# FEASIBILITY OF IN-FIELD SOIL ANALYSIS BY NEAR-INFRARED SPECTROSCOPY

AW SCHUMANN AND JH MEYER

*South African Sugar Association Experiment Station, Private Bag X02, Mount Edgecombe, 4300, South Africa*

There is increasing demand for intensive soil sampling, which facilitates soil mapping, site specific water, fertiliser, pesticide and herbicide recommendations as specified in the rapidly developing management system known as precision agriculture. The high cost of soil sampling and analysis in conventional laboratories has restricted the full implementation of this technology, and Near-Infrared Spectroscopy (NIRS) could be a cost effective solution. Recent improvements in NIRS instrument design have produced models that are small, light, vibration resistant and fast, capable of collecting a complete scanned spectrum in one second.

Intensive topsoil grid sampling (n=575) of a small 0,342 ha field and subsequent analysis on a laboratory NIR spectrometer NIRS6500 was conducted to test the feasibility of in-field portable NIRS sampling and on-line analysis of soils. Good calibrations were obtained with ISI software using modified partial least squares regression on a smaller sample subset (for example, clay % $R^2$=0,97, n=72). Other soil properties including gravimetric soil water, buffer capacity, pH, electrical conductivity, titratable acidity, organic matter, mineralisable nitrogen, potential ammonia volatilisation from urea, potential nitrification rate, and urease activity could be calibrated despite the use of field-moist unprepared soils in the NIR instrument. Validation of the clay equation demonstrated that an acceptable standard error of 2,1% clay (Figure 1) may be possible with this technique. Predicted NIRS results for the complete sample set (n=575) were mapped as shown for clay (Figure 2) and discussed in relation to sampling strategies, precision agriculture (lime and herbicide application), and simulation modelling (soil nitrogen processes). A portable NIRS unit would allow intensive fresh in-field sample analysis, which is essential for measuring biological processes, and eliminate the need for costly sample collection, transport, preparation and storage.

*Keywords*: grid sampling, near-infrared, precision agriculture, soil mapping

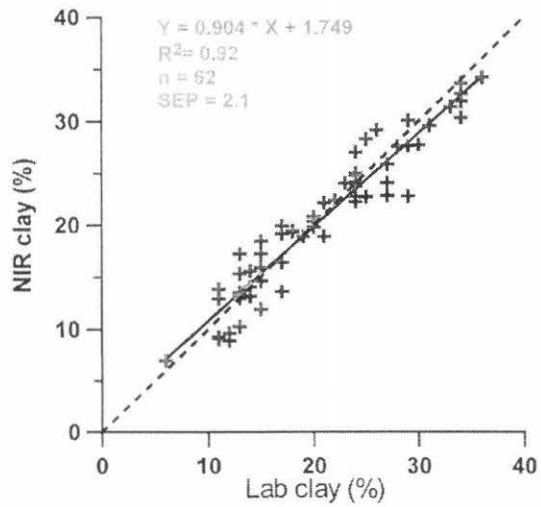


**Figure 1.** Prediction of soil clay content by NIRS using independent validation samples.

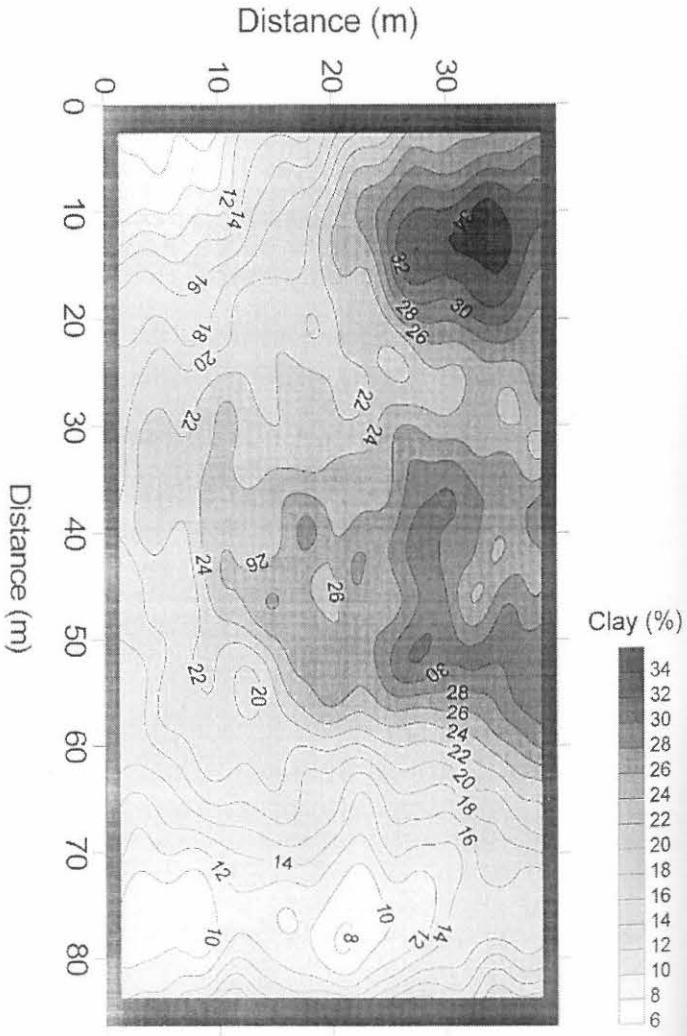


**Figure 2.** NIR-predicted soil clay map constructed from the 575 grid sample points.