had the least significance. Thus, after removing the 2440 nm band as a component, the next combination was 1350, 1850, 2450 nm and, eventually, the combination 1410, 1910, 2450 nm was decided upon. In the case of clay, a fourth component (2460 nm) was added subsequently, as it increased both r^2 and adjusted-r^2 values.

In all cases, except C_{org}, PLS regression was most successful using the first derivative (10 nm intervals) of the spectral data. The Savitsky-Golay filter was also experimented with, though this did not improve upon first derivative regression results (as interpreted by r^2 values). As shown in Table 3.3.2, all equations are significant to $p < 0.01$ and all components to $p < 0.1$ (most are $p < 0.01$). R^2 values are comparable to those of previous studies (see appendix). Figure 3.3.5 show scatter plots of actual vs. predicted values generated by each soil indicator's equation.

Table 3.3.2 Coefficients used to predict soil quality indicators from spectral data

Indicator	r^2	Adj-r^2	RMSE	p	Band (λ nm)	Coefficient	p
Clay % (first deriv.)	0.935	0.883	2.02	0.0036	Intercept	60.36	0.0003
					1410	-83990	0.0007
					1910	84700	0.0017
					2450	-21894	0.0595
					2460	-13924	0.0659
% C_{org} (original reflectance)	0.936	0.904	0.236	0.0006	Intercept	2.250	0.0165
					350	56.46	0.0025
					400	170.44	0.0011
					700	-19.70	0.0023
% N (first deriv.)	0.840	0.760	0.021	0.0084	Intercept	0.428	0.0003
					360	56.46	0.0025
					410	-276.11	0.0107
					760	-811.68	0.0179
Exch. K (first deriv.)	0.983	0.974	0.048	< 0.0001	Intercept	1.27	< 0.0001
					1350	6452	< 0.0001
					2420	-1854	0.0001
					2430	1757	0.0001

*p-values indicate significance (from t-values)

Soil quality indicators were then predicted for the remaining 90 samples using each indicator's multivariate equation [i.e., from Table 3.3.2, exch. K (me/100 g soil) = $1.27 + 6452 \cdot X_{1350} - 1854 \cdot X_{2420} + 1757 \cdot X_{2430}$]; Figure 3.3.6 provides an example, using the derivative of a random soil sample's spectra to predict clay content. In four instances for clay and C_{org}, equations produced values outside of an indicator's prediction interval ($\alpha = 0.1$, performed in SAS) and these values were removed from the data set to prevent extrapolation (outliers for N and K are indicated as appendix). To correlate soil quality indicators with soil type, land use, and management practices, indicator values were averaged for all soil samples taken in a particular category (e.g., all soils from RU2, or all soils from fields with contour ridges). C/N ratio was calculated as $\%C_{org}$ over %N and trends are reported alongside those of the other indicators.

Trends in soil quality indicators were tested for significance using one-tailed t-tests (performed in SAS). Management practices (from georeferenced soil sample site descriptions) were also matched with ASTER pixels to observe their influence in SLA-NDVI and MSI values, and trends were tested for significance using one-tailed t-tests.

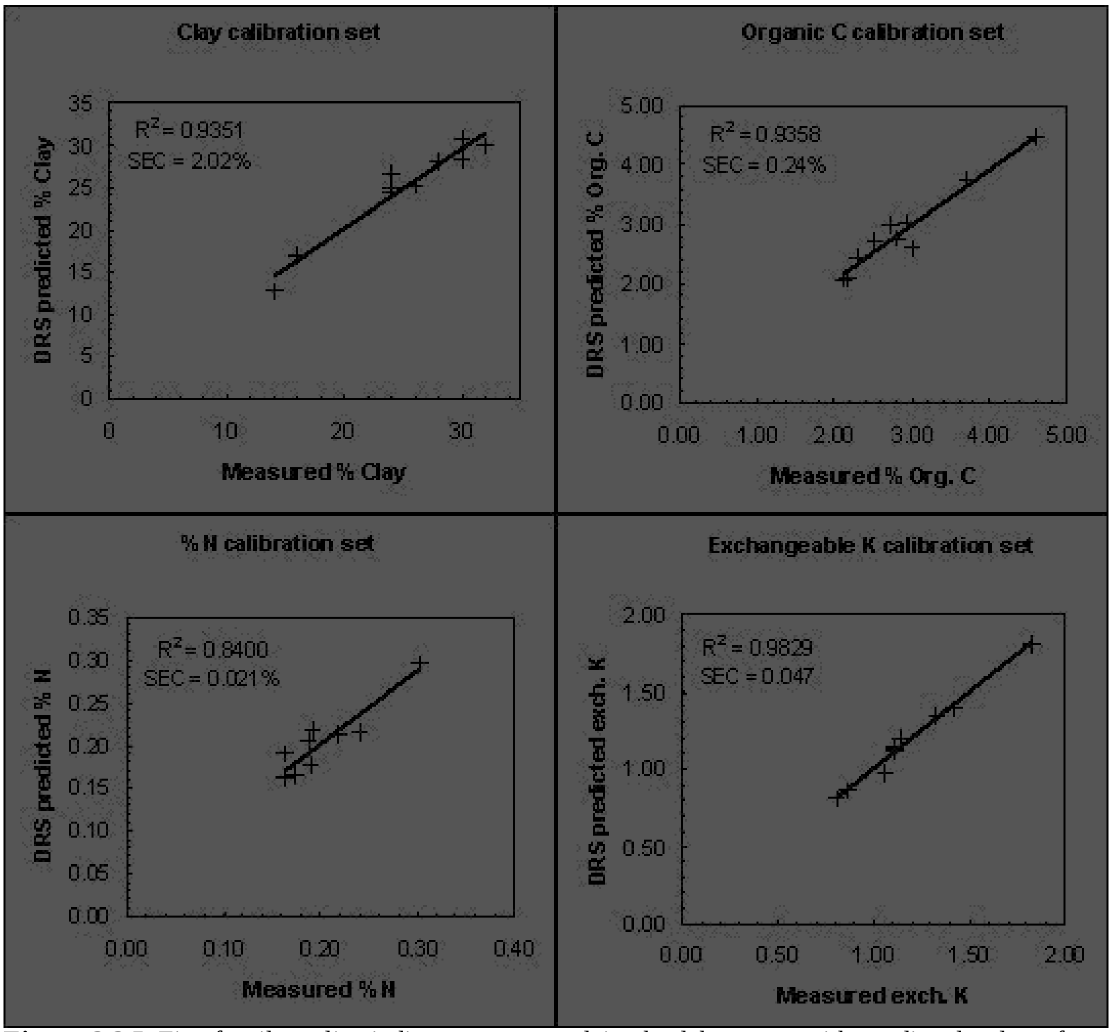

Figure 3.3.5 Fit of soil quality indicators measured in the laboratory with predicted values from calibration to soil spectra