Proximal sensing of soil organic matter using the Veris® OpticMapper™

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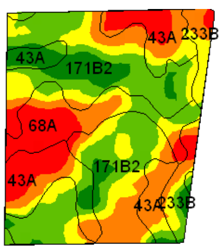
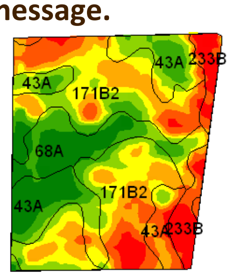
What we'll cover:

- The basis for creating the OpticMapper
- Sensor deployment
- Results
- Observations/discussion

The basis: decoding and interpreting the soil EC message.



EC—red high, green low



Carbon—green high, red low

Other conditions where EC needs addl info: salinity, 'black sands', low and high OM clay soils, fragipans

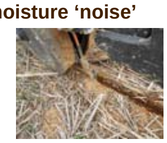
Deployment

Wavelength selection: data mining (Vis-NIRS); literature

660 and 940 nm

Sapphire window: dust-free, self-cleaning (Vis-NIRS)

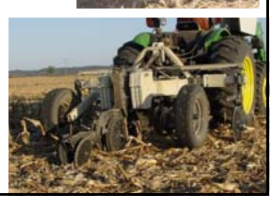
Subsurface : under residue and surface moisture 'noise'



Deployment

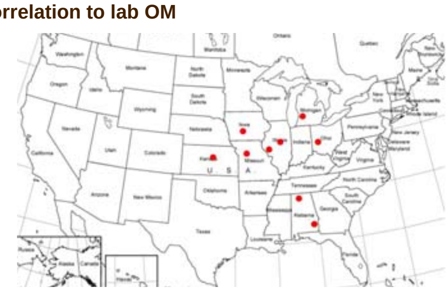
Depth Control: soil moisture variability within top few cm

Other parameters:
-conventional tillage or untilled conditions
-tractor or 4WD pickup
-Mobile Sensor Platform with EC sensors
-field speed 10-15 km/hr
-simple as Veris EC

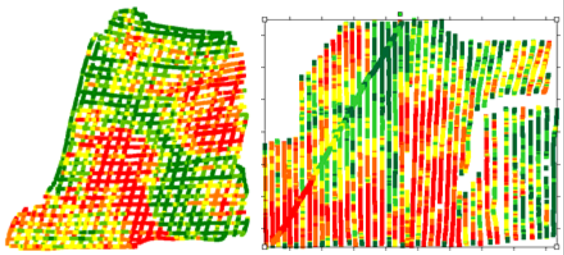


Results

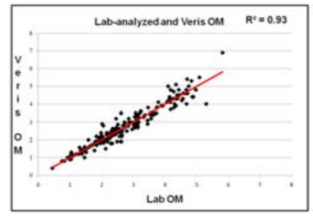
- Repeatability
- Calibrations and cross-validations
- Correlation to lab OM



Results--repeatability

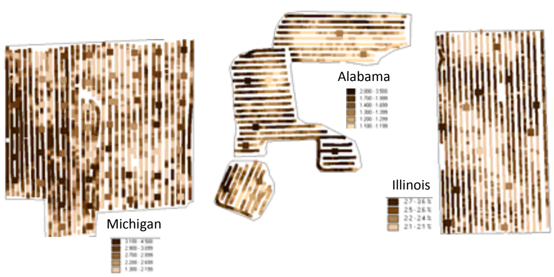


Results

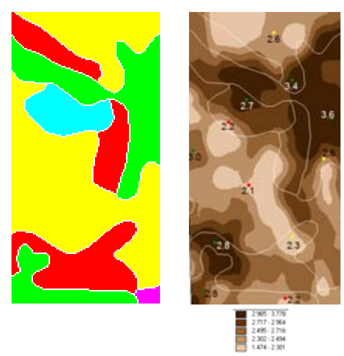


State	N	ha	# of flds	Std. dev.	Ave. OM %	OM % Range	R^2	RMSE	RPD
Kansas	24	132	4	0.54	2.3	1.6-3.5	0.93	0.14	3.86
Missouri	50	89	3	0.55	2.4	1.0-3.5	0.71	0.30	1.83
Iowa	41	65	2	0.51	4.3	3.4-5.5	0.57	0.33	1.55
Illinois	42	172	5	1.06	2.5	.4-5.1	0.95	0.23	4.61
Michigan	11	61	1	0.64	3.0	1.7-4.5	0.91	0.27	3.41
Ohio	13	85	3	1.57	2.8	1.3-6.9	0.85	0.59	2.66
Alabama	14	95	2	0.72	1.7	.9-3.5	0.79	0.32	2.25

Results--estimations



Results—ground-truthing



Lab-tested OM varies from 2.1 to 3.4 within the poorest soil type on this field; and from 2.2 to 3.6 within most productive soil type.

Results: OM and EC

state	EC-Red R^2
IA	0.002
AL	0.002
IL	0.005
KS	0.030
MO	0.070
MO	0.077
IL	0.126
MO	0.269
KS	0.275
MI	0.290
OH	0.301
KS	0.402
AL	0.420
IL	0.471
OH	0.484
IL	0.592
IL	0.700
OH	0.879
KS	0.917

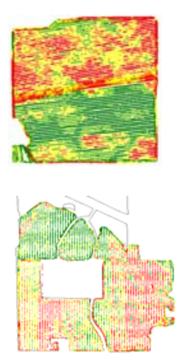
< .20 R^2

.20-.40 R^2

.40-60 R^2

> .60 R^2

Discussion: data quality

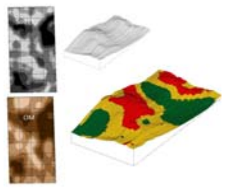


Equipment and soil moisture issues
Training: assessing field condition, mapping differing conditions separately, calibrating all areas with samples; equipment maintenance and testing

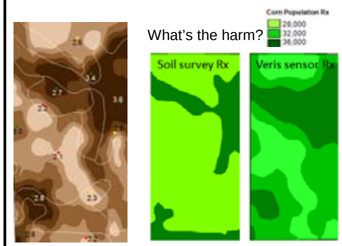
Veris Mapping Center
- -quality control
- -data diagnostics
- -filtering, clean-up
- -visual review
- -communication with customer
- -calibration/validation (MVR)
- -$.25/ac ($.62ha)
- -EC included at no additional cost

Discussion: applications

- Seed populations
- Nitrogen
- Sampling zones
- VR irrigation
- Soil-applied herbicides
- Helps estimate pH buffer



Discussion: applications



-80 ac field
-19 ac differ by one level
-13 ac by two levels
-planting 4,000 fewer seeds/ac on highly productive soil could result in >$100/ac of missed production
-over $2000 potential annual loss for using the 'free' survey

Summary…why we believe this sensor is important:

- **OM relates closely to productive potential**
- **OM is 'calibratable' across fields, farms, regions**
- **OM relates to nitrogen mineralization, use, and loss (as does texture, but in different ways)**
- **The 2nd sensor makes EC more efficient and useful**
- **The addition of OM sensing brings proximal sensing closer to the 'tipping point'**