

Soil spectral signatures for sugarcane fertiliser recommendations through an adapted soil typology

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Abstract

Sugarcane is a major pillar of Reunion Island's economy and covers 54% of arable land. In order to optimize yields, costs and sustainability, a soil-specific nutrient management expert system for volcanic soils, SERDAF, was developed in the 1990s, based on soil type and the chemical analyses of soil samples. Recent work, based on infrared spectral analyses combined with soil descriptions, have shown that some soil units of the soil map were misleading. This presentation will demonstrate how soil infrared spectral profiles can help to reclassify soil type and update the soil map.

Mid-infrared spectroscopy is a powerful tool for soil classification because it allows detailed mineralogical descriptions of soil samples. Different mineral and organic components absorb infrared radiation at different frequencies. The resulting absorption spectrum produces a characteristic shape that may be used for soil classification purposes. It will, therefore, be possible to redefine the Reunion soil map using a database of chemical analyses, made up of more than 45 000 samples collected from 1992 to present, and soil infrared spectral signature investigations.

Mining of the soil chemical analysis database showed marked variability in soil carbon (C) within some soil units, suggesting inconsistencies in soil type definitions and distributions. This, in turn, suggested that there is a need to revisit the soil map to improve fertiliser recommendations produced by the expert system. As nitrogen (N) and phosphorus (P) fertiliser requirements are highly sensitive to soil type, a more accurate definition of soil units will allow improved nutrient management guidelines. Laboratory experiments will provide updated values of the apparent utilization coefficient of N fertiliser applied as urea. Soil P-sorption capacities of soil units will also be adjusted.

The observed limitations of the current expert system suggested significant potential to improve the efficiency and relevance of fertiliser recommendations for sugarcane in Reunion. The impact of the planned revision on fertiliser recommendations will be investigated using sensitivity analyses.

Keywords: nutrient management, Reunion, soil, spectral signatures, sugarcane