Determination of Crop Residue Cover Using Field Spectroscopy

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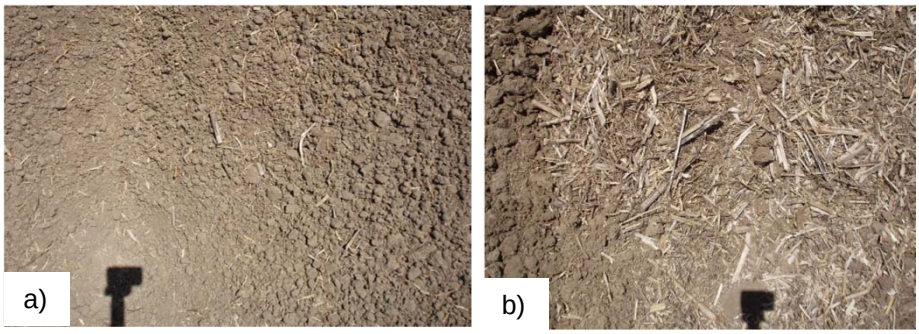
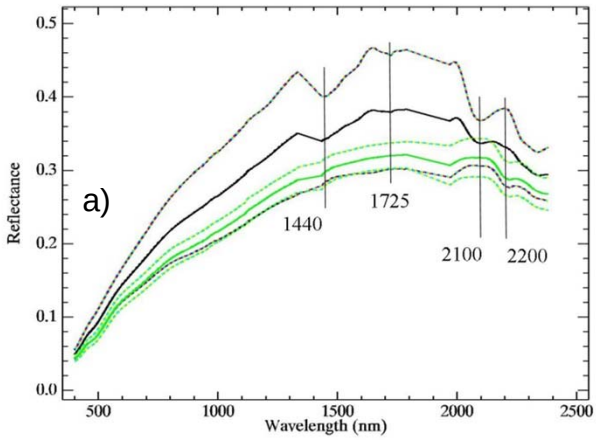
Our assessment of existing and new remote sensing spectral indexes for crop residue cover measurement suggests that the spectral resolutions of hyperspectral and multispectral airborne and satellite sensors can accurately determine the variability of residue and exposed soil. This spatial information will improve carbon sequestration models for cropland management.

Goal: Determine effective reflectance indexes for several airborne and satellite sensor bandwidths.

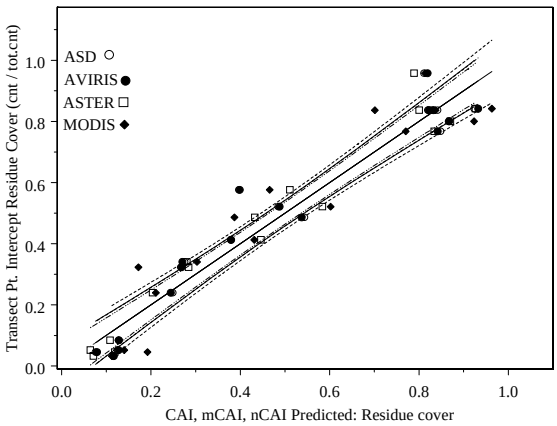


Digital photos coincident with spectral measurements of corn residue in a) standard and b) conservation tillage.

Line transects and photos measured amount of residue and soil. More than by 3700 photo points were interpreted with software for precise placement and detailed repeatable inspection (SamplePoint, USDA-ARS, Cheyenne, WY). With each photograph, ASD field spectrometer measured the reflectance. These spectra were convolved to match the bandwidth of AVIRIS airborne, and ASTER and MODIS satellite sensors to evaluate reflectance indexes to measured residue contents.



Spectral mean (solid line) and 90 % confidence limits (dashed) for conservation tillage (black) and standard tillage (green) for corn residues demonstrates albedo alone is ineffective for determining residue amounts.



Prediction of transect residue cover by the four instrument. Spectral resolutions. Dashed lines are 95 % confidence limits using combinations of lignin/cellulose band indexes.

		ASD	AVIRIS	ASTER	MODIS
CAI	RMSE	0.08	0.08	0.09	0.13
	r^2	0.94	0.94	0.92	0.84
	n	303	303	303	303

Regression coefficients between Cellulose Absorption Index (CAI) and photo point-intercept residue cover measurements show CAI effective with these sensors resolutions.

Among the many reflectance indexes applied to simulated sensor bandwidths, Cellulose Absorption Index, Angle Near Infrared (ANIR)/Shortwave-infrared Angle Slope (SASI), and Spectral Mixture Analysis (SMA), CAI and ANIR/SASI the most effective among the sensors.

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