Conservation Agriculture (CA) in Malawi: Integrated Assessment of Soil Health Outcomes

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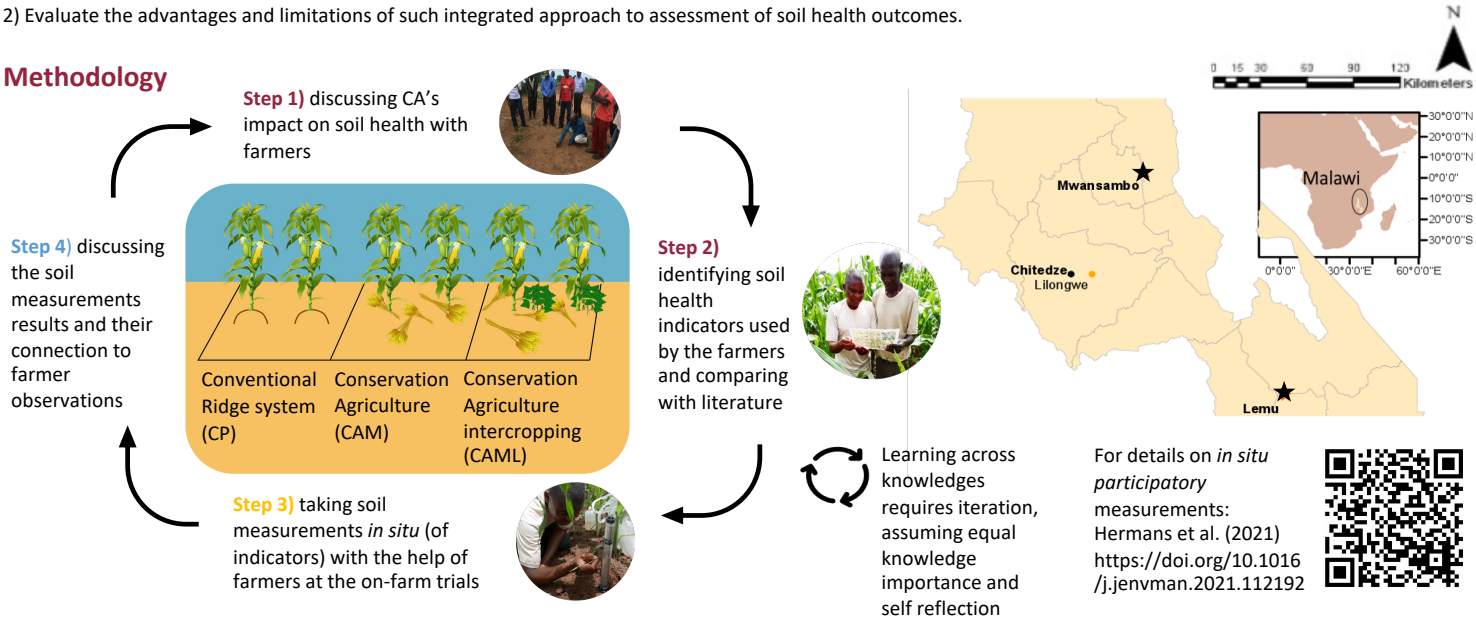
Introduction

Despite positive results on soil parameters such as soil water retention, yield and heat stress resilience, CA uptake across southern Africa has remained low. Previous studies on CA impact on soil health have mainly focused on 'scientific' measurements, thereby not including local knowledge to understand farm system experience of soil health improvement. However, combining soil science and local experience: 1) Contextualises understanding of CA impact on soil health on-farm and 2) improves understanding farmer-decision making on land management

Aims:
1) Develop a stepwise framework to combine local knowledge and conventional soil science to develop a contextualised understanding of the impact of CA on soil health on farm trials in two Malawian communities;
2) Evaluate the advantages and limitations of such integrated approach to assessment of soil health outcomes.

Methodology



Results

Step 2) Soil health indicators

Comparing farmer soil health indicators with soil health literature resulted in measuring:

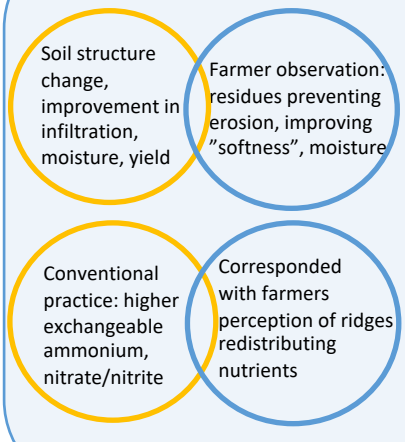
- *Total Carbon*
- *Total Nitrogen*
- *Ammonium*
- *Nitrate & Nitrite*
- *Infiltration & Moisture*
- *Soil Structure Stability index*
- *Bulk Density*
- *Visual Evaluation of Soil Structure (VESS)*
- *Yield*

Step 3) Soil measurements

CA improves:
- **Soil moisture** (Mwansambo 7.54%-38.15% lower for CP; Lemu 1.57%-47.39% lower for CP)
- **Infiltration** (Lemu CAM/CAML 0.15 cms^{-1}, CP 0.09 cms^{-1}; Mwansambo CP/CAM 0.14 cms^{-1}, CAML 0.18 cms^{-1})
- **Soil structure**
- **Yield** (Mwansambo CP 3225 $kgha^{-1}$ CAML 5067 $kgha^{-1}$, CAM 5160 $kgha^{-1}$)

Conventional ridge systems recorded higher
- **Exchangeable ammonium** (Lemu CP 76.0 $mgkg^{-1}$, CAM 49.4 $mgkg^{-1}$, CAML 51.7 $mgkg^{-1}$)
- **Nitrate/nitrite values** (Mwansambo CP 200.7 $mgkg^{-1}$, CAM 171.9 $mgkg^{-1}$, CAML 103.3 $mgkg^{-1}$).

Step 4) Discussing measurements & farmer observations



\+ Agreements: e.g. moisture, structure

\- Discrepancies: Impact of ridges, nutrients and aeration

Farmer Decision-making?
Adapting CA information to local context. Example: Perceived benefits of residues (e.g. in terms of C) and ridges as redistribution nutrients has led to the popular practice of burying residues in ridges.

Key Conclusions

- Farmers and measurements agree CA improves soil infiltration, moisture and structure.
- Higher inorganic Nitrogen values were recorded in conventional practice, fitting with farmer perception on ridges and its popularity.
- Discrepancies were found between soil measurements and farmer observation on ridges.
- Integrated approach adds to nuanced and localized perceptions on land management, farmer decision-making and builds a wider evidence base for CA's performance.

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