

# Using rapid soil nitrate tests to inform N management in smallholder farming systems of Africa

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In Sub Saharan Africa (SSA), low soil fertility is the main constraint for smallholder farmers to achieve food security and break out of protracted poverty traps. Conservation agriculture practices involving minimum tillage, residue retention and crop rotations have been widely promoted in the region to prevent further soil fertility decline. Adoption of these practices aim to improve water infiltration and retention, and soil carbon and nitrogen (N) cycling, though often cause yield penalties due to N immobilisation associated with low quality maize residues and minimum tillage. Increasing N fertiliser application rates can overcome such yield penalties however this option is generally unacceptable to cash-poor smallholder farmers. Providing options for improved understanding so as to manage the limited soil N supply to meet critical crop N demand throughout the season may potentially encourage investment and stabilise yields. However, given the complex and dynamic nature of soil N cycling and the lack of soil testing facilities, simple tools that can estimate plant N availability can be useful. We therefore assessed the sensitivity of an ion selective electrode (ISE) rapid field ready soil nitrate meter against laboratory methods with colourimetric automated analytical finish for a range of soils across SSA. Issues with the nitrate meter detection limit and the generation of a sufficiently clear analysable soil solution extracted in a short timeframe were overcome via the use of 0.3mmol/L Ca(NO<sub>3</sub>)<sub>2</sub> extraction solution combined with a settling period and filtration. Minimum detection limit with the optimised nitrate meter methodology was 5ppm ±2.5ppm grading upwards to 10ppm ±5ppm when results returned exceed a 100ppm threshold. We propose that accurately calibrated ISE meters with appropriate soil extract methodology have potential for use in agronomic extension with smallholder farmers in SSA.