

Conservation agriculture increases climate resilience for staple food crops

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Introduction

Smallholder farmers in southern Africa are often stuck in a poverty trap that prevents wide scale adoption of sustainable farm intensification technologies such as conservation agriculture (CA). Local adaption of CA components that minimise food insecurity risk with minimal cash inputs would improve adoption.

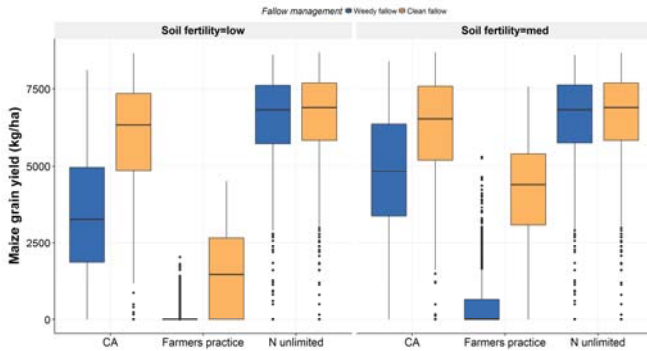
Here we;

1. used experimental results from on-farm trials conducted across Zambia, Zimbabwe, Mozambique and Malawi from 2005 to 2015 to assess the impact of conservation agriculture on maize yields and food insecurity risk;
2. parameterised the APSIM model to explore the effects of individual CA component combinations on maize yield across productivity gradients typical of Sub Saharan Africa.

2. Simulation modelling CA components

We used the validated APSIM model to simulate combinations of CA components with improved agronomic management including residue retention, tillage, crop rotation, planting basins, fallow weed management and mineral nitrogen application. These technologies were evaluated across soils of different fertility, depth and texture and climates with bi- and uni-modal rainfall patterns and annual total rainfall ranging from 700 to 1400mm.

Results averaged across treatments in the low rain environments (<800 mm median rainfall) show that maize yields approach nitrogen unlimited yield when all CA components are implemented with best practice agronomy even without additional nitrogen inputs provided weeds are managed in fallows (shown in figure below).

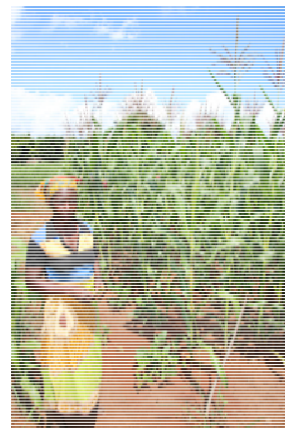
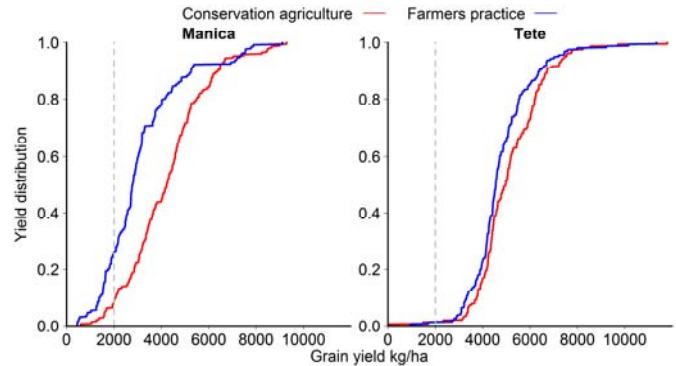


Sheep and goats graze weedy fallows during the dry season even in on-research-station cropping system trials (pictured below)



1. On-farm CA

Full adoption of CA i.e. minimum tillage, residue retention and crop rotation, decreased the frequency of food insecurity risk (<2000 kg/ha) by 35 and 1%, respectively for drier Manica and wetter Tete provinces, Mozambique when compared to conventional control with the same level of inputs (shown in the figure below). With full adoption of all CA components farmers could also reduce the maize crop area from 4 (average total maize crop size) to 1 ha per year and still produce sufficient food on-farm for the average sized family in 98.8 and 92.0% of seasons in Tete and Manica, respectively. This would enable diversification on 75% of the smallholder land.



Mrs Oliveria from Sussundenga, Mozambique implemented intercropping maize with cowpea but continued to till soil for weed control. With the improved agronomy and CA components she was able to grow crops without added nitrogen during the 2015 El Niño even though her neighbours crops failed (pictured on LHS)

Key findings

- CA reduces food insecurity risk in drier environments
- Dry season nutrient management in free grazing systems should be a priority for future research programs.
- Enhanced multidisciplinary research capacity is required to adapt CA systems and for transformational change in dynamic smallholder farming systems across sub Saharan Africa.



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