

Prescriptions dynamiques IA pour une agronomie de précision et résiliente face au climat

L'IA pour des recommandations de chaulage et
de fertilisation enfin fiables.

Lotfi Khiari

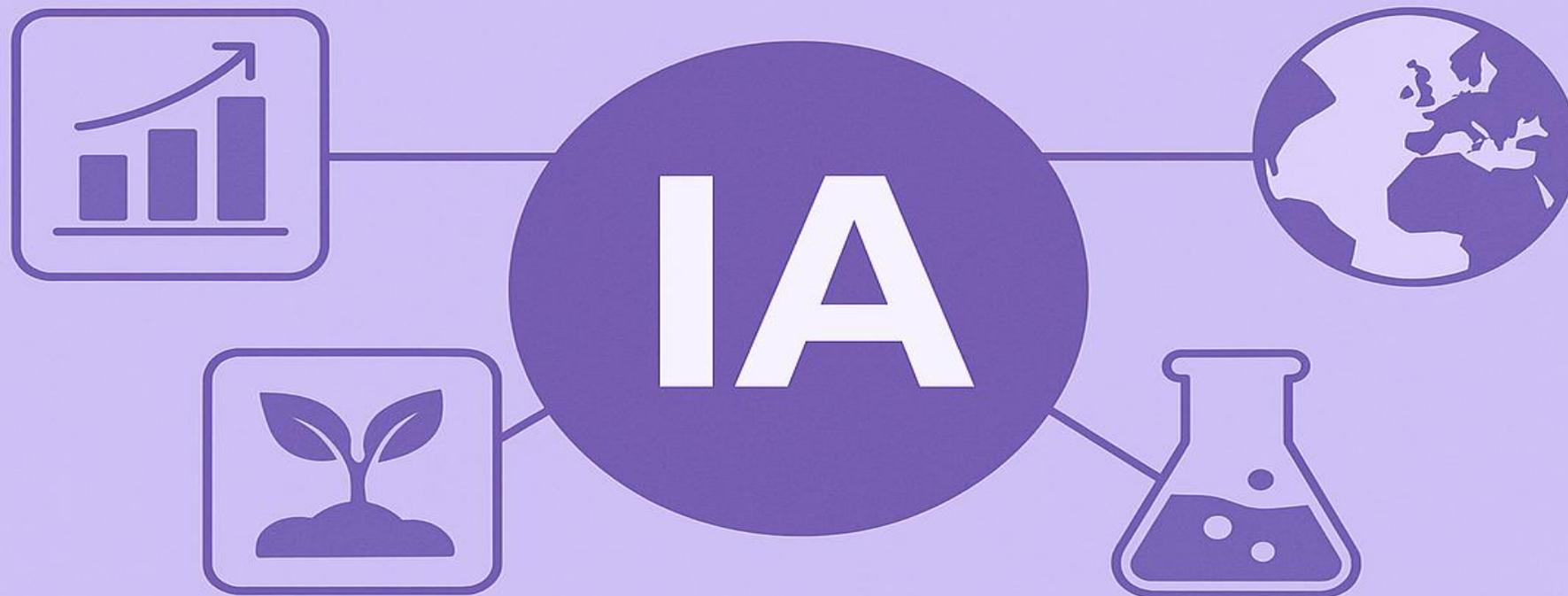
22 janvier 2026



UNIVERSITÉ
LAVAL



Nouvelles recommandations basées sur l'IA



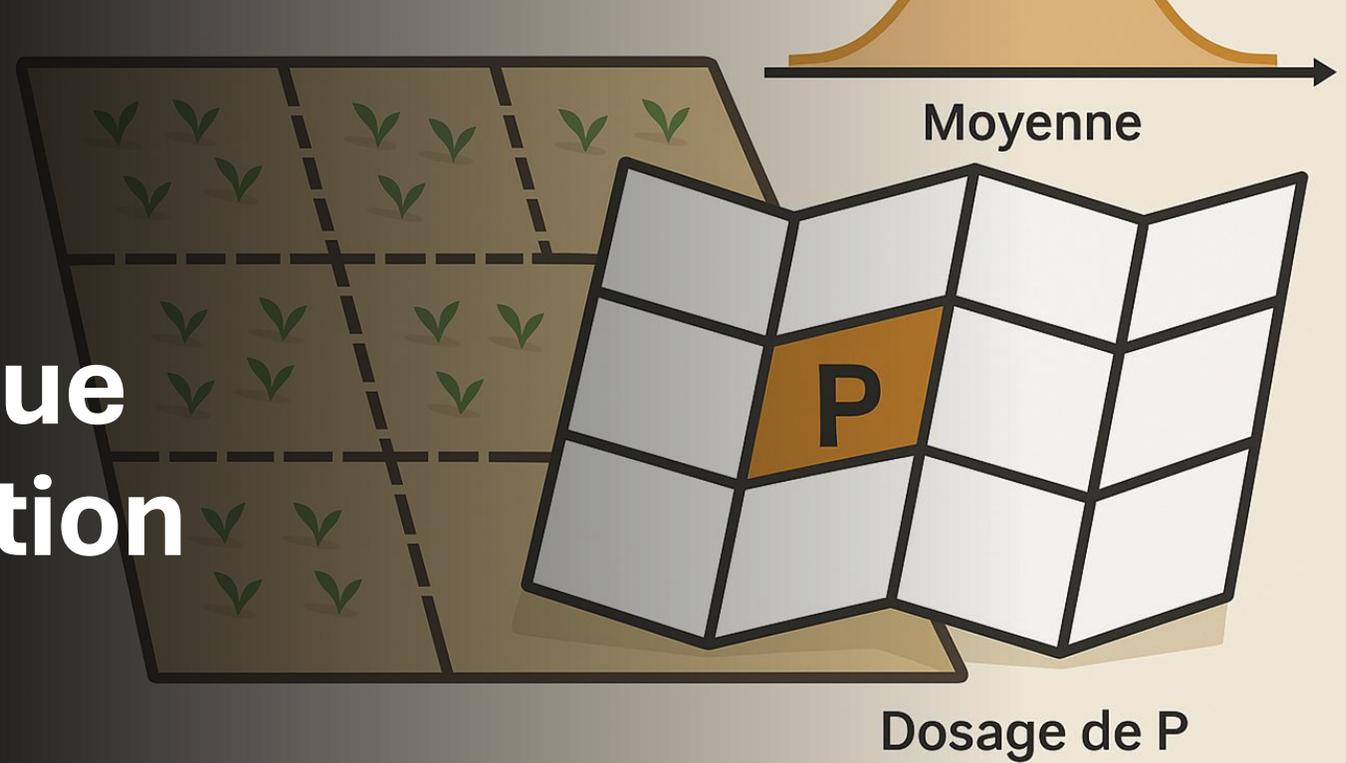
Exemple de grille au Québec



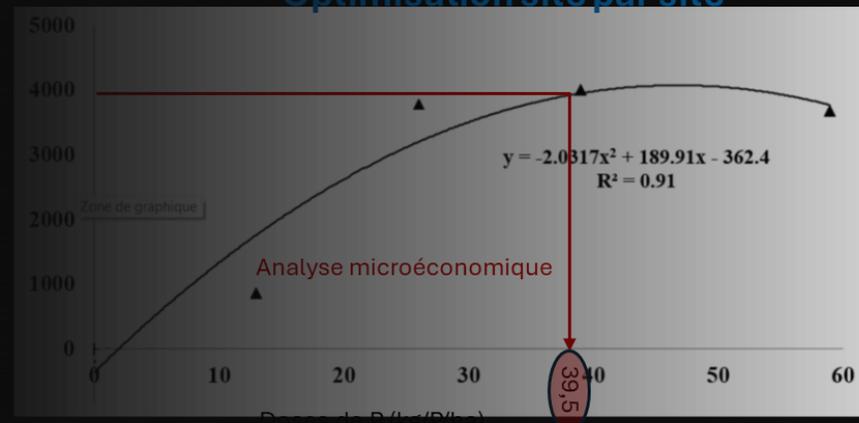
Classe de fertilité II	P du sol (P _{min} Kg/ha) I	Recommandation kg P ₂ O ₅ /ha III et IV
(1/7) Très faible	0 - 30	80
(2/7) Faible	31 - 60	65
(3/7) Moyenne inférieure	61 - 90	45
(4/7) Moyenne supérieure	91 - 120	35
(5/7) Élevée	121 - 150	20
(6/7) Très élevée	151 - 250	0-20
(7/7) Excessivement élevée	251 et +	0



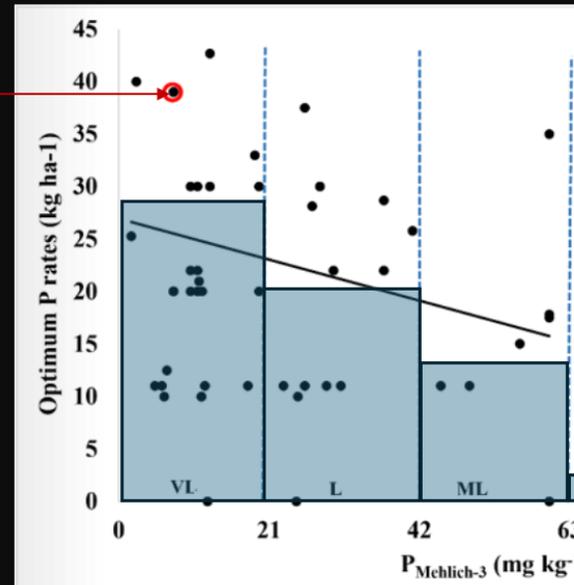
Méthode classique de recommandation du P



Optimisation site par site



Grille de fertilisation



MODÈLES MÉCANISTIQUES EN AGRONOMIE ET FERTILISATION

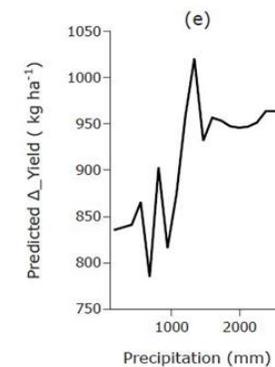
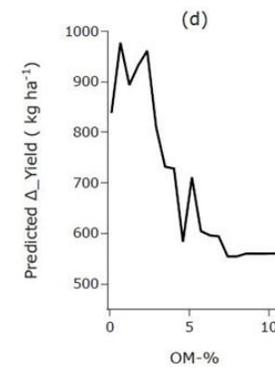
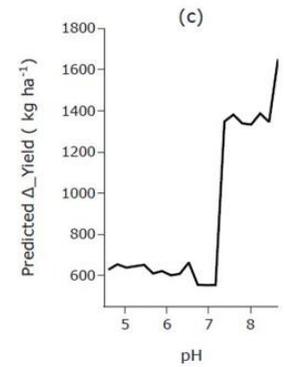
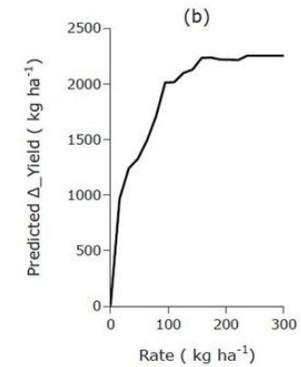
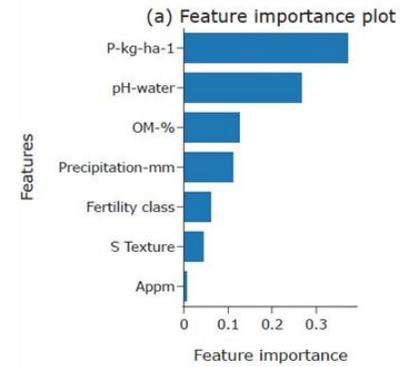
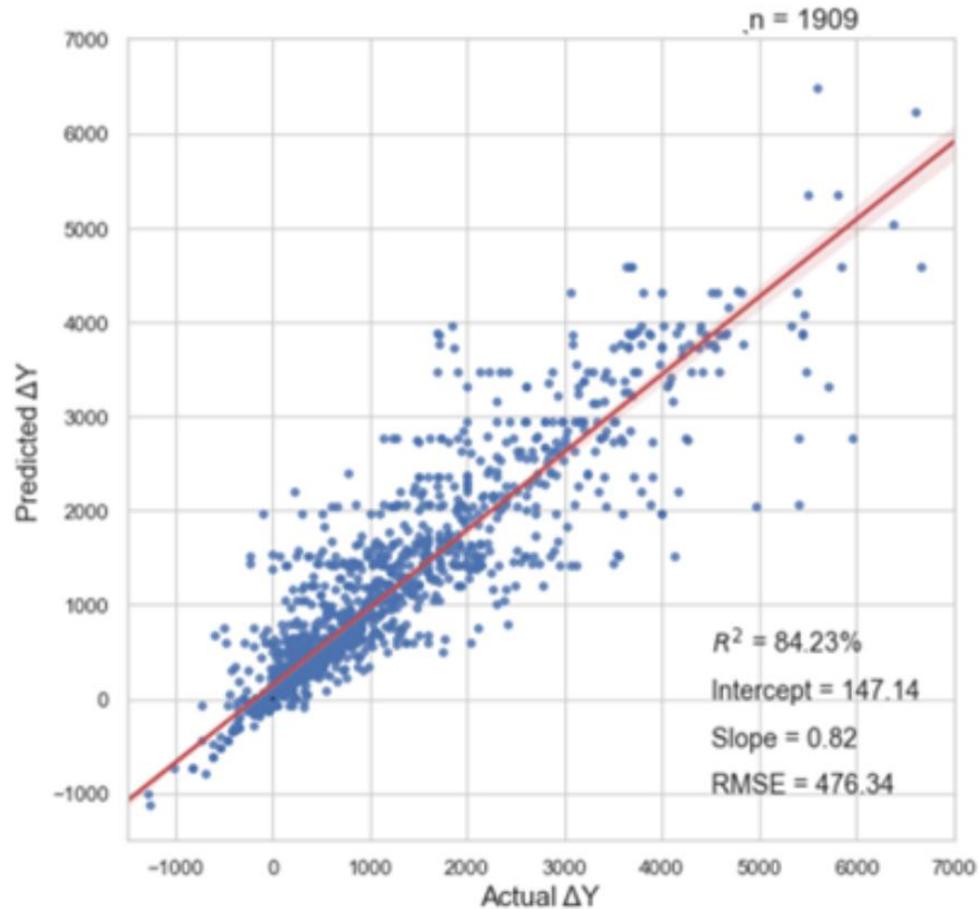


« Les modèles mécanistes intègrent plusieurs éléments nutritifs (N, P, K) et des processus sol-plante. Toutefois, leur complexité, leur paramétrisation lourde et leur faible transférabilité limitent leur utilisation opérationnelle en agriculture de précision. »

Modèle de recommandation dynamique MDR



Du P assimilable aux modèles multi-indicateurs : l'IA propulse la robustesse des recommandations de 8 % à 84 %



Prescription dynamique (blé-orge)

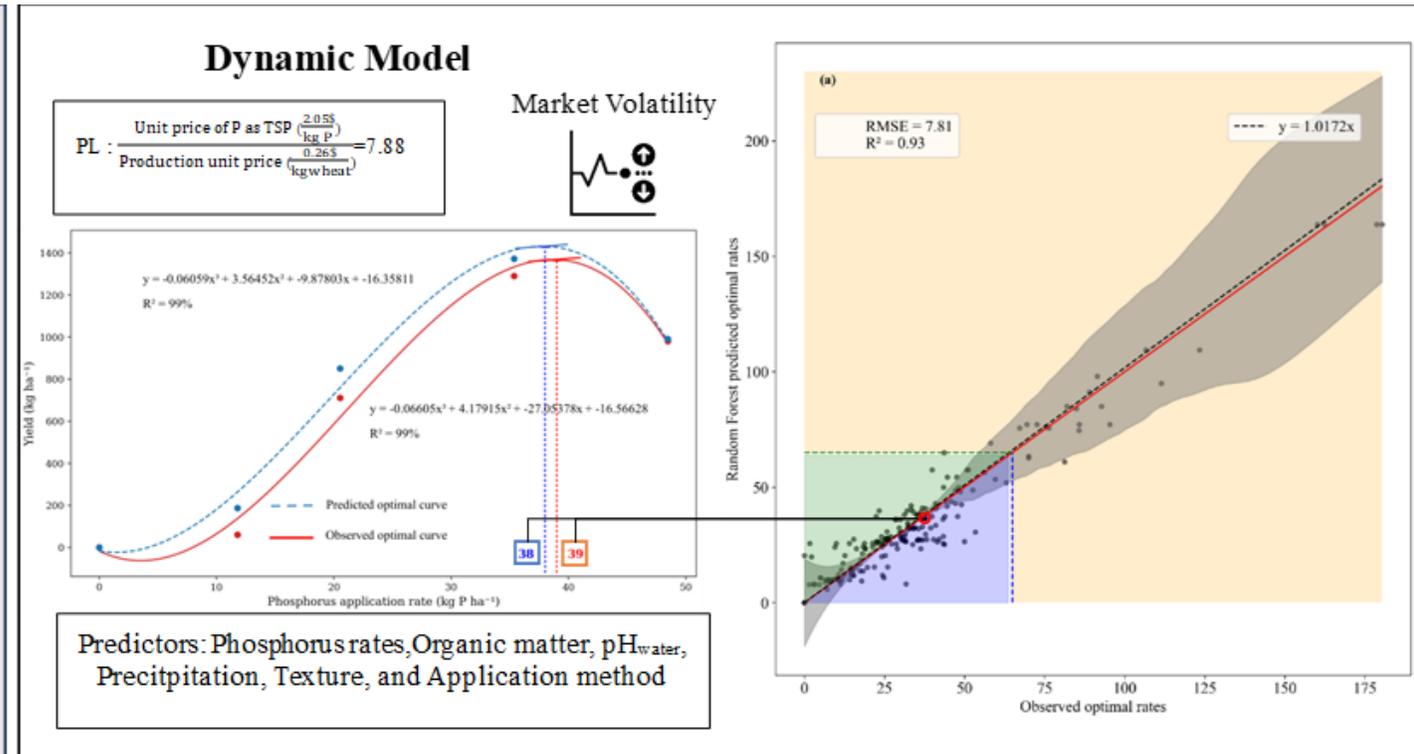
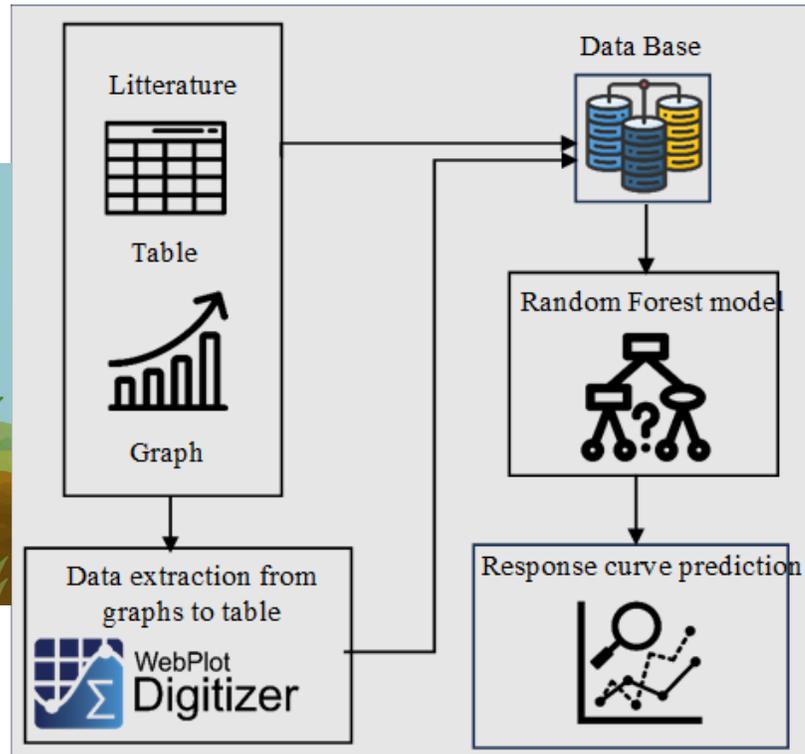


Plate-forme

momentum

Global P

Home

My Profile

Recommendation

Predictions Overview

Logged in as test@gmail.com. Logout

Predictions Overview

Crop: soybean
Created At: yyyy-mm-dd
Clear Filters

Prediction Details

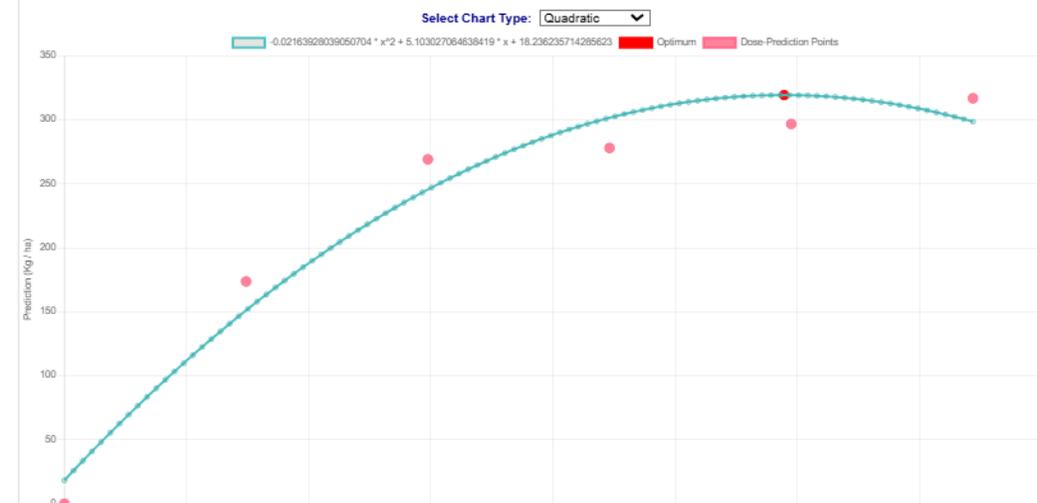
Load All Predictions

Crop ▲	Fertility	pH	Precipitation	Organic Matter	Texture ▲	Application Method ▲	Created At
soybean	L	5	1000	5	G3	FERT	2/4/2025
soybean	L	5	50	5	G3	FERT	2/4/2025
soybean	L	5	50	14	G3	FERT	2/4/2025
soybean	L	5	1000	5	G3	FERT	2/4/2025
soybean	L	5	50	5	G3	FERT	2/4/2025

« Previous 1 2 3 ... 22 Next »

Prediction Results

Prediction Value: soybean



DA

Diagnostic de l'acidité

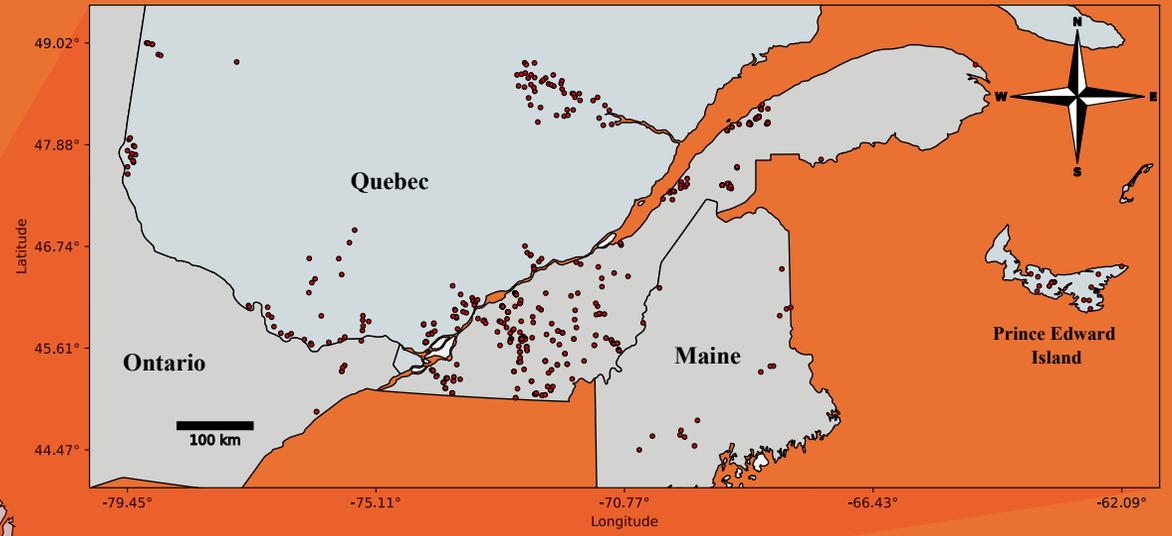
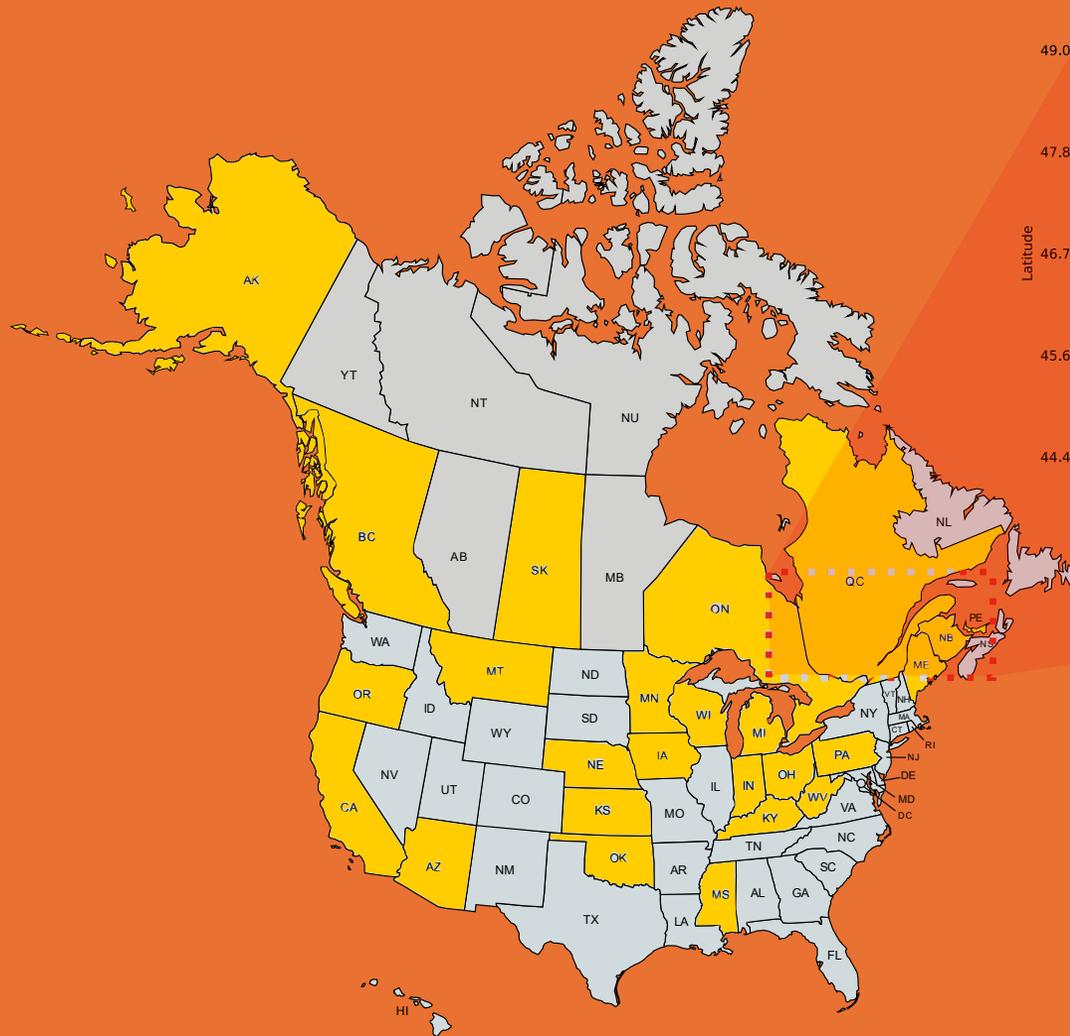


QA

Qualité de l'amendement

RA

Recommandation d'application



- Sampling sites
- Canadian provinces and US states that have been reported to use SMP buffer to determine lime requirements
- Studied area



CEC estimée (CRAAQ, 2010)

Robustesse: 66%



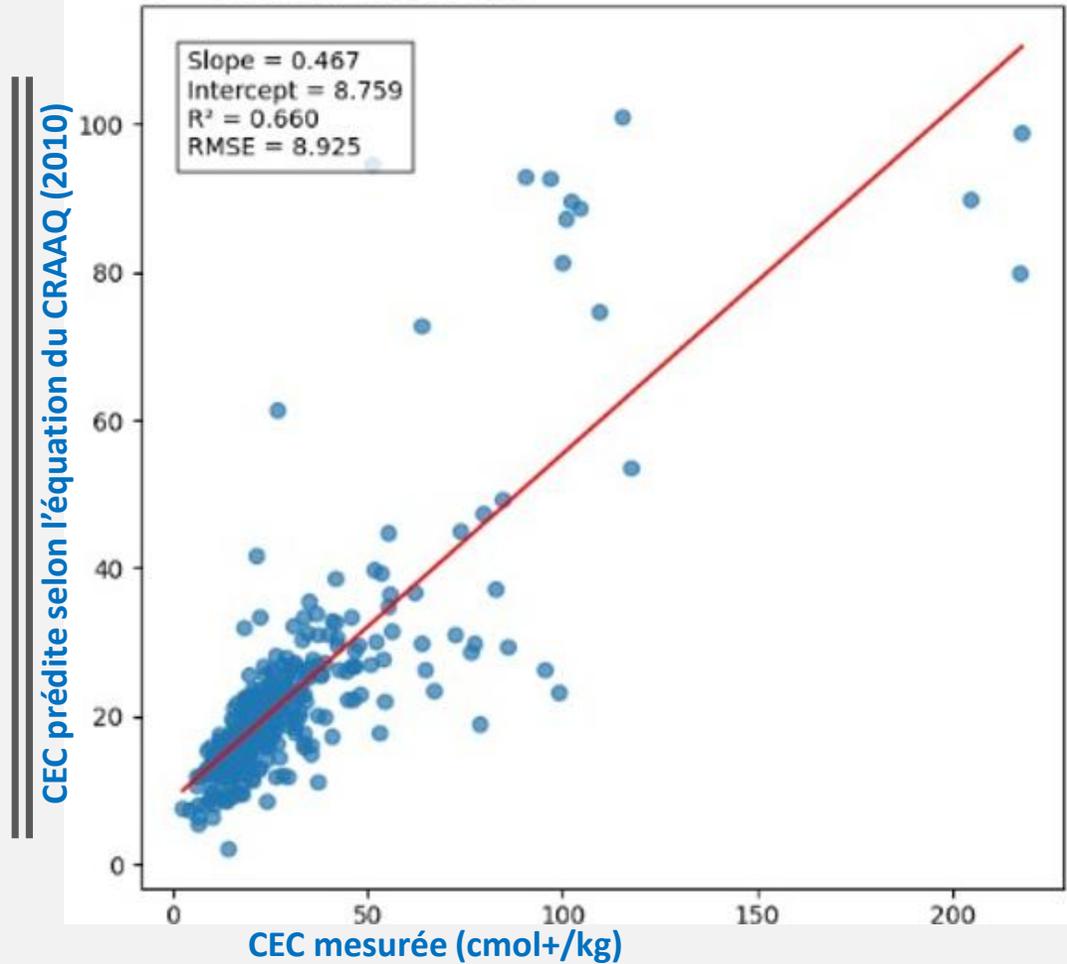
Exactitude: 47%



Sensibilité: 8,8 CEC unites



Précision: 8,9



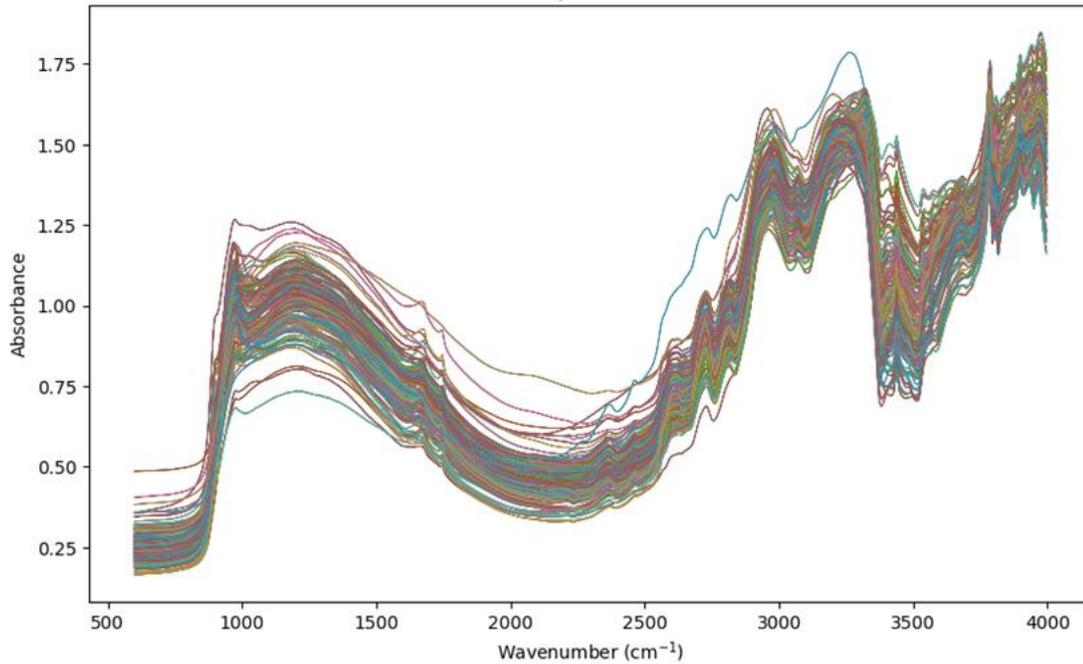


Signature spectrale MIR

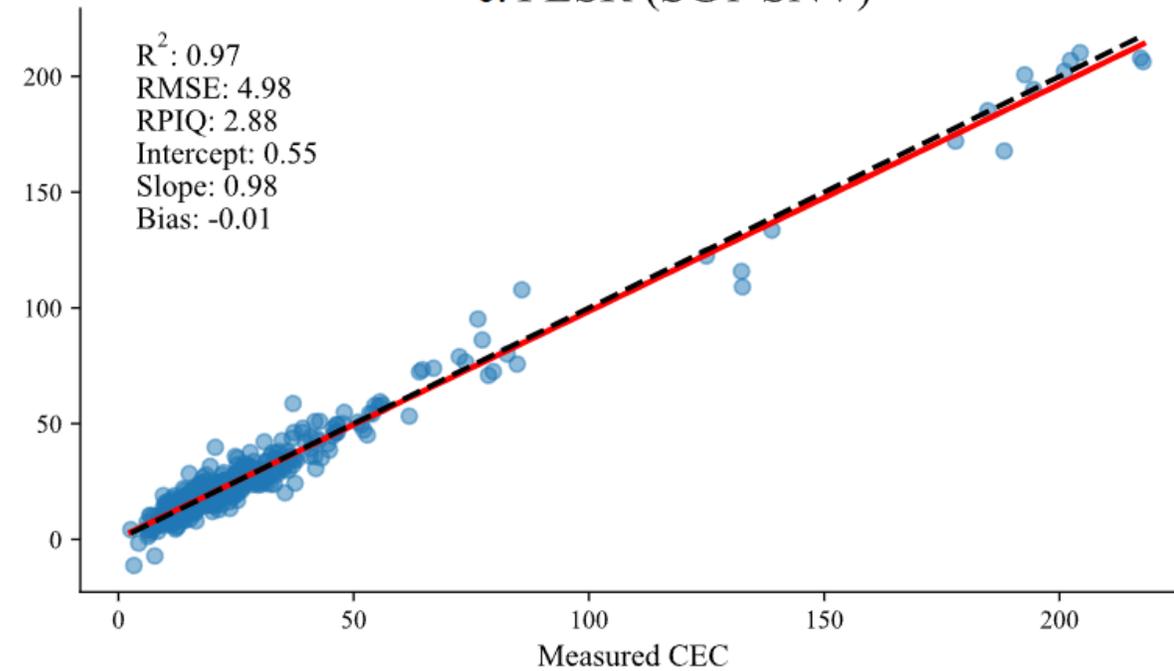


DA

Raw spectral data



c. PLSR (SG1-SNV)



Robustesse: 97%



Exactitude: 98%

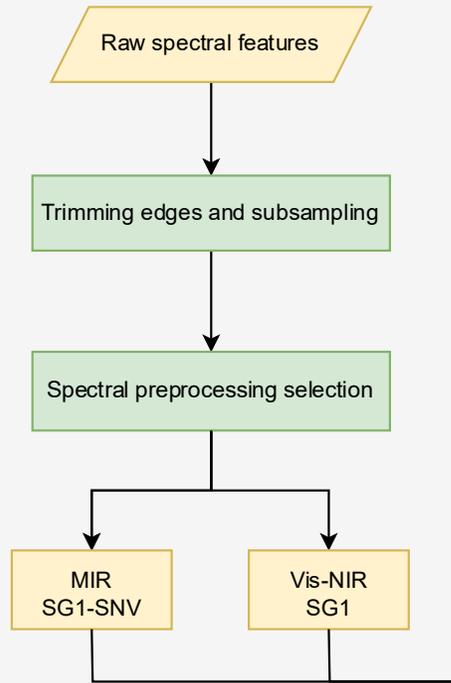


Sensibilité: 0.55 CEC unites

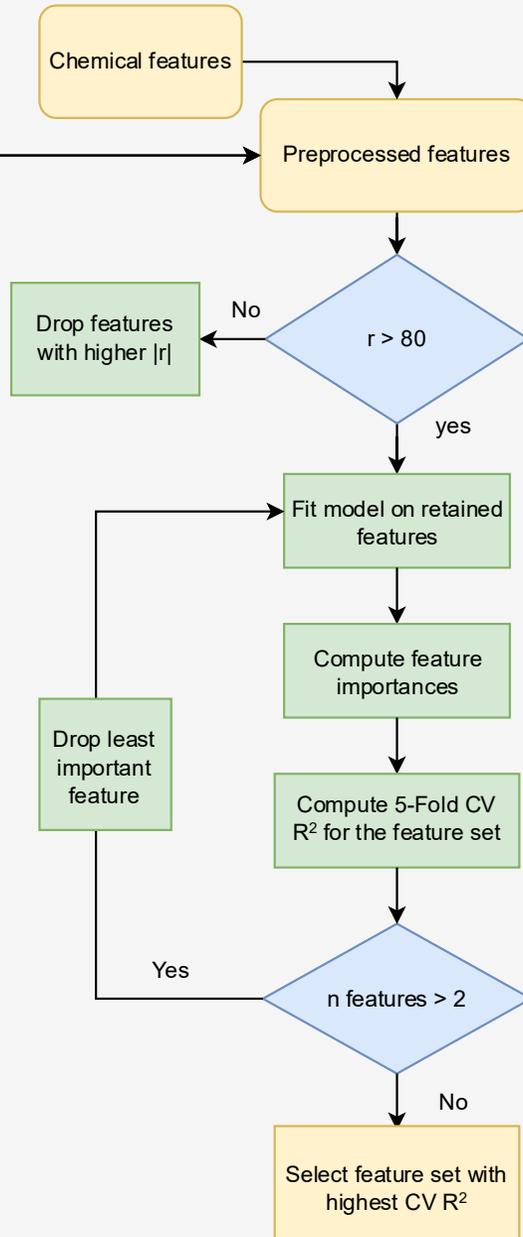


Précision: 2.88

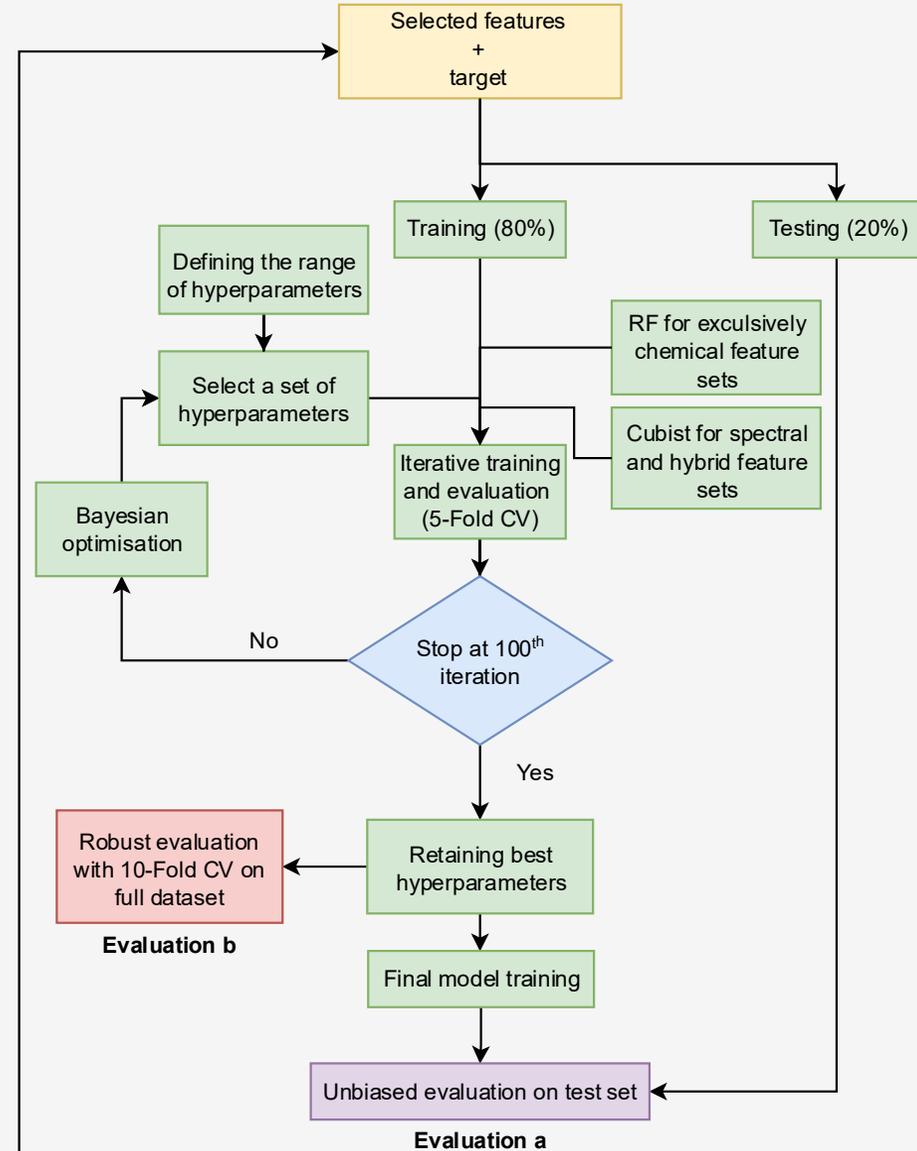
Spectral preprocessing



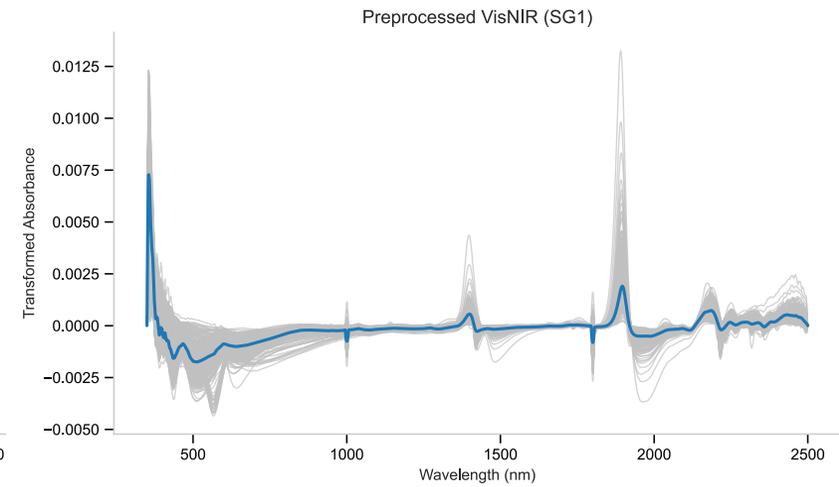
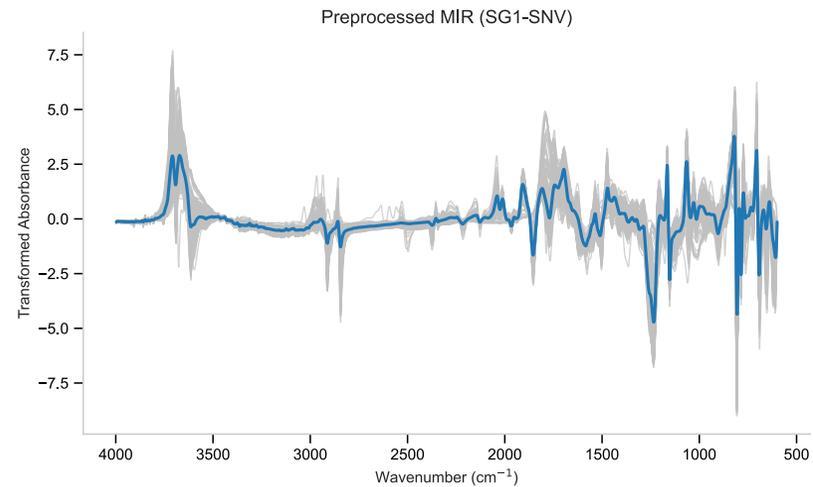
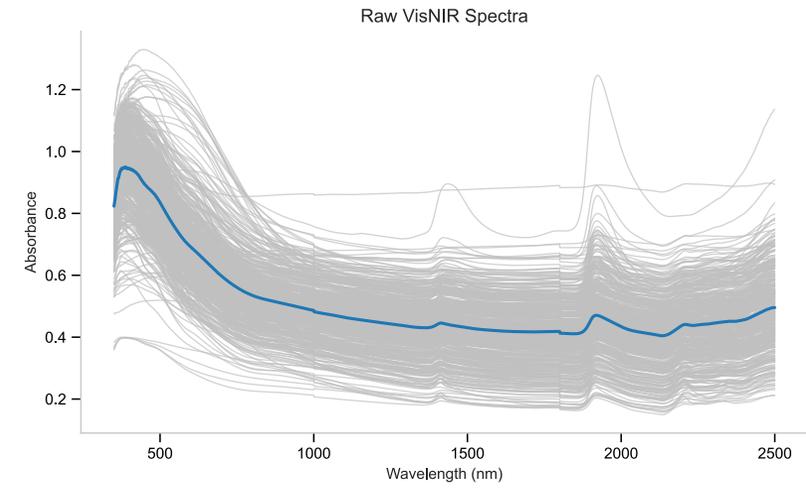
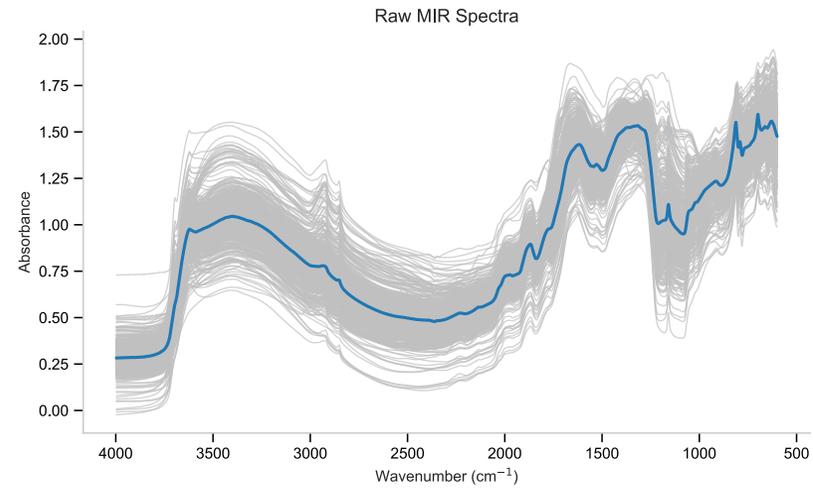
Feature selection (RFECV)



Modeling



Prétraitement des signatures spectrales au MIR



Performance de prédiction des besoins en chaux avec les signatures spectrales au MIR

Robustesse: 92%



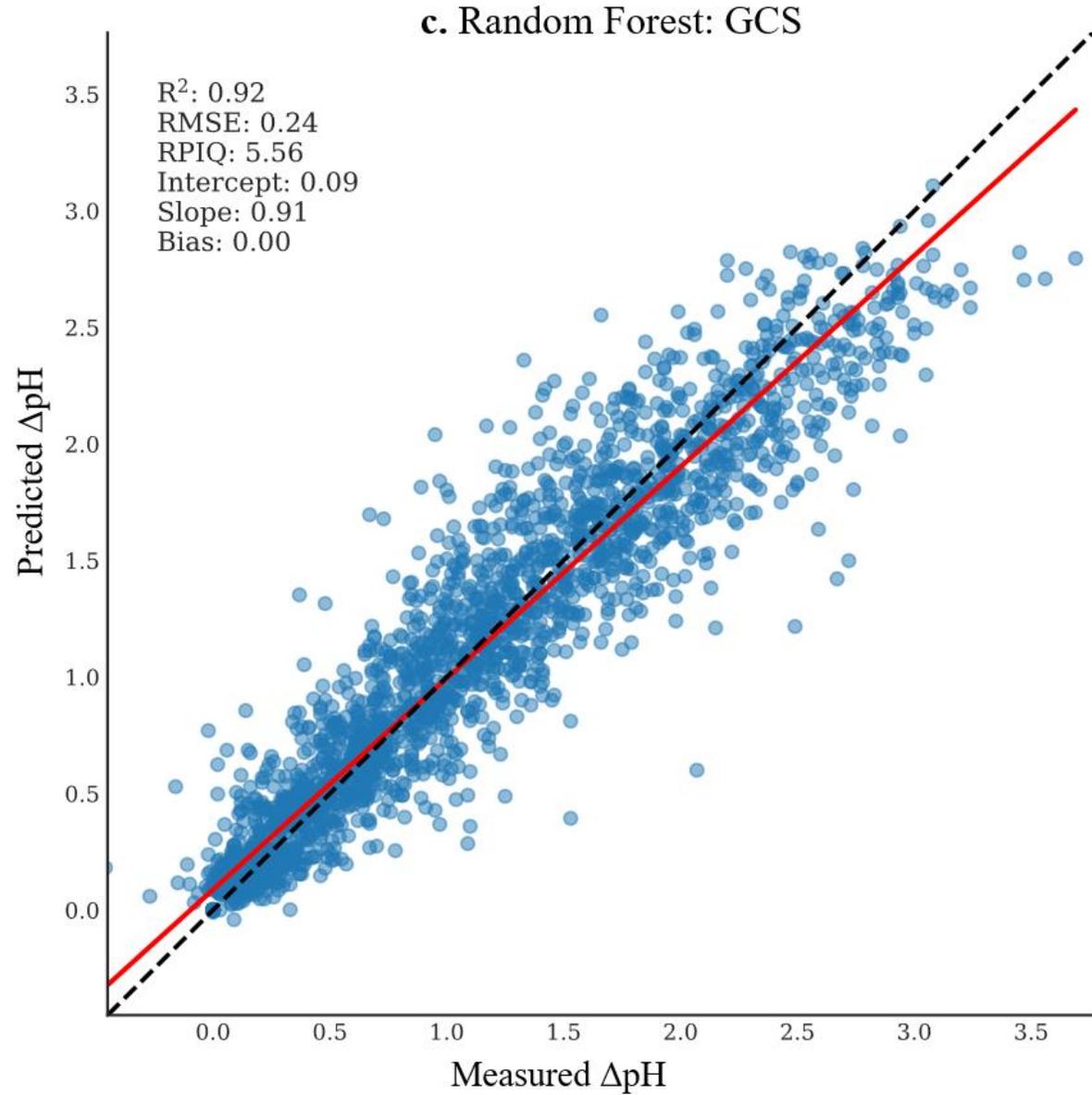
Exactitude: 91%



Sensibilité: 0.09 ΔpH

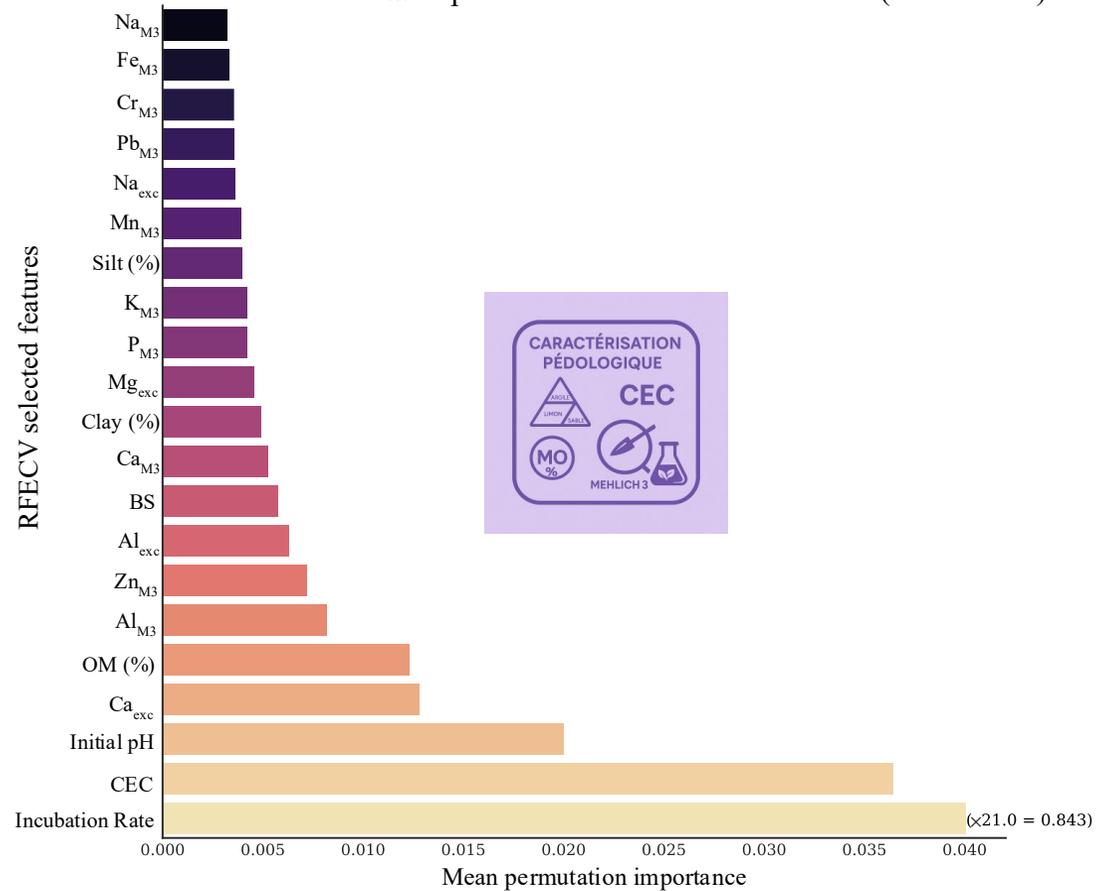


Précision: 0,24

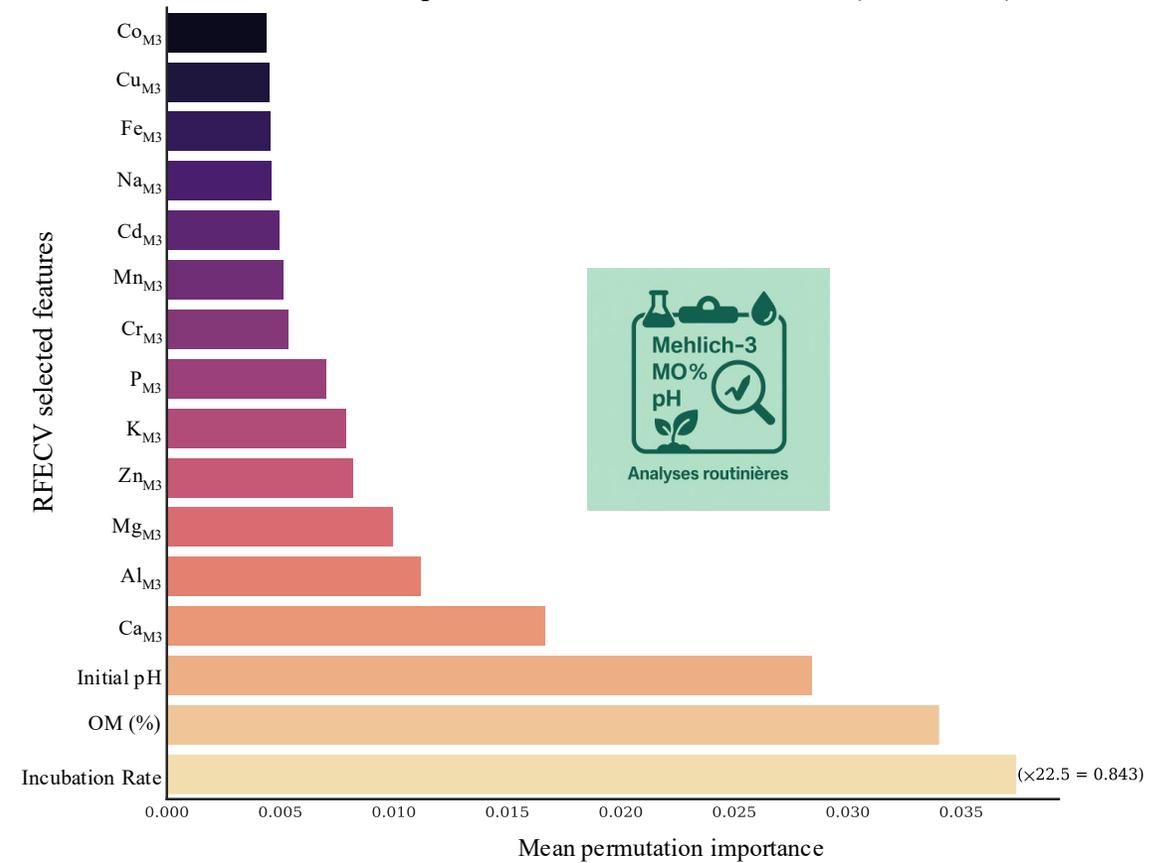


Signature chimique et pédologique

a. Importance of final selected features (GCS model)

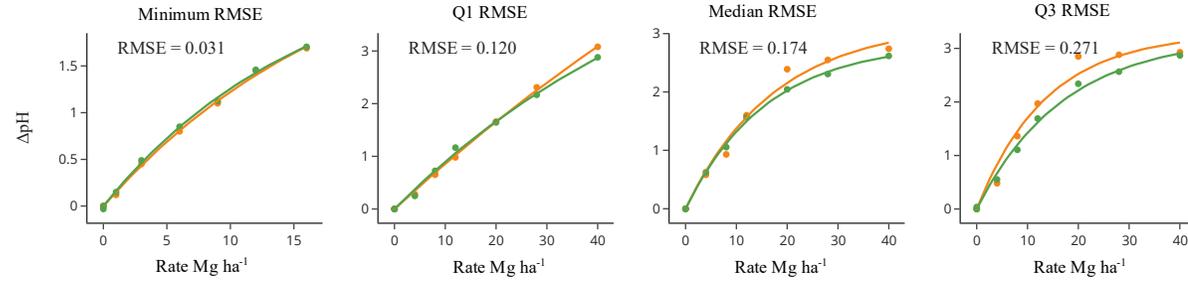
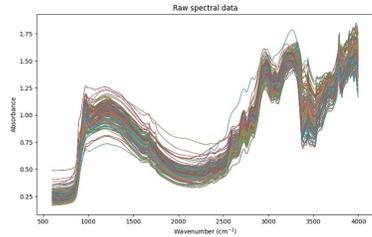


b. Importance of final selected features (RCS model)

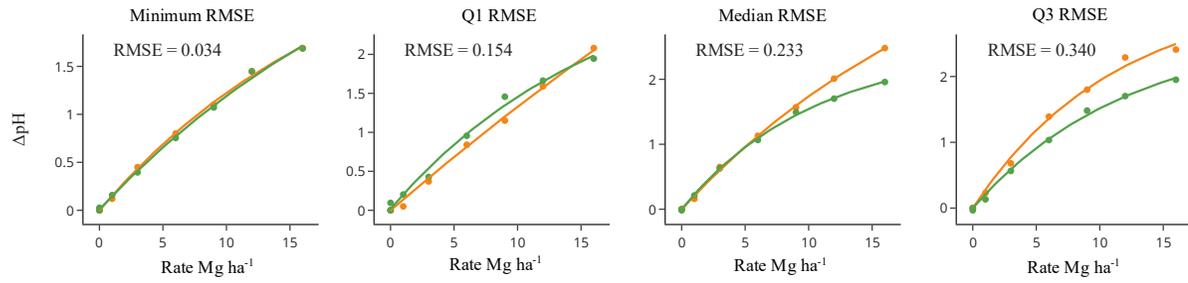
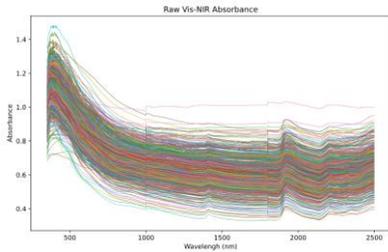


● Observed ΔpH ● Predicted ΔpH — Observed Fit — Predicted Fit

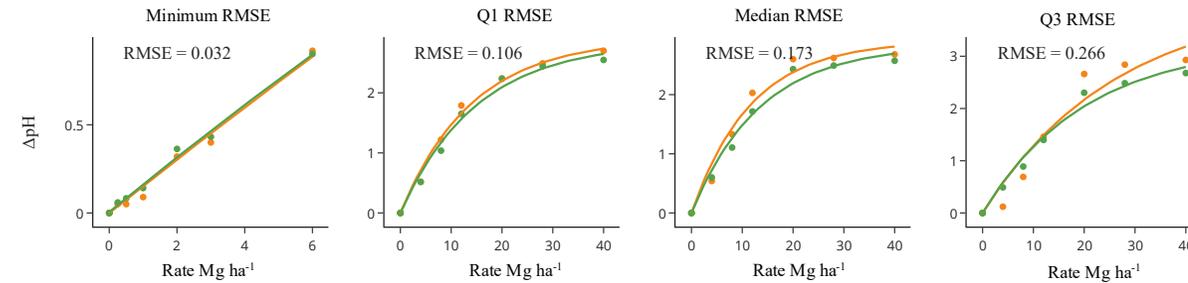
a. MIR Model



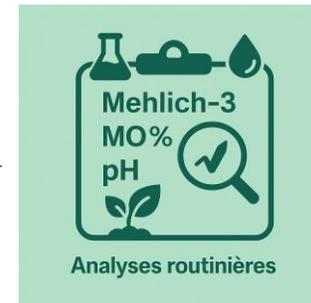
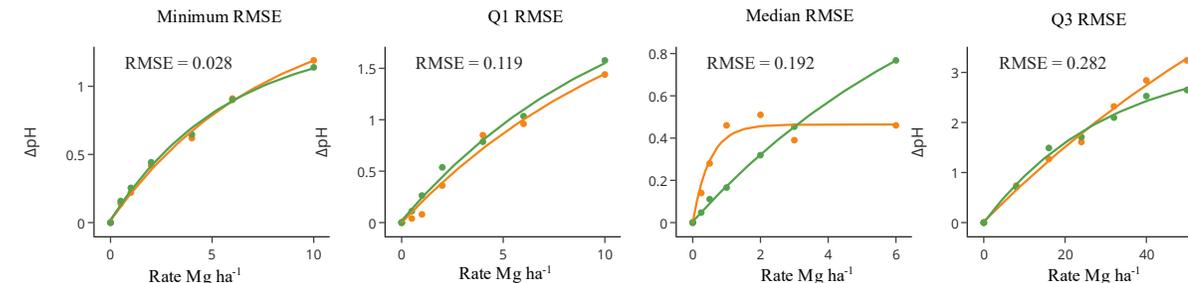
b. VisNIR Model



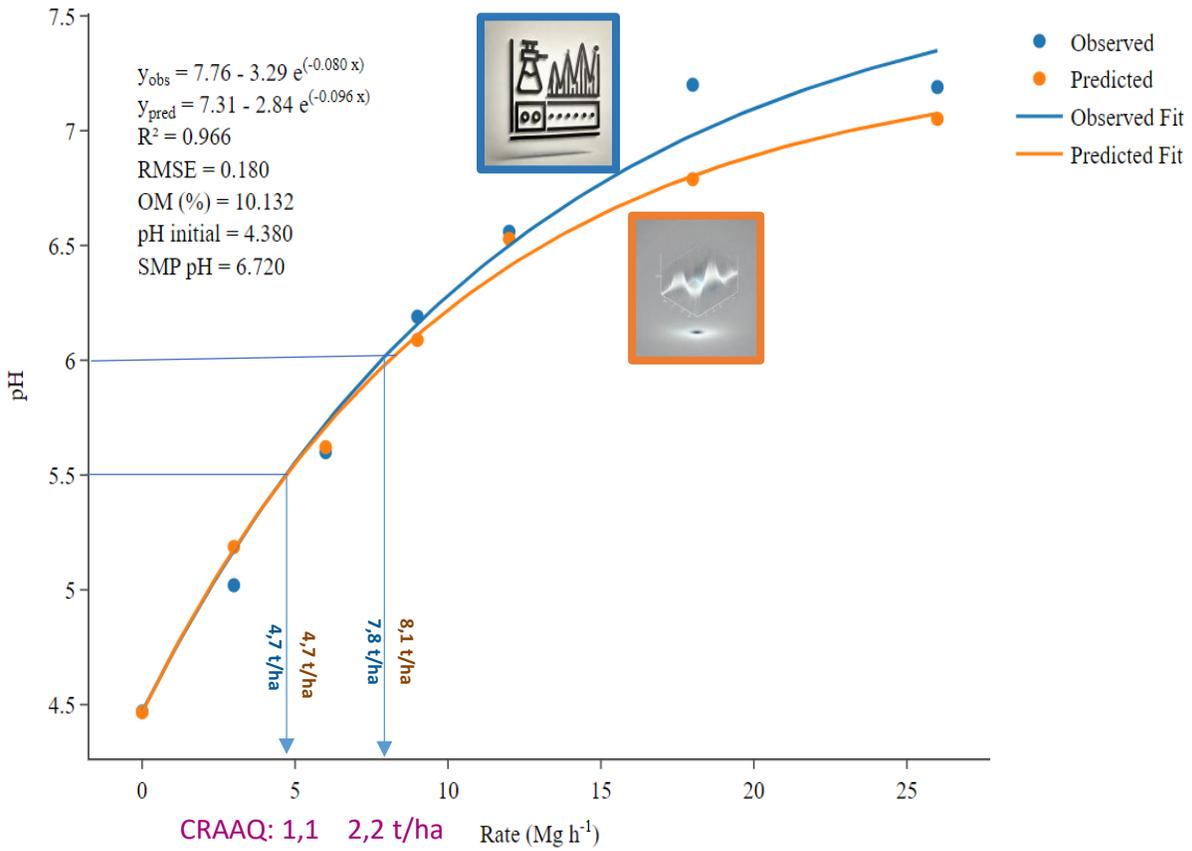
c. GCS Model



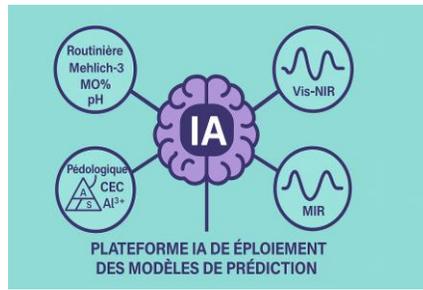
d. RCS Model



Soil 211 pH Incubation Curve (Cubist: SG1-SNV)



RA



- Home
- My Profile
- Diagnosis of Acidity
- Quality of Amendment
- Recommendation Of Ammendement
- Pipeline Management

Users Overview

Users Overview

Hello, admin@admin.com! You're authenticated.

User Details					
UserName	Email	Phone Number	User Role	Status	Actions
NewUser	user@gmail.com	123456	Guest	Inactive	Edit
admin	admin@admin.com		Administrator	Active	Edit

[Previous](#)
1
[Next](#)

Triple validation des modèles dynamiques



Validation scientifique
par les pairs



publications dans des journaux reconnus assurant la rigueur méthodologique.



Validation par
les experts du
CRAAQ



examen critique par la commission spécialisée en fertilité des sols.



Validation
terrain par les
agronomes



adoption et retour d'expérience des conseillers agroenvironnementaux.

Merci

