ASSESSING AND MANAGING SOIL QUALITY FOR SUSTAINABLE AGRICULTURAL SYSTEMS

SANREM-CRSP LTR4
Cross-Cutting Initiative

OBJECTIVES

- Assess community perceptions and indicators of soil quality, including differences in perceptions of soil quality due to differences in gender, environment and socio-economic factors.

- Evaluate the use of spectroscopic-based (near-infrared, mid-infrared, and visible range) analytical methods to assess soil organic matter fractions and soil quality in degraded and non-degraded soils [in Bolivia (Cochabamba and Umala), Indonesia, and Philippines].

- Collaborate in the evaluation of soil metagenomic methods as an indicator of soil degradation.

SOIL QUALITY SURVEY

- **One survey for male and female community members and one for agricultural professionals who work in community.**

- **Questions asked about perceptions of soil quality and desired characteristics of a soil quality test.**

- **Farmers primarily use soil physical properties (i.e., soil color, texture and structure, water retention/drainage) and plant growth as criteria for assessing soil quality.**

- **Agricultural professionals indicate that the soil quality test needs to be convenient, low-cost and be accompanied by sufficient training for its use.**

FIELD METHODS

Labile C Determination Using KMnO$_4$ (Weil, 2003)

- **Hand-held field spectrometer – 550 nm**
- **Field chart**
- **Relatively low-cost, rapid and portable**

Solución KMnO$_4$ después de agitarlo con el suelo			
Pobre	Regular	Bueno	Excelente
>0 − 0.25	>0.25 − 0.50	>0.50 − 0.75	>0.75 − 1.0
Escala del Indice de Calidad de Suelos			

Tabla de campo sobre Calidad de Suelos

FIELD METHODS

Portable Field Near Infrared (NIR) Spectrometer

- **Determination of soil organic C using a portable field NIR spectrometer, Fieldspec Pro FR (Stevens et al., 2006)**

- **It may relate to use of remotely sensed infrared imagery to improve diagnostic capabilities to assess plant and soil health.**

- **Rapid, portable, and non-destructive method.**

LABORATORY METHOD

Diffuse Reflectance Fourier Transform Infrared Analysis (DRIFT) – Mid Infrared Analysis

- **Can determine changes in ratios of reactive (O-containing) and recalcitrant (C, H and/or N) functional groups due to management practices.**

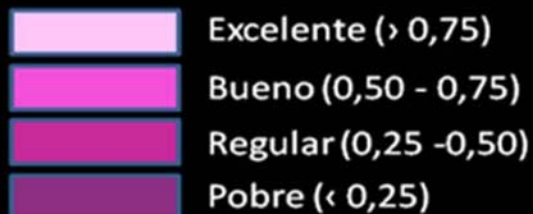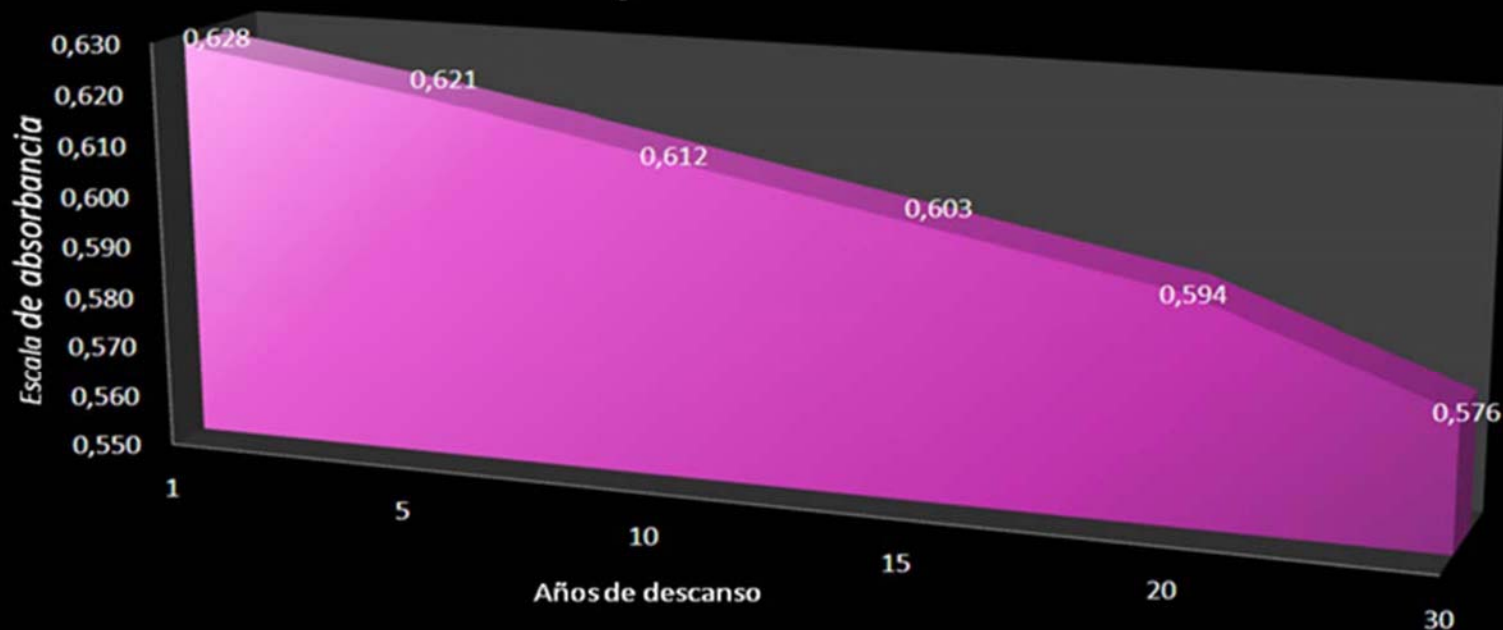- **Advantages are that it measures organic C groups so can assess labile and stable C pools.**

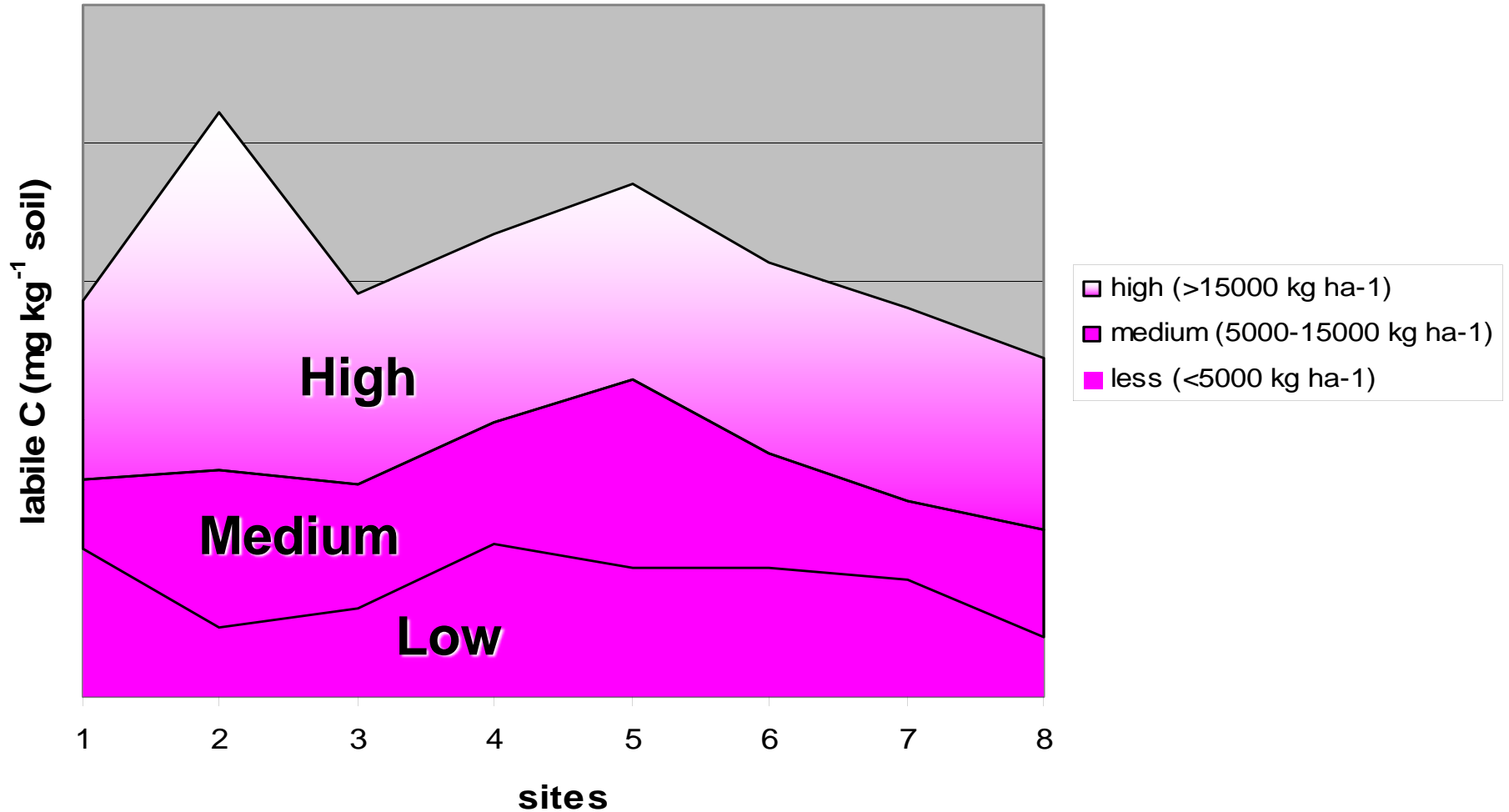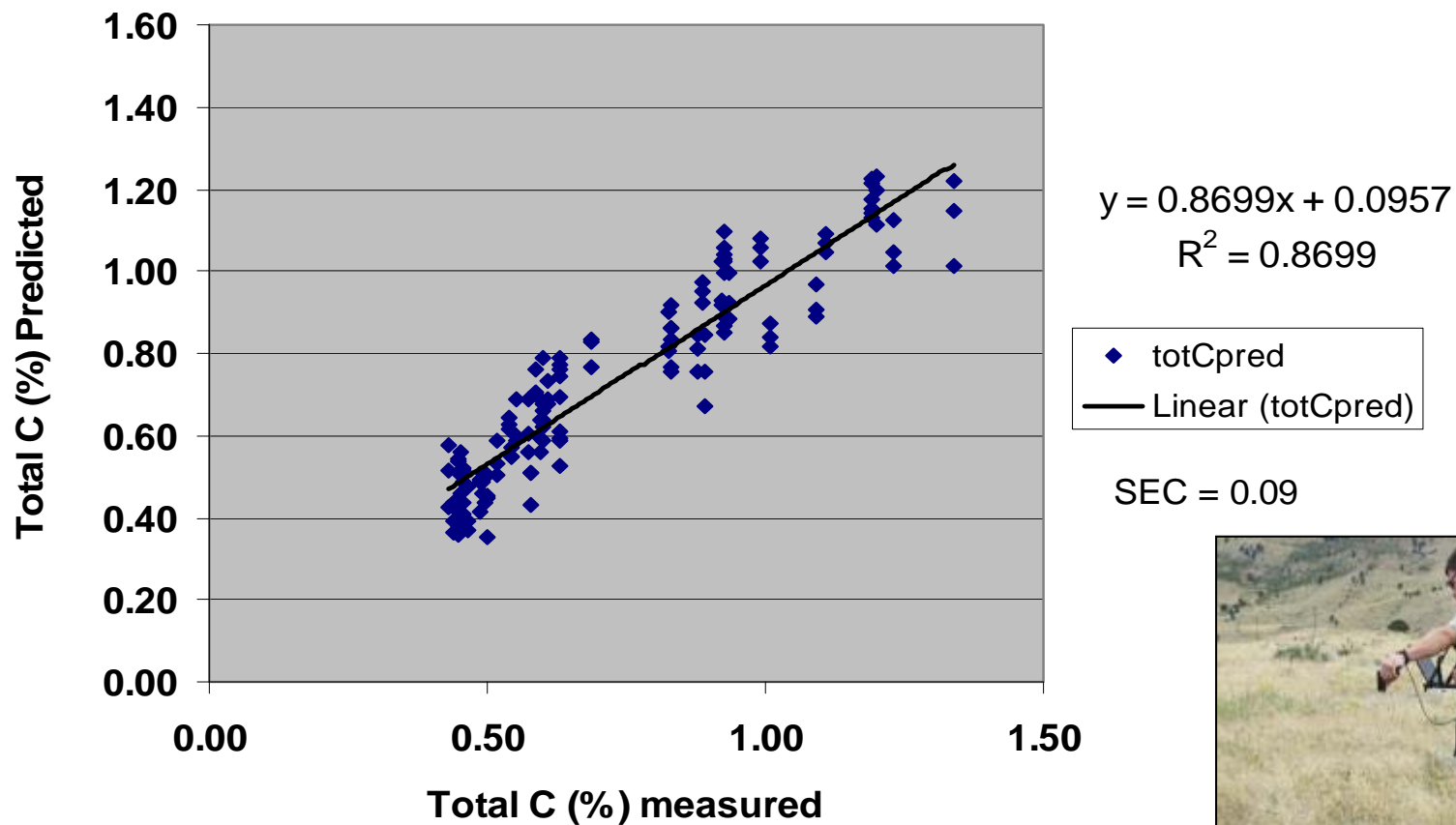# EFFECTS OF FALLOW AND CROPPING ON SOIL ORGANIC C IN UMALA
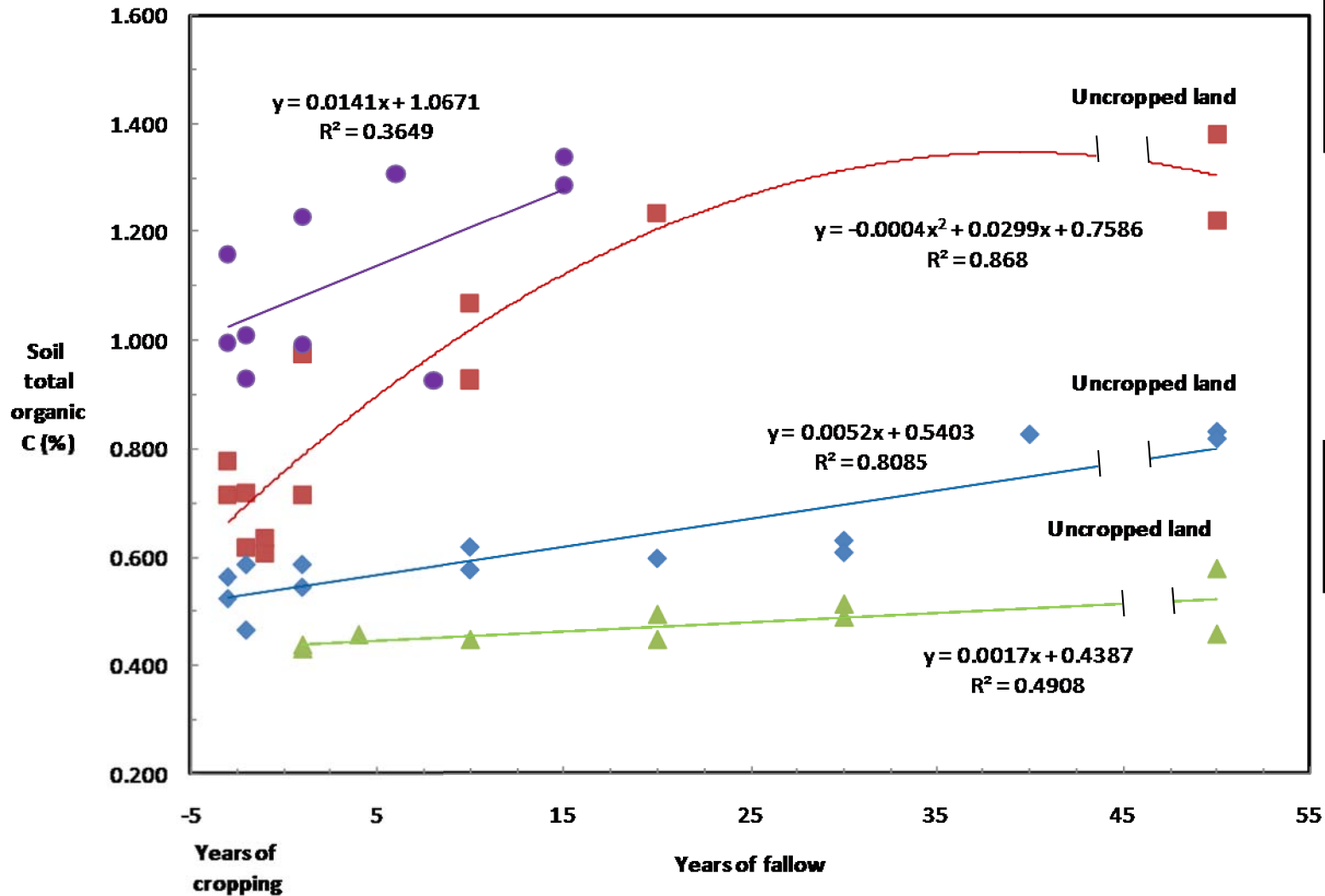
Potassium permanganate-extractable C in fields with different fallow periods in Umala

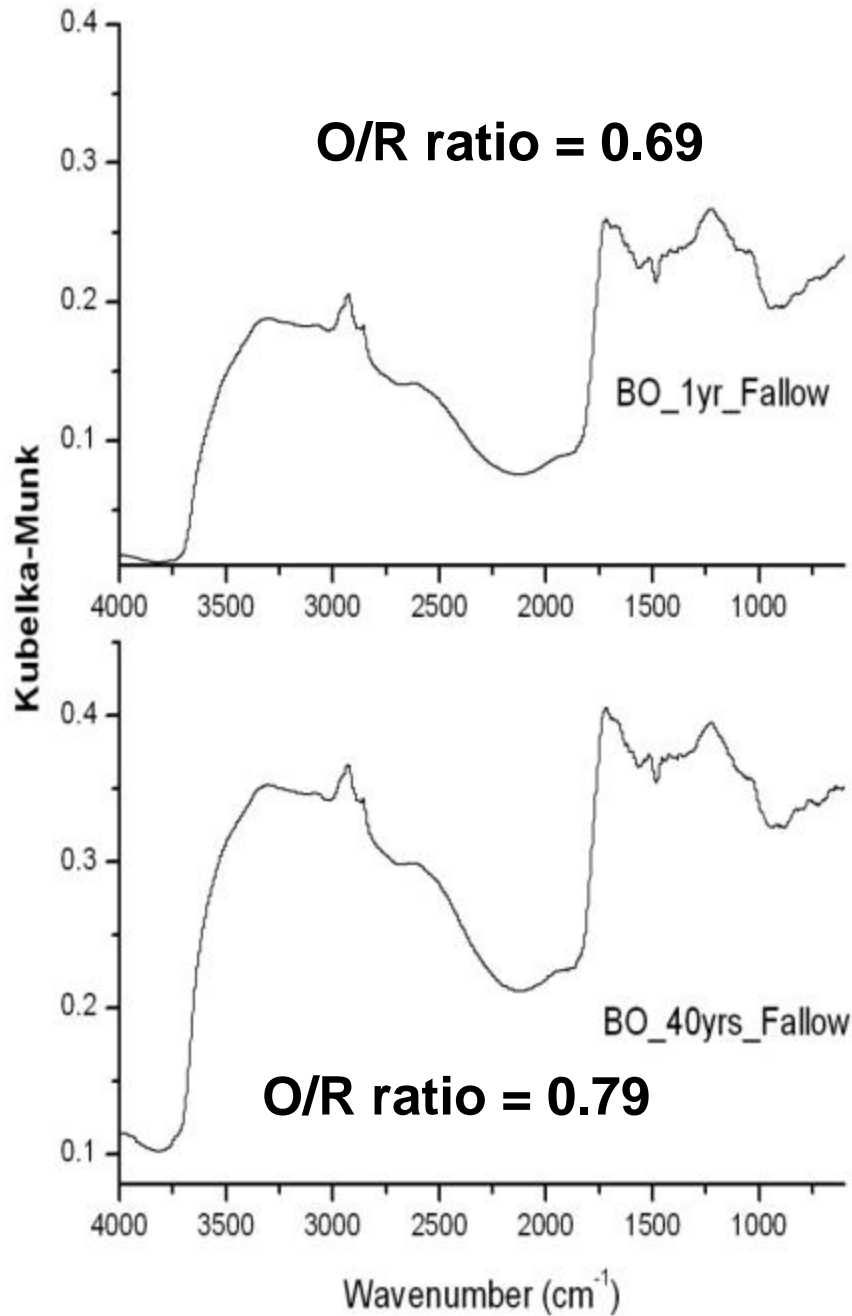# EFFECTS OF LANDSCAPE POSITION AND CROPPING ON LABILE C IN THE PHILIPPINES USING THE KMnO$_4$ TEST
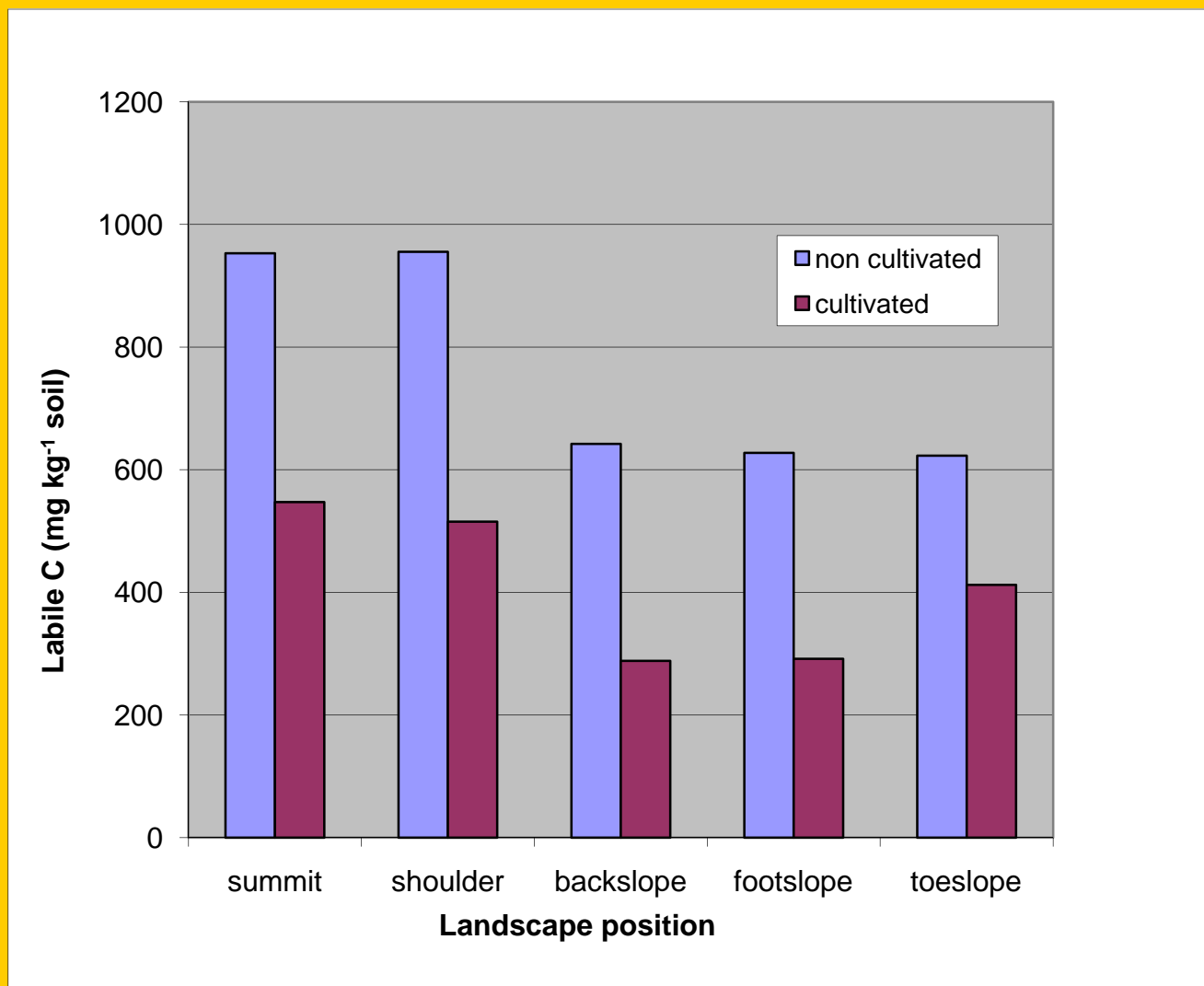
EFFECTS OF POULTRY MANURE APPLICATIONS ON LABILE C IN INDONESIA USING THE KMnO$_4$ TEST

Predicted versus measured total soil organic C using NIR

O/R ratio = 0.69

O/R ratio = 0.79

Mid-infrared spectra of humic acid after 1 year and 40 years fallow

SIGNIFICANT FINDINGS

- Laboratory and field-based tests (e.g., KMnO$_4$ test) that measure more biologically-available forms of soil organic matter can be indicators of changes in management practices and are relatively rapid and inexpensive tests of soil quality and soil degradation.

- Near infrared spectroscopy (NIR) is a rapid and nondestructive field method for evaluating changes in soil organic matter fractions, but its current cost may make it less favorable for developing countries.

- Development of an inexpensive NIR field instrument may have some promise for use in soil quality assessment.