

# Rapid characterization of Organic Resource Quality for Soil and Livestock Management in Tropical Agroecosystems Using Near Infrared Spectroscopy.

Shepherd KD, Palm CA, Gachengo CN and Vanlauwe B. 2003. *Agronomy Journal* 95:1314-1322.\*

Email correspondence: [k.shepherd@cgiar.org](mailto:k.shepherd@cgiar.org)

## Abstract

Organic resources constitute a major source of nutrient inputs to both soils and livestock in smallholder tropical production systems. Determination of resource quality attributes using current laboratory methods is both timely and costly. This study tested visible and near infrared (wavelengths from 0.35 to 2.50  $\mu\text{m}$ ) reflectance spectroscopy (NIRS) for rapid prediction of quality attributes for a diverse range of organic resources. A spectral library was constructed for 319 samples of oven-dried, ground plant material originating from green leaf (186 samples), litter (33), root (25), and stem (21) samples from over 83 species including tropical crops and trees used for agroforestry, and manure samples (39). Organic resource attributes were calibrated to first derivative reflectance using regression trees with stochastic gradient boosting, and screening tests were developed for separating various organic resource quality classes using classification trees.

Validation  $r^2$  values for actual versus predicted values using a 25% hold-out sample were 0.91 for nitrogen, 0.90 for total soluble polyphenol, and 0.64 for lignin concentration. Screening tests gave validation prediction efficiencies of 96% for detecting samples with high N concentration, 91% for low total soluble polyphenol, and 86% for low lignin concentration. The spectral screening tests were robust even at small ( $n = 48$ ) calibrations sample sizes. Screening tests for detecting samples with low or high levels of P, K, Ca and Mg gave prediction efficiencies of 74 to 92%. NIRS can be used to rapidly screen organic resource quality. Global spectral calibration libraries should be established for a range of resource quality attributes.

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