Proximal Soil Sensing

Session 4 In situ soil spectroscopy
Chair: A. Mouazen

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Dozen-soil-parameter mapping using a Real-time soil spectrophotometer

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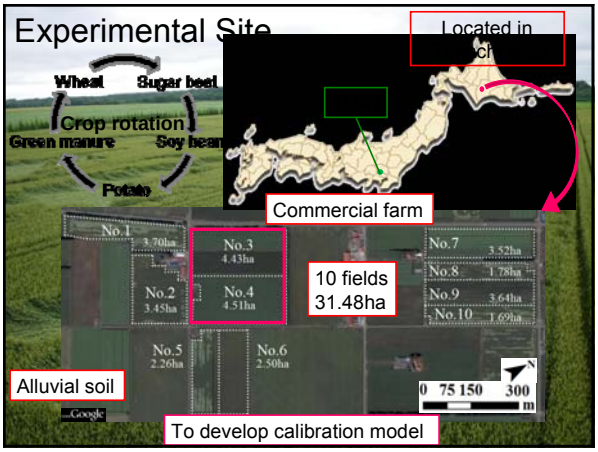
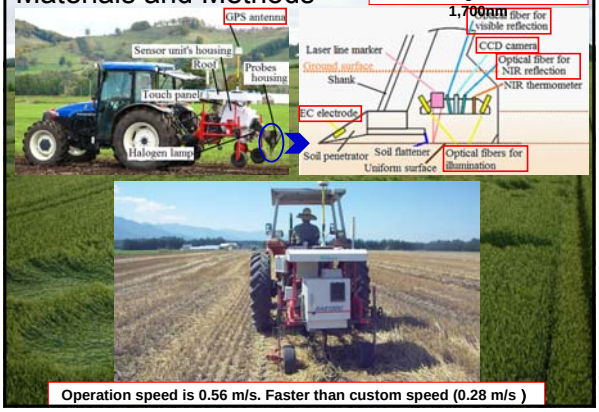
Our objectives are to develop dozen-soil-parameter calibration models based on VIS-NIR soil reflectance data measurements directly carried out in agricultural fields using the Real-time soil sensor, and to give these soil maps for the grower.

Contents

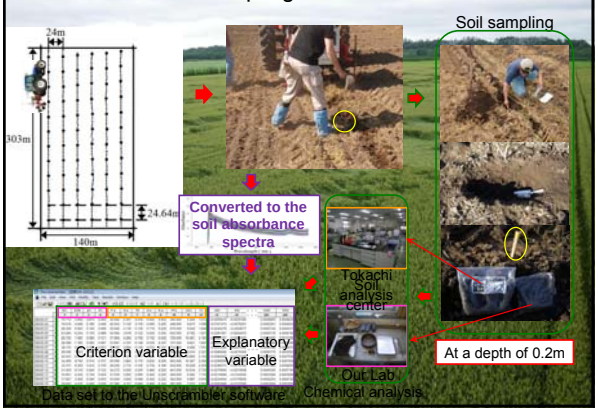
Experimental Site



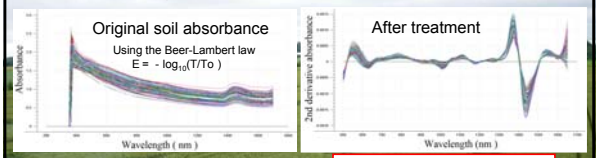
Materials and Methods



Procedure of Soil Sampling and Calibration



Multivariate regression



To Reduce the noise
Enhance the weak signals

the 2nd Derivative,
or
mixed with the smoothing
(the Savitzky-Golay)

How to find out outliers using image data

Image data of the soil surface

To develop calibration model
confirm the sensitivity analysis

the PLS regression
Full-Cross Validation

The Unscrambler V9.8 was used(CAMO, Norway)

Statistic of the data set

Parameter	Number of samples	Minimum	Maximum	Mean	Range
pH	144	4.810	7.170	5.724	2.360
MC (%)	144	11.323	34.459	21.866	23.136
SOM (%)	144	3.883	10.220	6.595	6.337
TC (%)	144	0.791	3.130	1.878	2.339
N-a (mg/100g)	144	0.154	1.545	0.632	1.391
N-n (mg/100g)	144	0.210	4.180	0.703	3.970
N-s (mg/100g)	144	3.403	8.966	5.243	5.563
N-t (mg/100g)	144	0.066	0.241	0.144	0.175
P-a (mg/100g)	144	25.238	114.732	54.232	89.494
PAC	144	311.000	1069.000	632.278	758.000
EC (mS/cm)	144	0.025	0.267	0.069	0.242
CEC	144	5.861	22.615	14.625	16.754

72 data set Collecting : After harvesting winter wheat, from No.4 , in August, 2008.
72 data set Collecting : After harvesting sugar beet, from No.3 , in November, 2008.

RESULTS

look at Table 2 of my proceeding.

Comparison of the sensitivity analysis result.

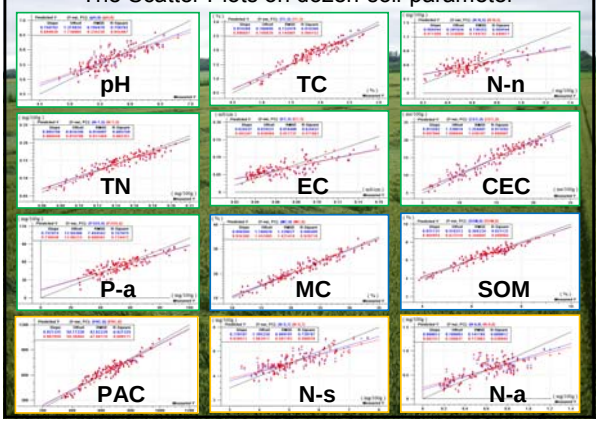
Parameters	Calibration			Validation			References
	correlation	R^2	SEC	correlation	R^2	SEV	
pH	0.87	0.76	0.20	0.81	0.66	0.24	This paper
pH	—	0.71	0.10	—	0.54	0.13	Shibusawa et al.
MC (%)	0.97	0.95	1.23	0.96	0.93	1.43	This paper
MC (%)	—	0.91	1.89	—	0.66	3.11	Shibusawa et al.
SOM (%)	0.96	0.92	0.30	0.95	0.90	0.35	This paper
SOM (%)	—	0.95	0.26	—	0.65	0.56	Shibusawa et al.
TC (%)	0.95	0.91	0.13	0.94	0.89	0.15	This paper
TC (g/kg)	—	0.91	0.65	—	—	—	Chang and Laird
EC (mS/cm)	0.80	0.64	0.016	0.75	0.57	0.017	This paper
EC (mS/cm)	—	0.74	0.024	—	0.65	0.042	Shibusawa et al.
CEC	0.96	0.92	1.26	0.94	0.89	1.44	This paper
CEC	—	0.88	—	—	—	—	Shepherd and Walsh

Viscarra Rossel, R.A., D. Walvoort, A. McBratney, et al. 2006. Geoderma 131 (1-2) 59-75

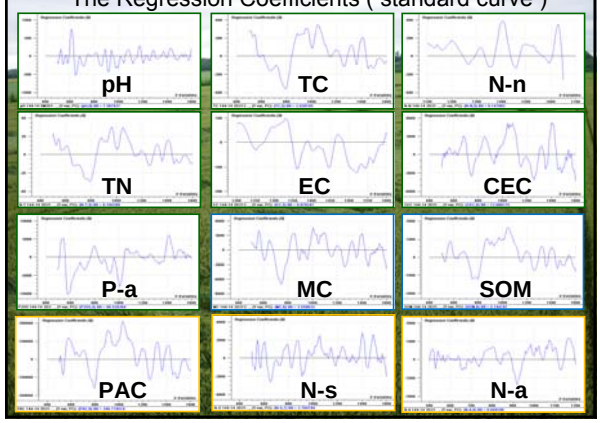
Parameters	Calibration			Validation			References
	correlation	R^2	SEC	correlation	R^2	SEV	
N-a (g/100g)	0.83	0.69	0.14	0.73	0.54	0.17	This paper
N-n (mg/100g)	0.71	0.50	0.14	0.67	0.45	0.15	This paper
N-n (mg/100g)	—	0.80	3.70	—	0.54	4.74	Shibusawa et al.
N-s (mg/100g)	0.85	0.73	0.47	0.77	0.59	0.58	This paper
N-t (%)	0.94	0.89	0.01	0.93	0.87	0.01	This paper
N-t (g/kg)	—	0.86	0.04	—	—	—	Chang and Laird
P-a (mg/100g)	0.87	0.76	7.48	0.85	0.72	8.03	This paper
P-a (mg/kg)	—	0.81	—	—	—	—	Daniel et al.
PAC	0.96	0.92	42.18	0.95	0.90	48.13	This paper

Viscarra Rossel, R.A., D. Walvoort, A. McBratney, et al. 2006. Geoderma 131 (1-2) 59-75

The Scatter Plots on dozen-soil-parameter

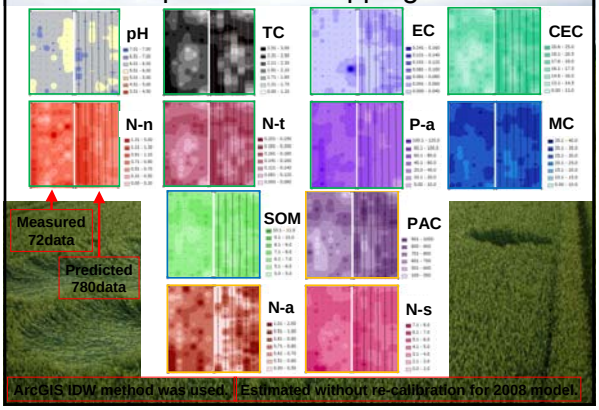


The Regression Coefficients (standard curve)



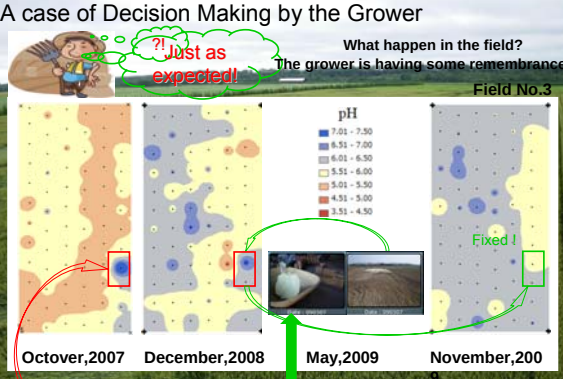
Dozen-soil-parameter Mapping

This is a case of field No.3 in 2009.



ArcGIS IDW method was used. Estimated without re-calibration for 2008 model.

A case of Decision Making by the Grower



Spilled a large amount of the lime fertilizer

Distributed the powdered sulfur, like this.

Conclusions

- Dozen-soil-parameter calibration models were developed using multivariate regression.
- The sensitivity analysis for dozen-soil-parameter was obtained almost the same result with previous study.
- A major result of this study was accepted by the grower as one of a decision-making support tool.

Thank you for your attention.

We look forward to your visit to the 4th ACPA in Obihiro, Japan.