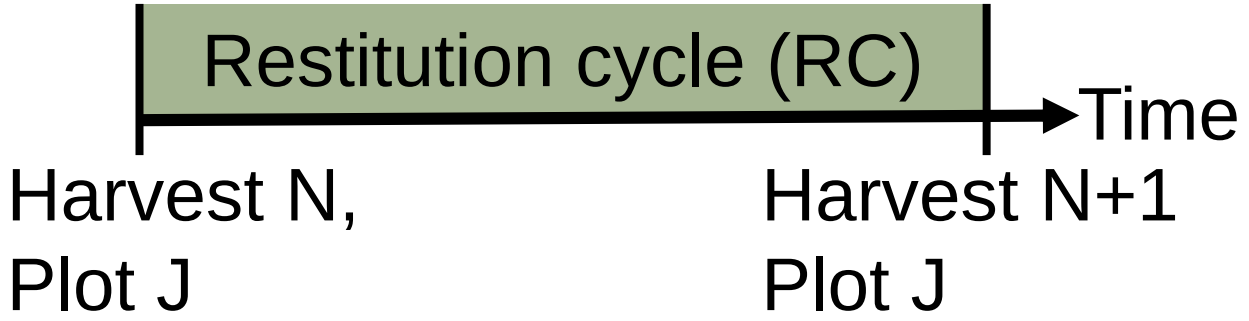




M&M. N_2O sampling



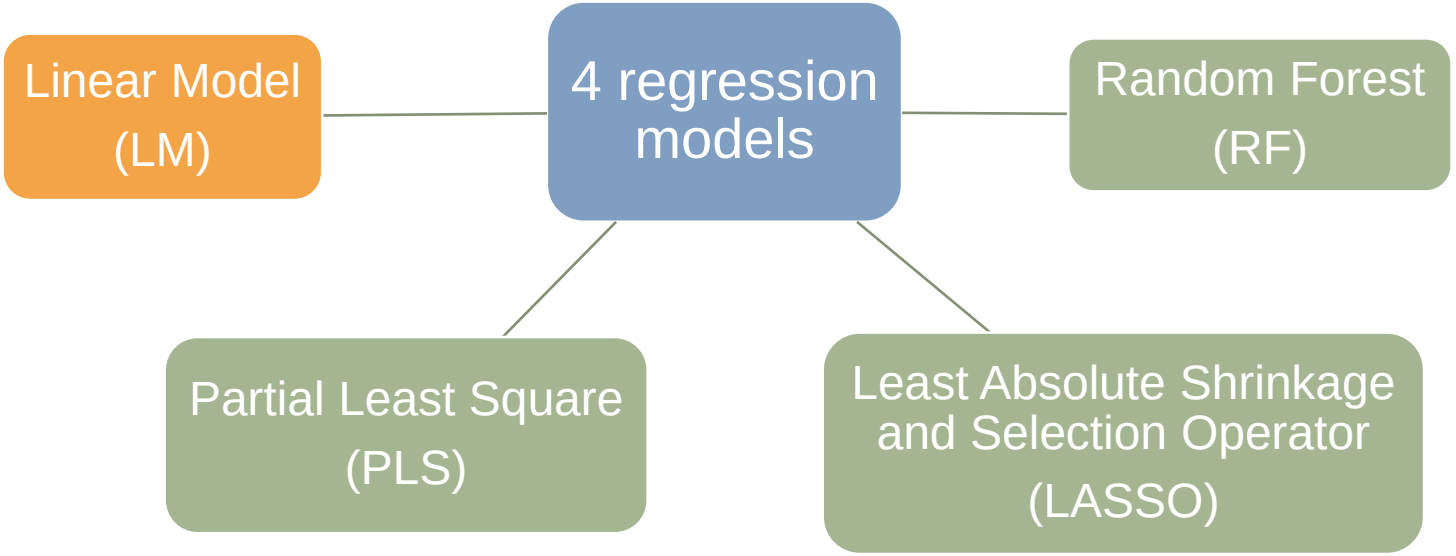
M&M. Restitution cycles



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

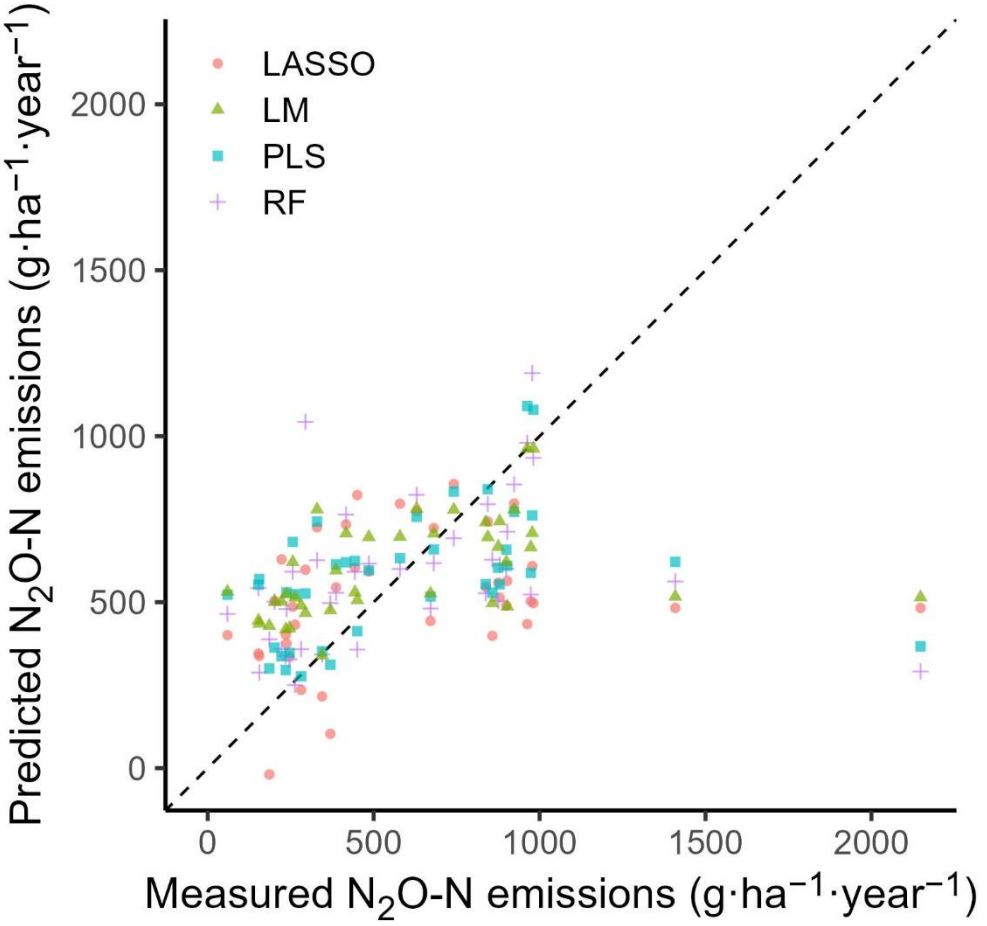
R&D. The dataset of 158 restitution cycles (RC)

25 candidate predictors including:

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