



Conservation Agriculture in Southern Africa- Assessing its Potential to Respond to Climate Change

By Christian Thierfelder

Outline of this presentation

- Introduction
- CA and Climate-smart agriculture
- Conservation agriculture – its benefits and challenges
- Some research evidence
- Research gaps and needs



Traditional farming systems in southern Africa

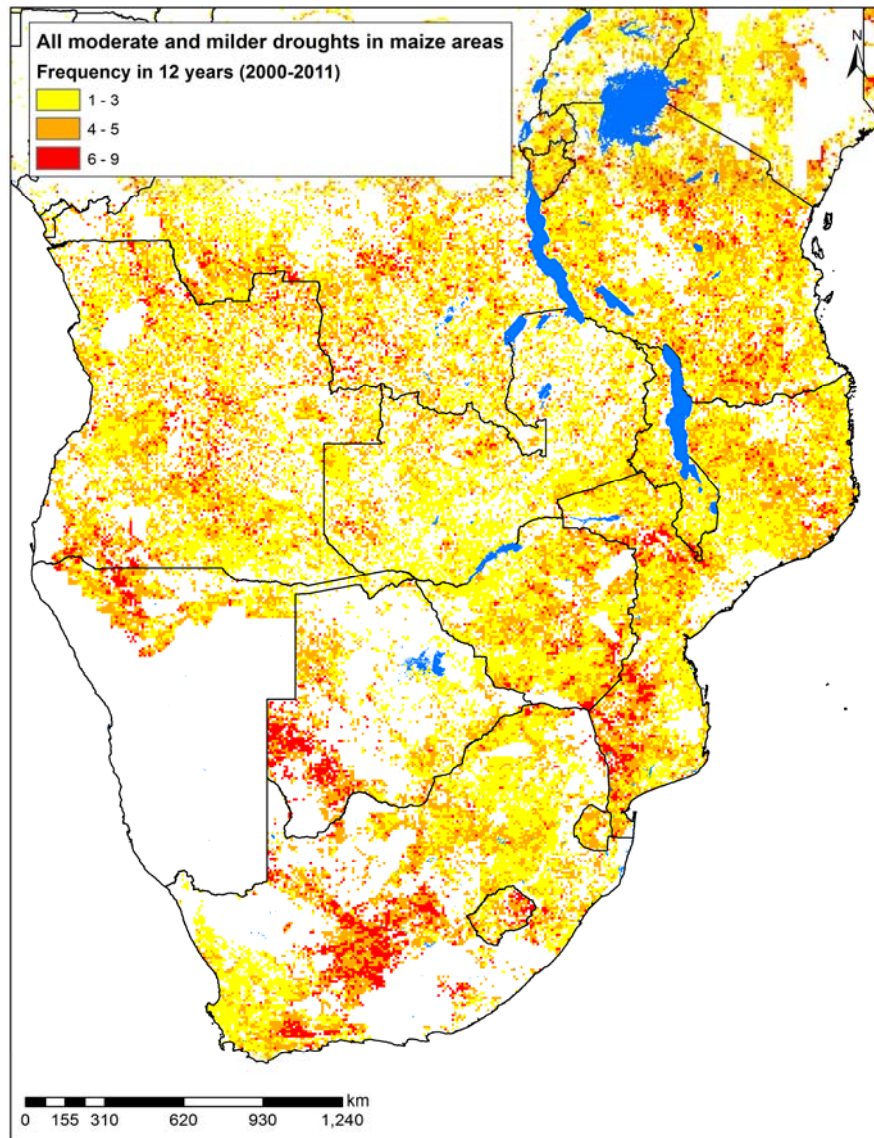
- Based on mouldboard plough or hand hoe
- Largely focussed on maize (50-80% of land area) often planted in monoculture
- Mostly rainfed systems
- Farming systems are diverse, sometimes with intensive crop/livestock interactions



- **Crop residues are burned, grazed, or fed to animals**
- **Farmers rarely use improved varieties and/or mineral fertilizer (10kg ha^{-1} NPK in SSA)**
- **Farmers still use a lot of manual labour**
- **Large cropping areas are on inheritantly poor sandy soils**
- **The predominant climate is very variable**



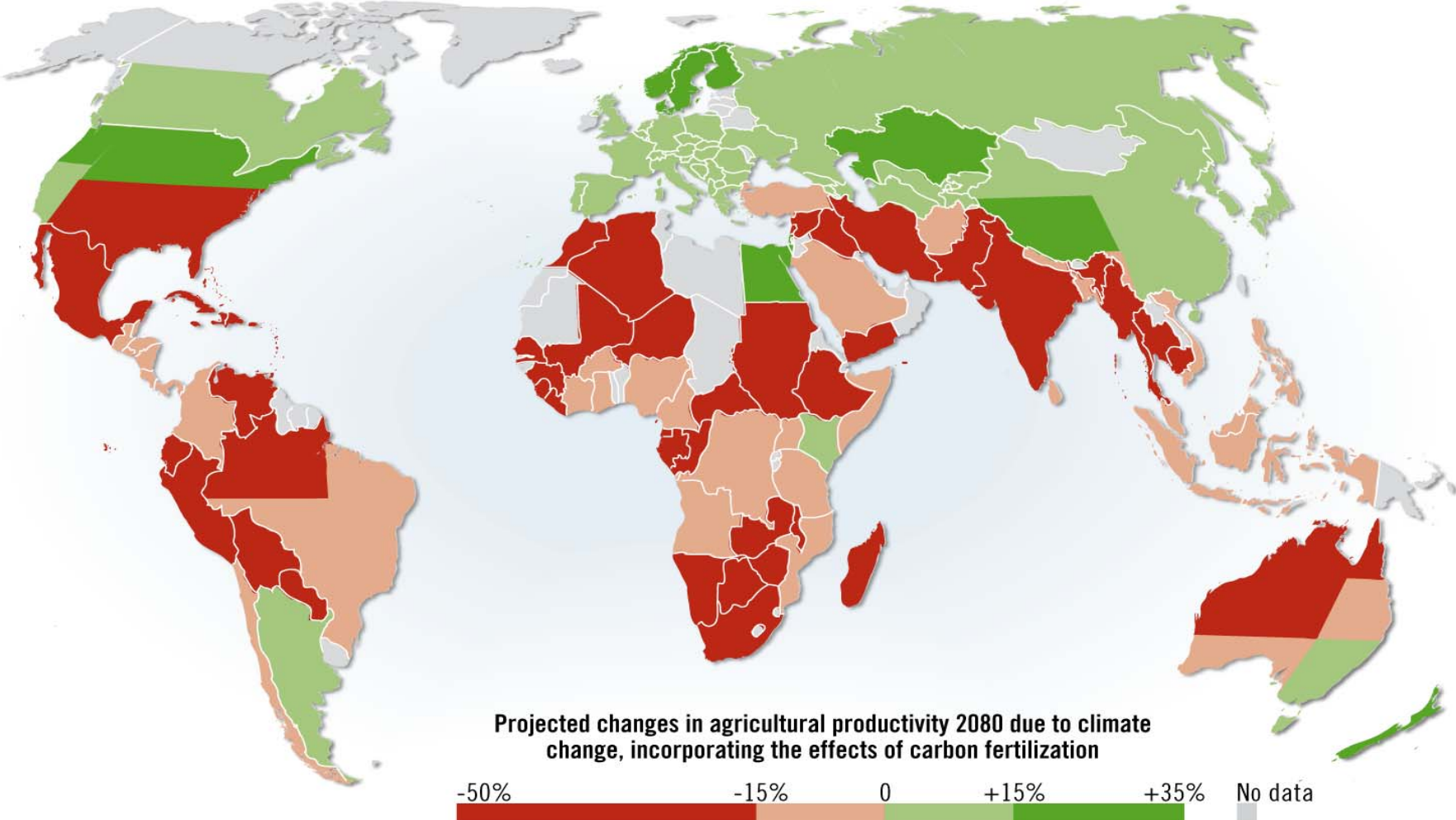
The Challenges in Africa



Source: Sonder, unpublished

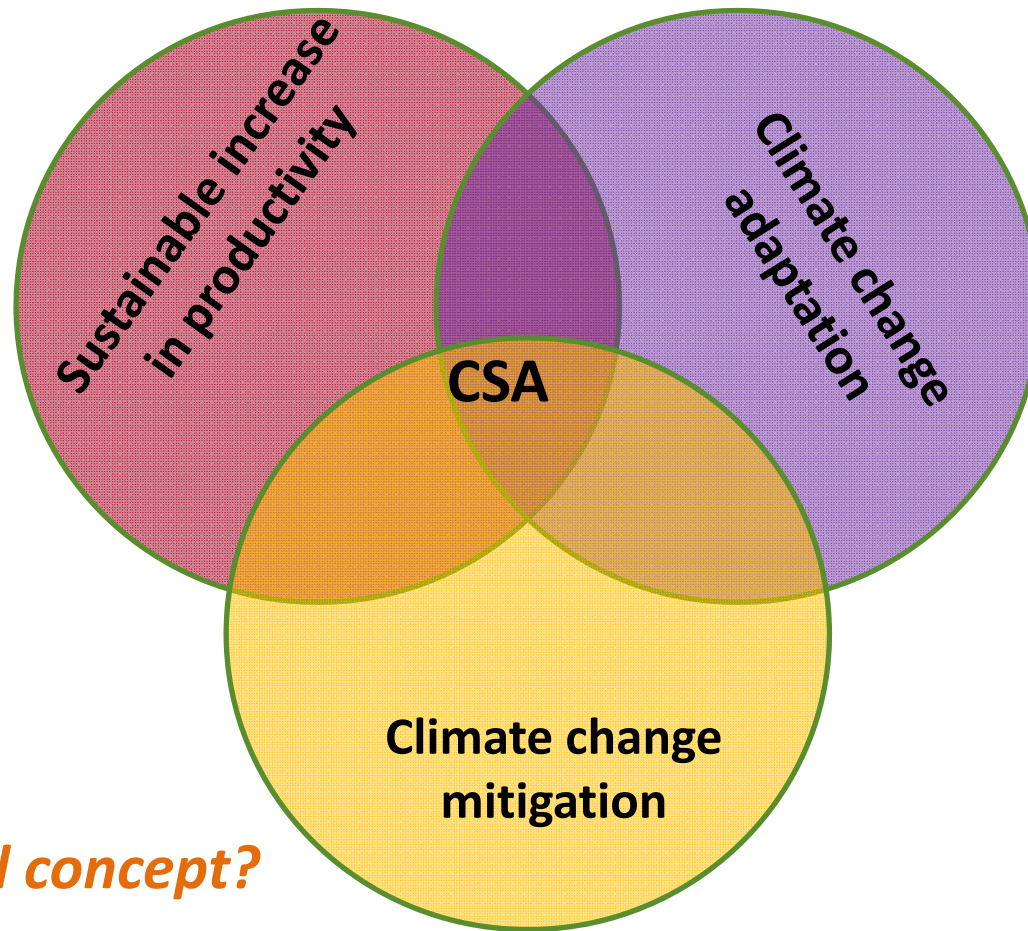


Projected change in agriculture productivity, 2080



Source: Hugo Ahlenius, UNEP/GRID-Arendal.

What do we understand by Climate-smart Agriculture (CSA)?



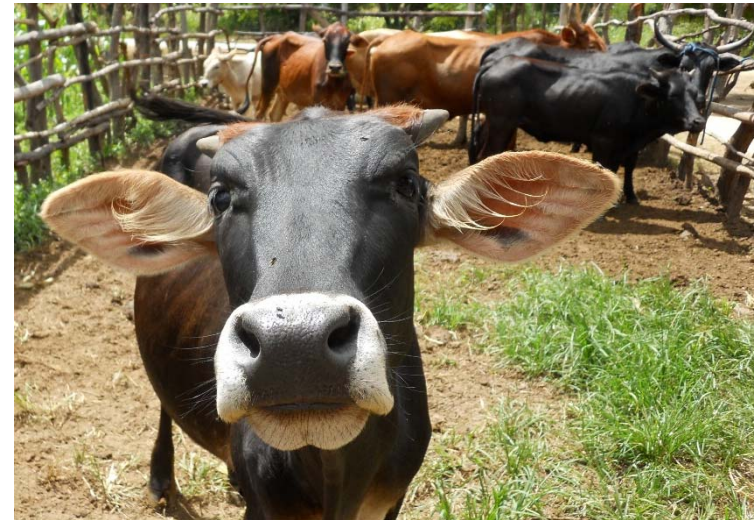
Is this a useful concept?



*....are not all agriculture systems
climate-smart?*

What practices could be lumped under the CSA umbrella?

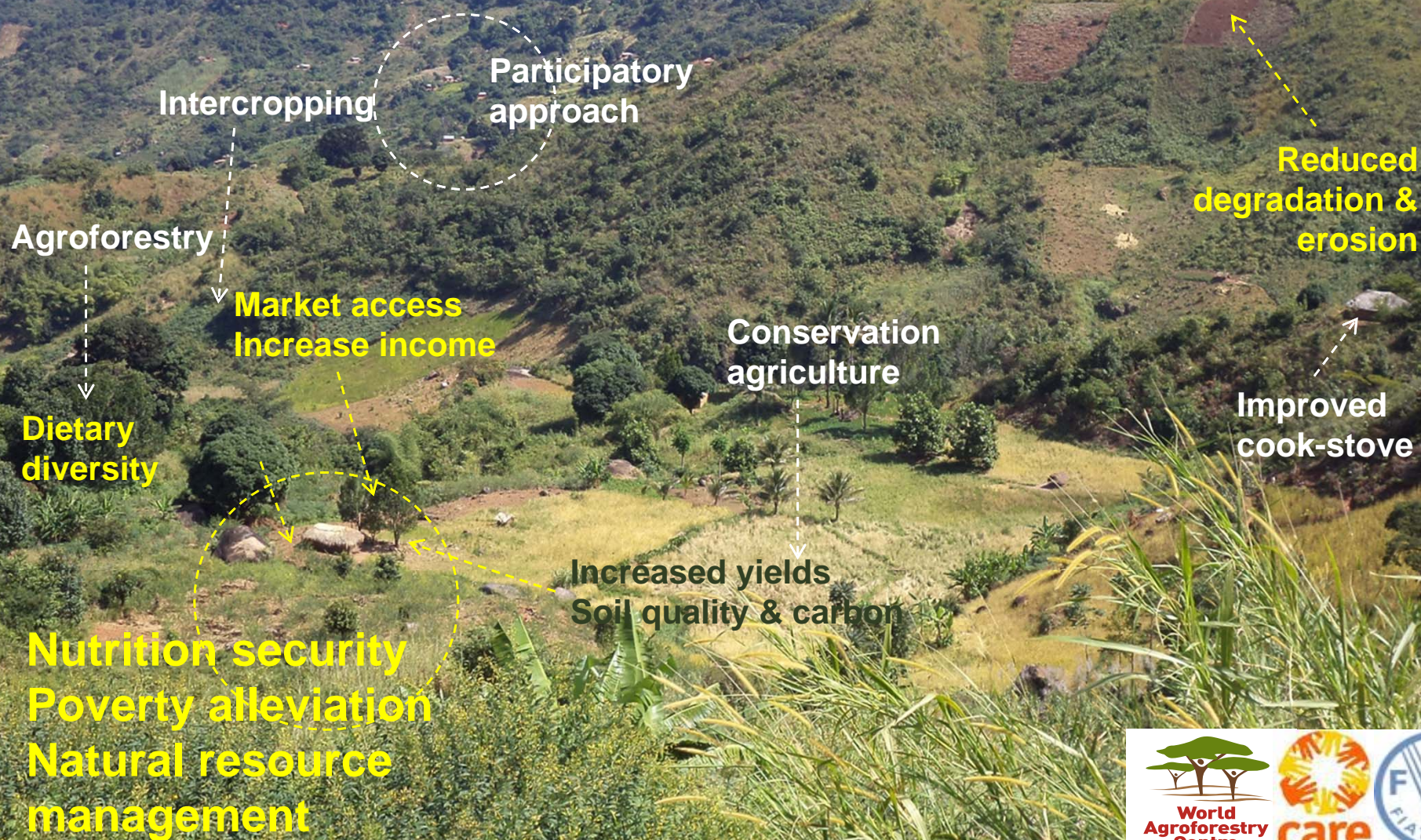
- Conservation agriculture
- Agroforestry (CAWT)
- Rangeland management
- The use of drought-tolerant germplasm
- Water harvesting technologies
- Targeted fertilizer application
- Improved cattle feeding
- Alternate wetting and drying in rice
-



***There is not one CSA practice....
but different and complimentary
combinations of practices to achieve the
greatest CSA potential in a landscape!***



Landscapes with multiple CSA options



What is Conservation Agriculture?

CA comprises the following principles:

- Minimal soil movement
- Surface crop residue retention
- Crop rotations and green manure crops



CA - a flexible system....



• *Jab-planter*



• *Dibble stick*



• *AT Direct seeder*



• *Hoe-planter*



• *Basin planting*



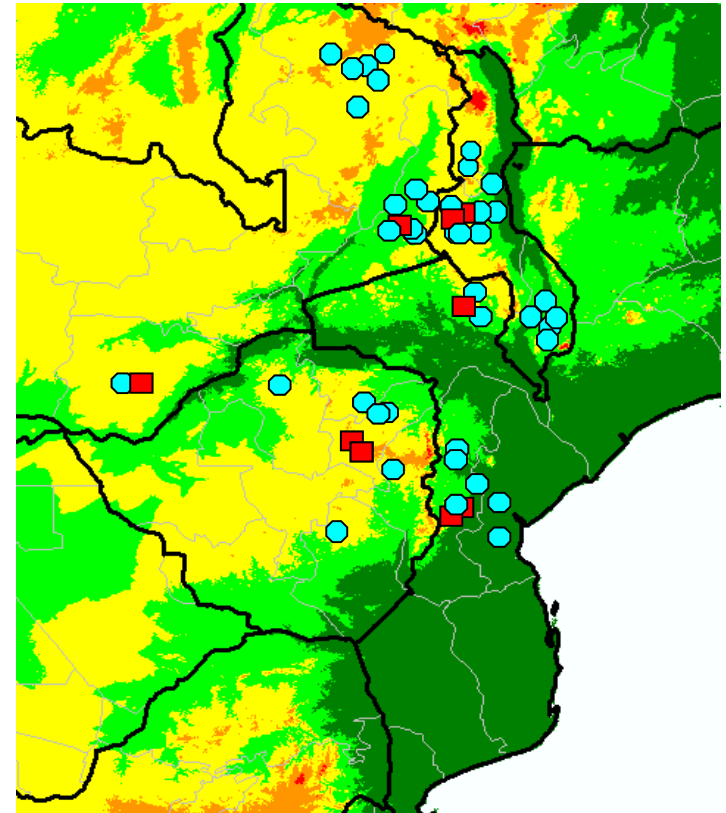
• *Magoye ripper*

New Developments for Africa....



CIMMYT's Research Focus in Southern Africa

- Is conservation agriculture (CA) a more **profitable, viable and sustainable system** than conventional agriculture?
- What are the **biophysical challenges** to productive CA systems and how can they be overcome?
- How **climate-smart** is CA in the context of southern Africa
- What socio-economic factors and circumstances affect the **adoption and outscaling** of CA systems in southern Africa?



Why focus on Conservation Agriculture?

- CA reduces **soil and land degradation**
- CA can help to **adapt production** to climate variability and change!
- CA is more **water-, nutrient-, and energy-use-efficient**
- CA improves the **productivity** of current farming systems



Some research evidence....



First rains

Conventional tillage



Conservation agriculture



In season....

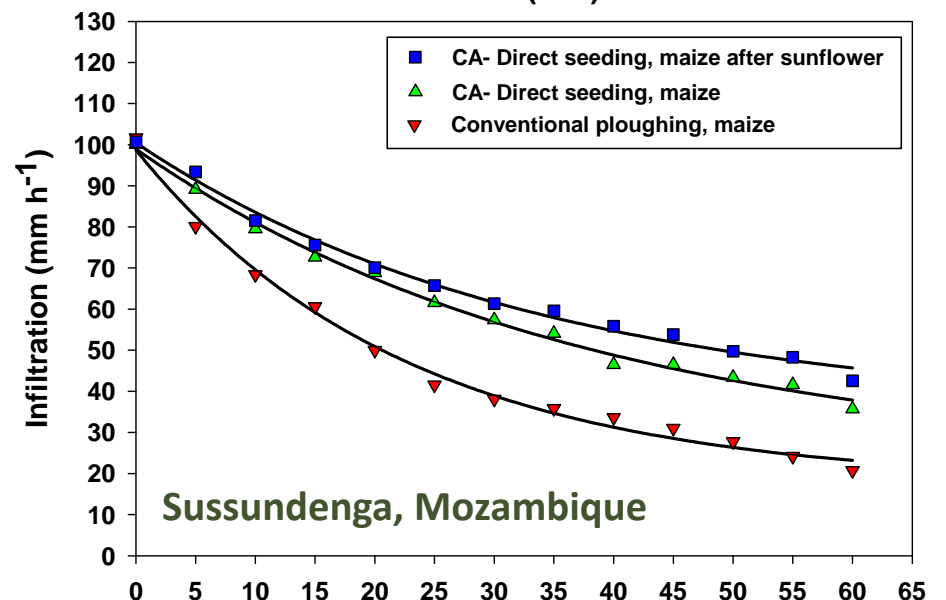
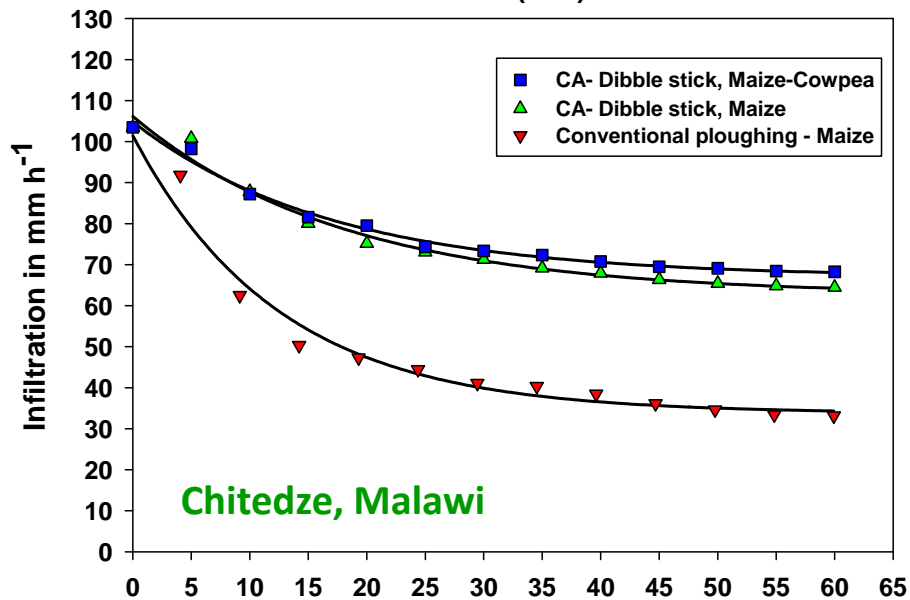
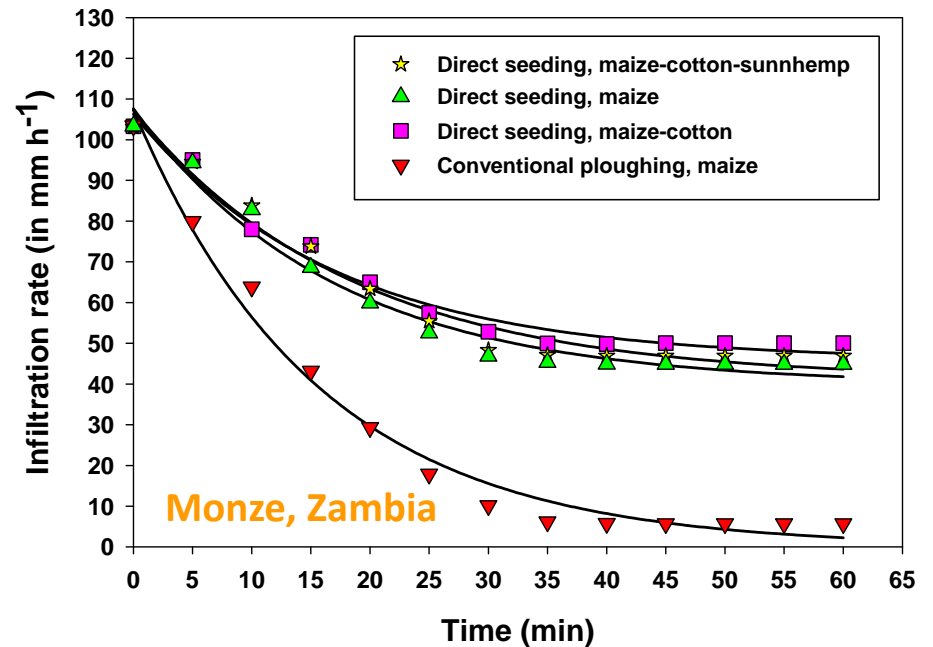
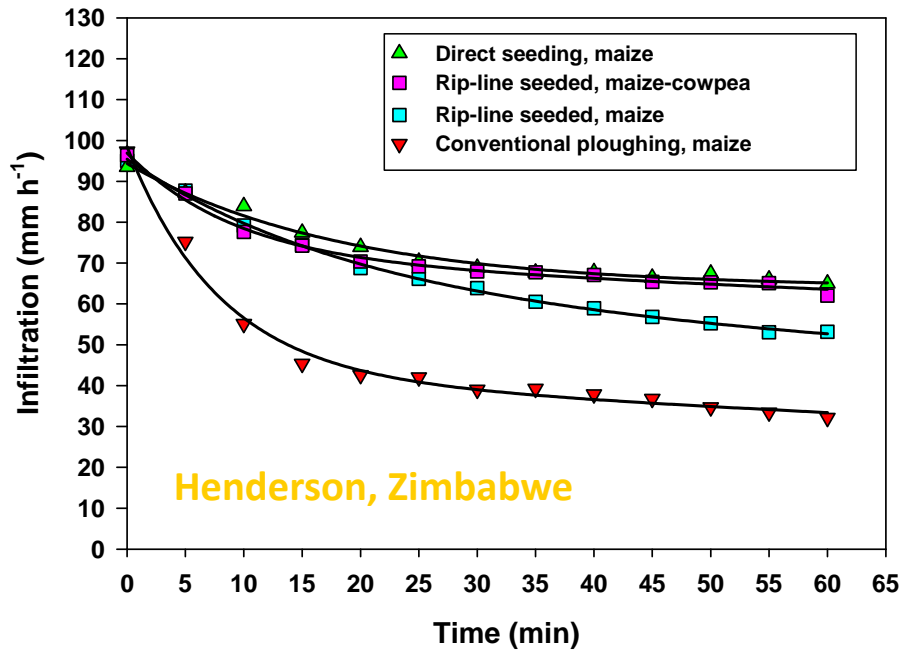
Conventional ridge tillage



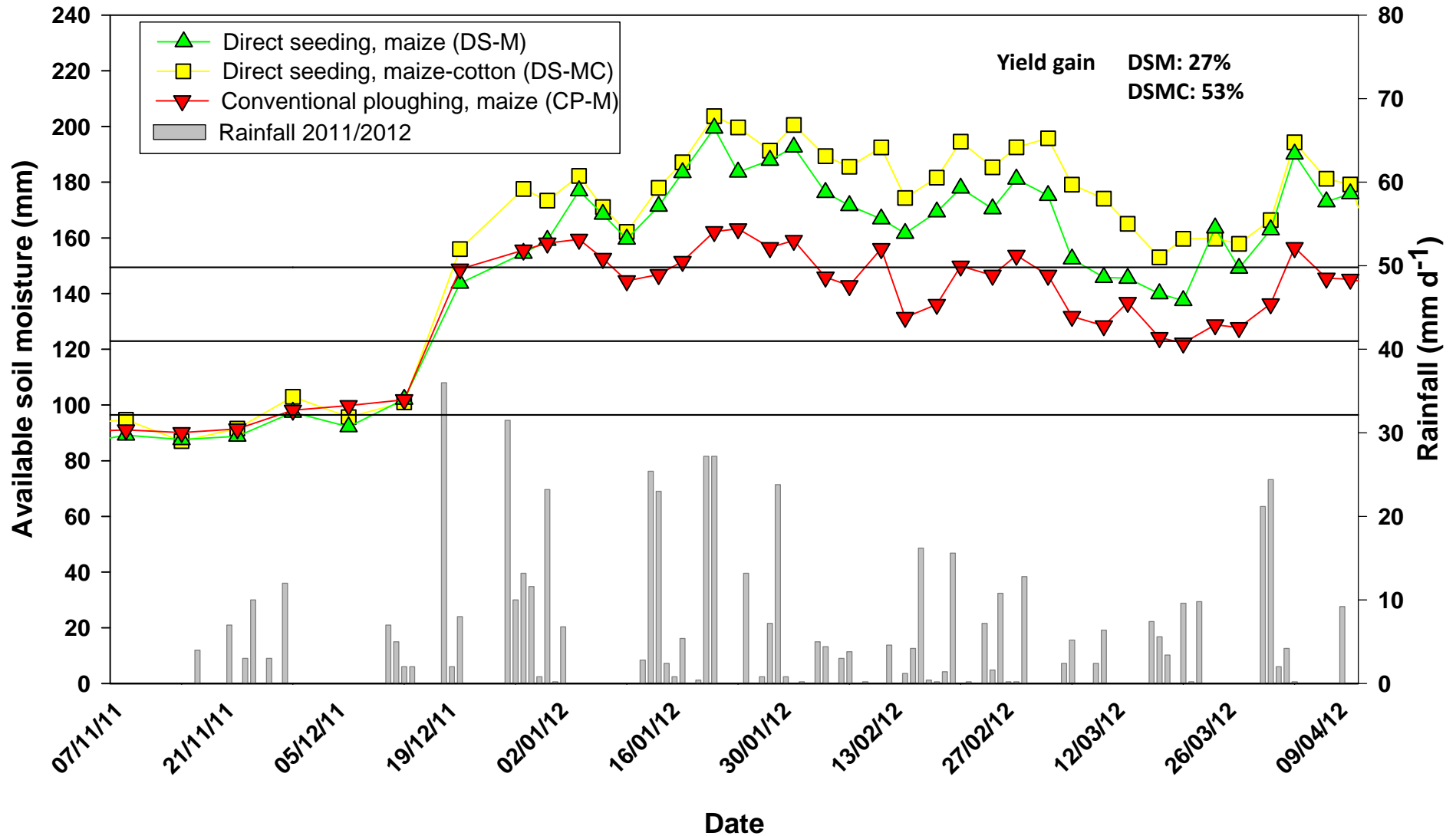
Conservation agriculture



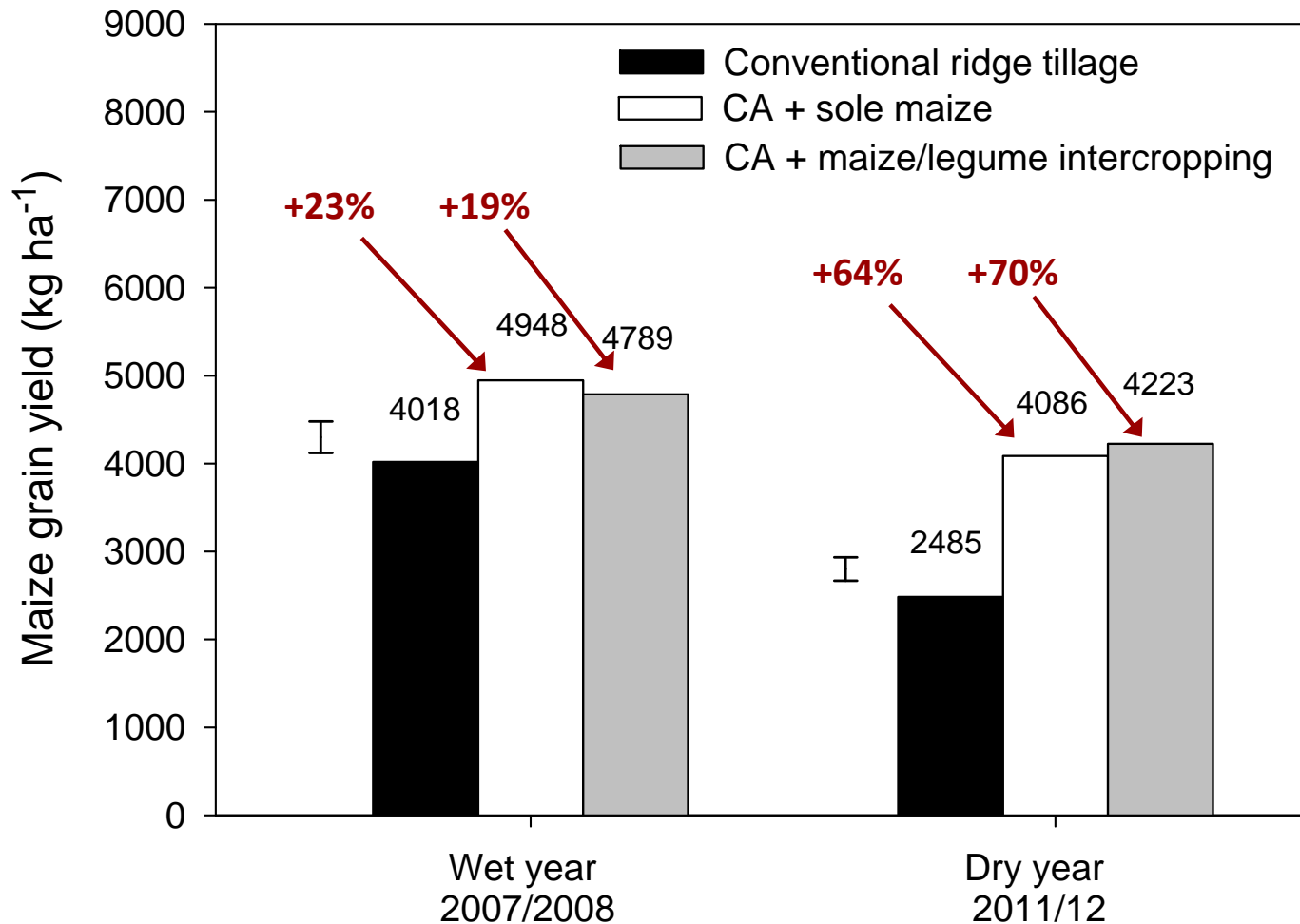
Infiltration is crucial in CA systems!



Soil moisture, 0-60cm, MFTC, 2011/2012

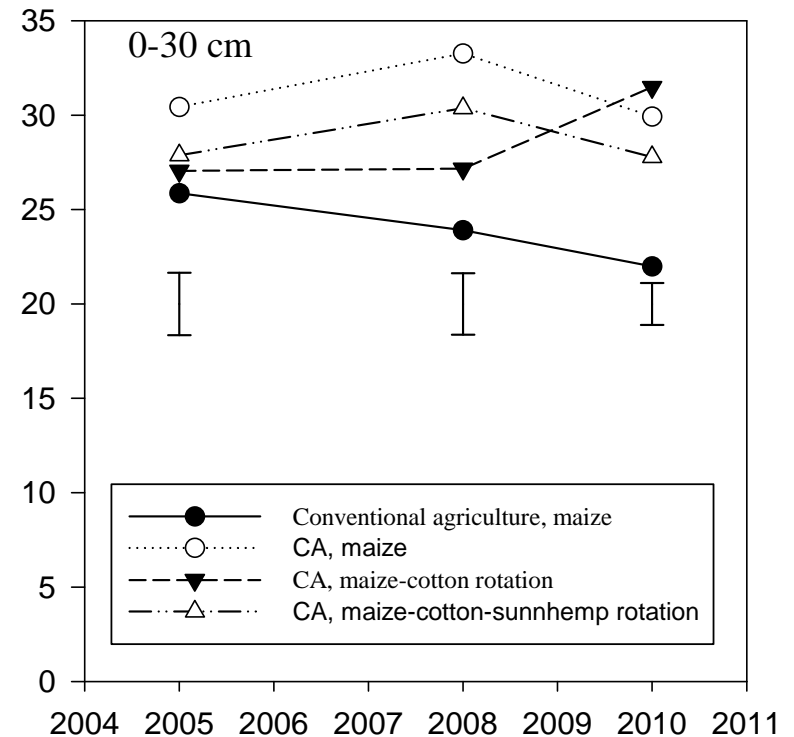


CA performance in a wet and dry year, Malawi, 2007/08 and 2011/12



Mitigation potential

- Data on soil carbon sequestration **inconclusive**
- Some studies report benefits, some not.....!
- Carbon accumulation often **observed in the first 0-30 cm** but not in deeper layers
- Few studies on **GHGs**

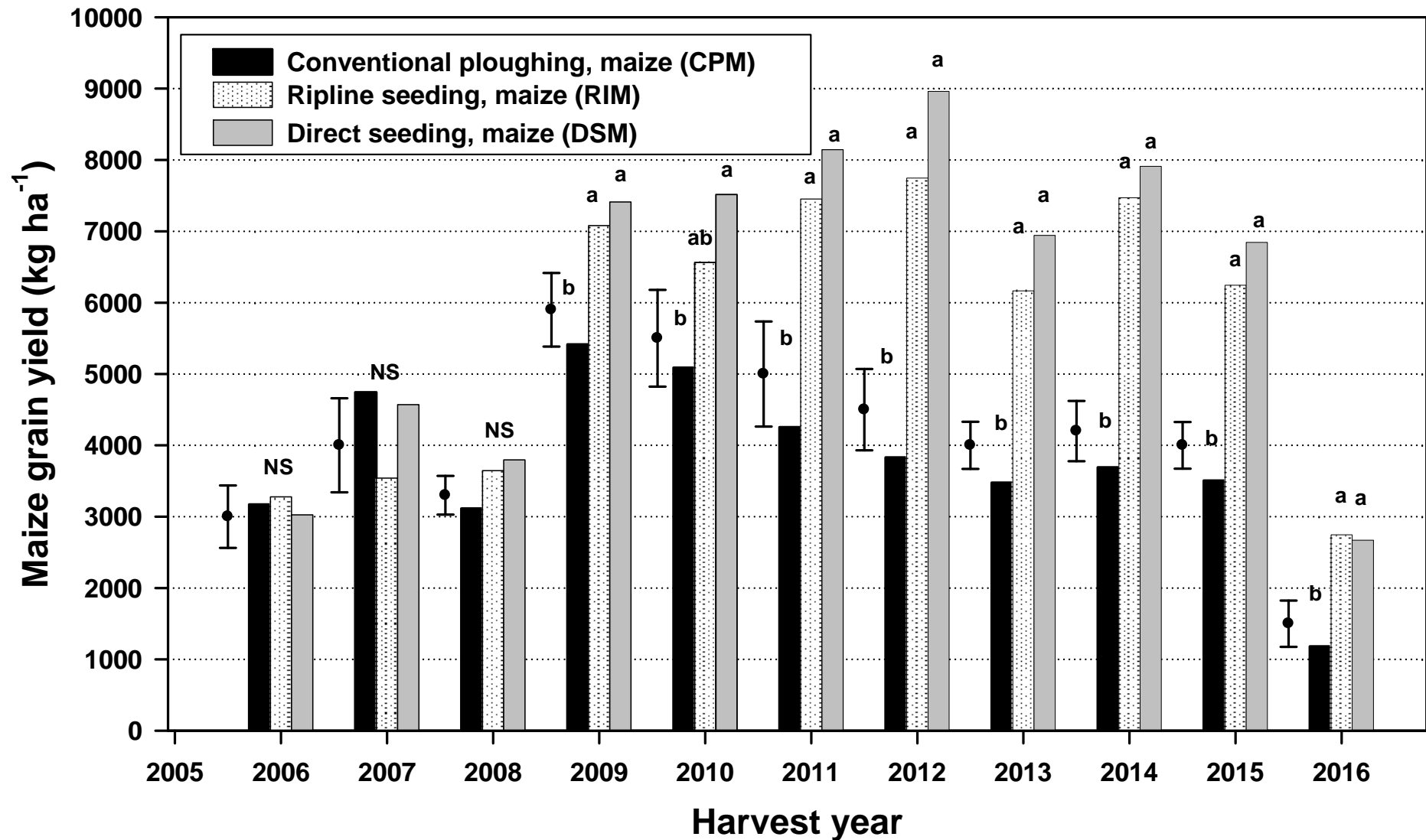


Soil carbon dynamics, Monze FTC, 2005-2010

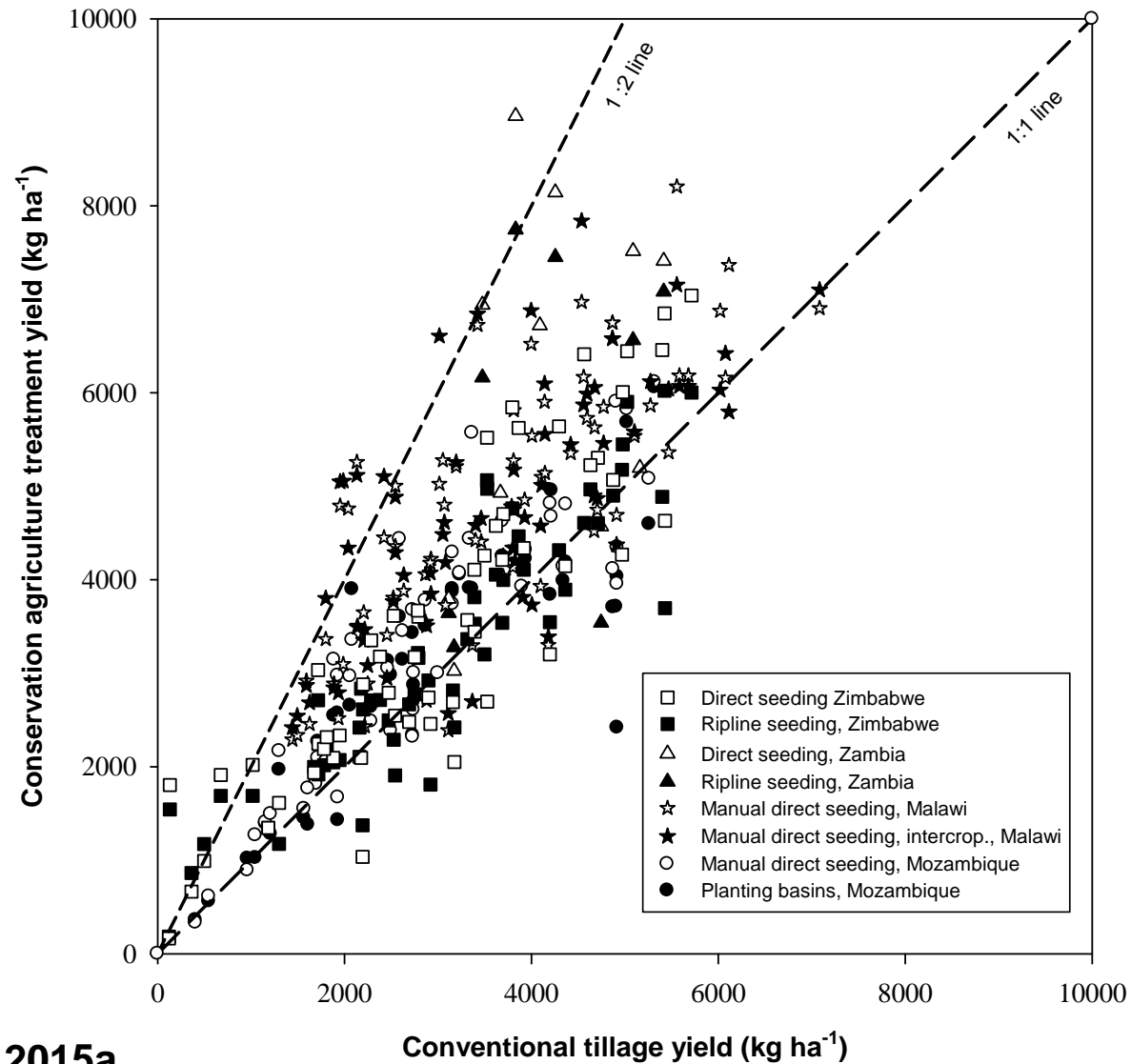
El Niño season 2015/2016....



CA performance on replicated on-farm trials – Monze 2005-2016



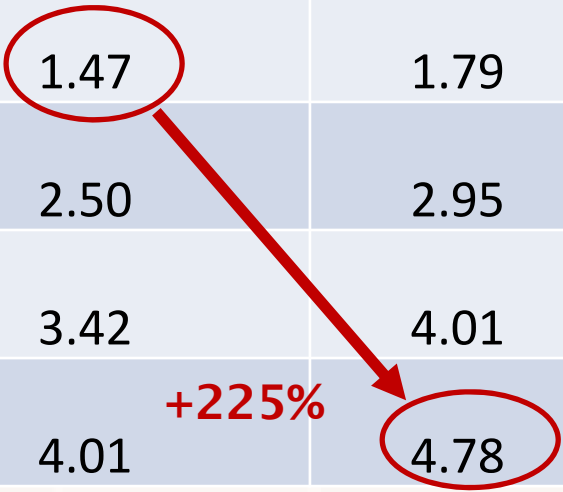
Regional yield response to CA in southern Africa from 2005-2016



Thierfelder et al. 2015a

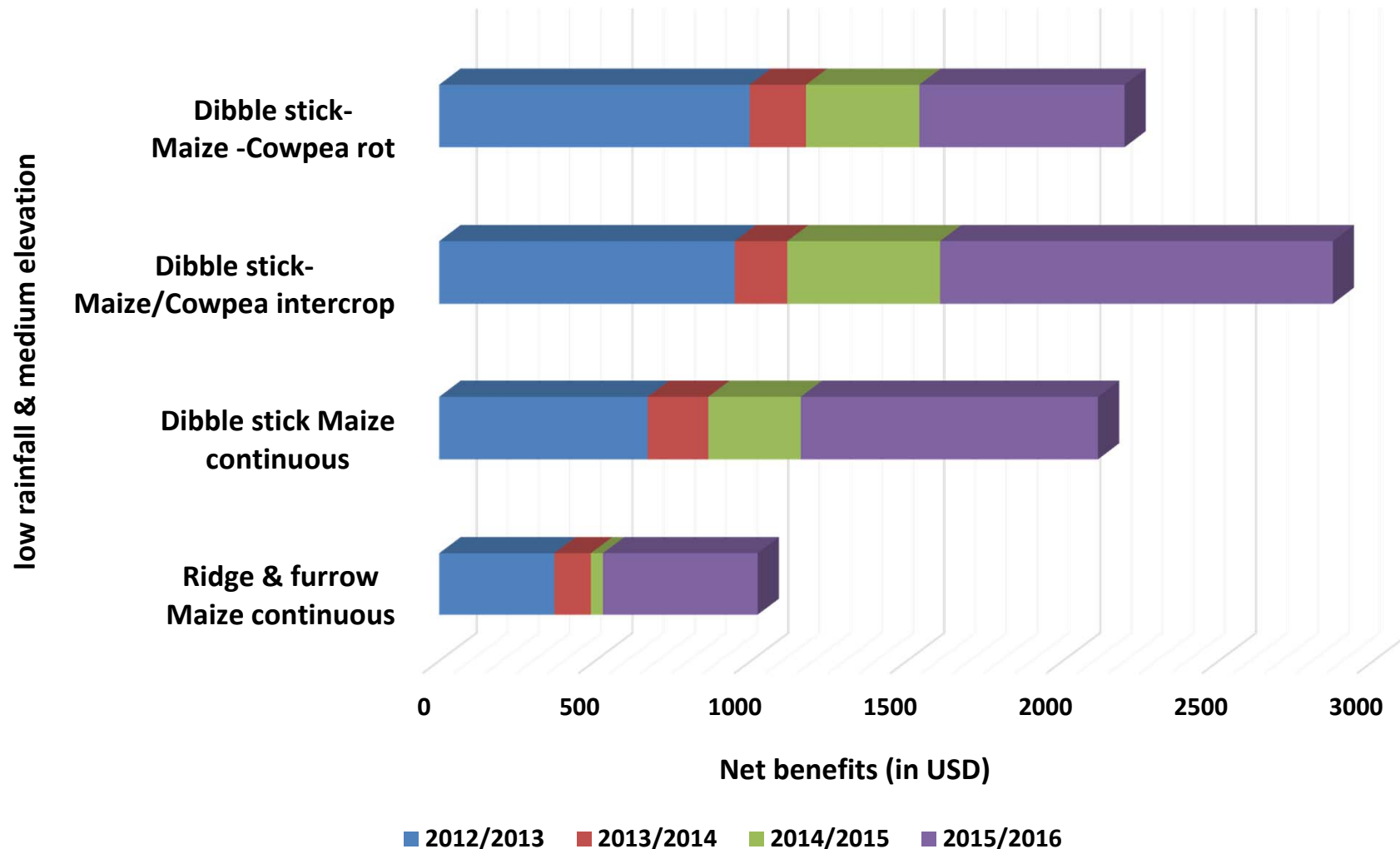
Potential yield gains through combinations of technologies, Mozambique, 2009-2014

	Maize grain yield (t ha ⁻¹)		Yield gain (%)
	Conventional agriculture	CA-Direct seeding	
Traditional variety no fertilizer	1.47	1.79	21
Traditional variety with fertilizer	2.50	2.95	18
Improved OPVs with fertilizer	3.42	4.01	17
Improved Hybrids with fertilizer	4.01	4.78	19

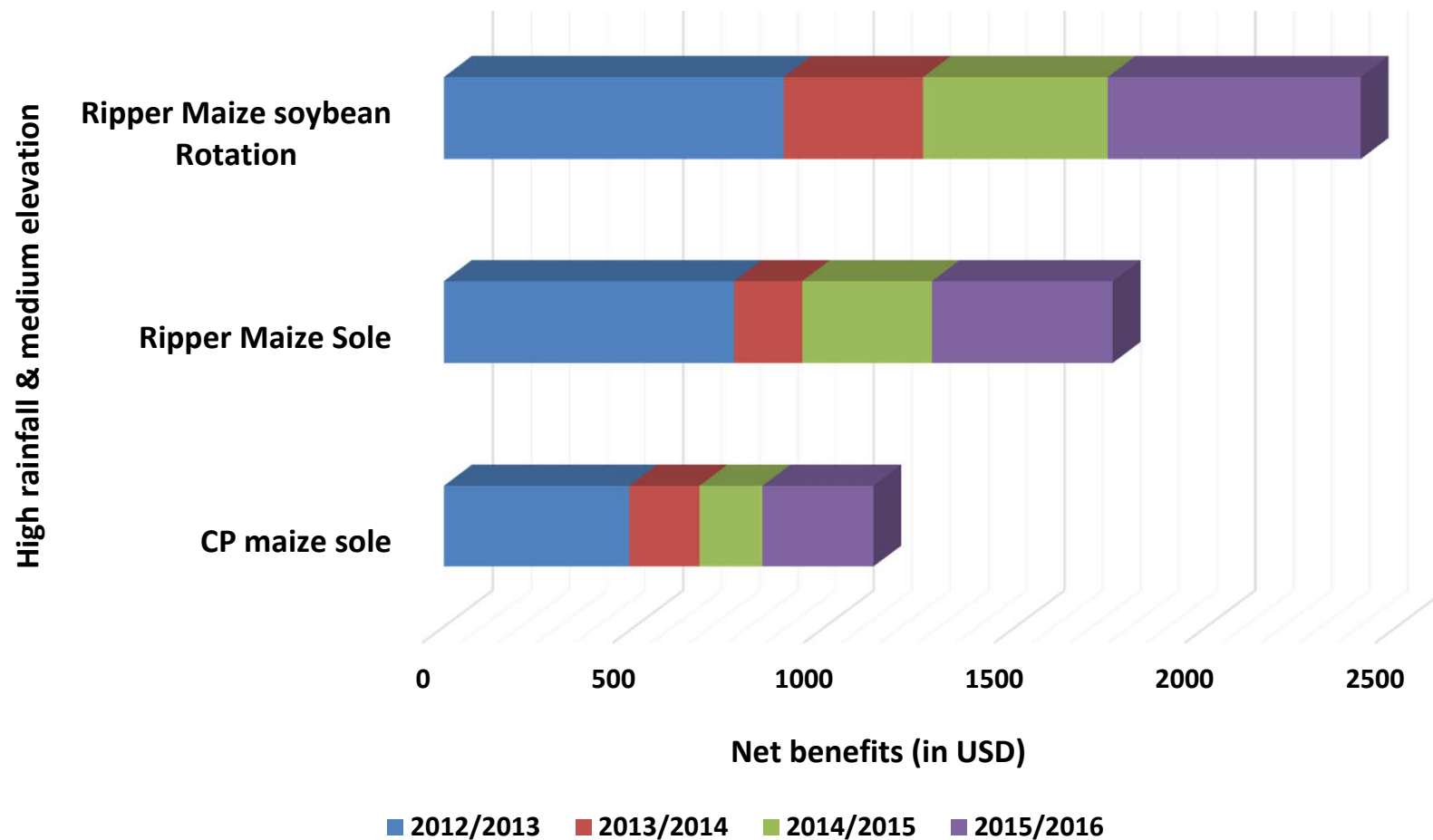


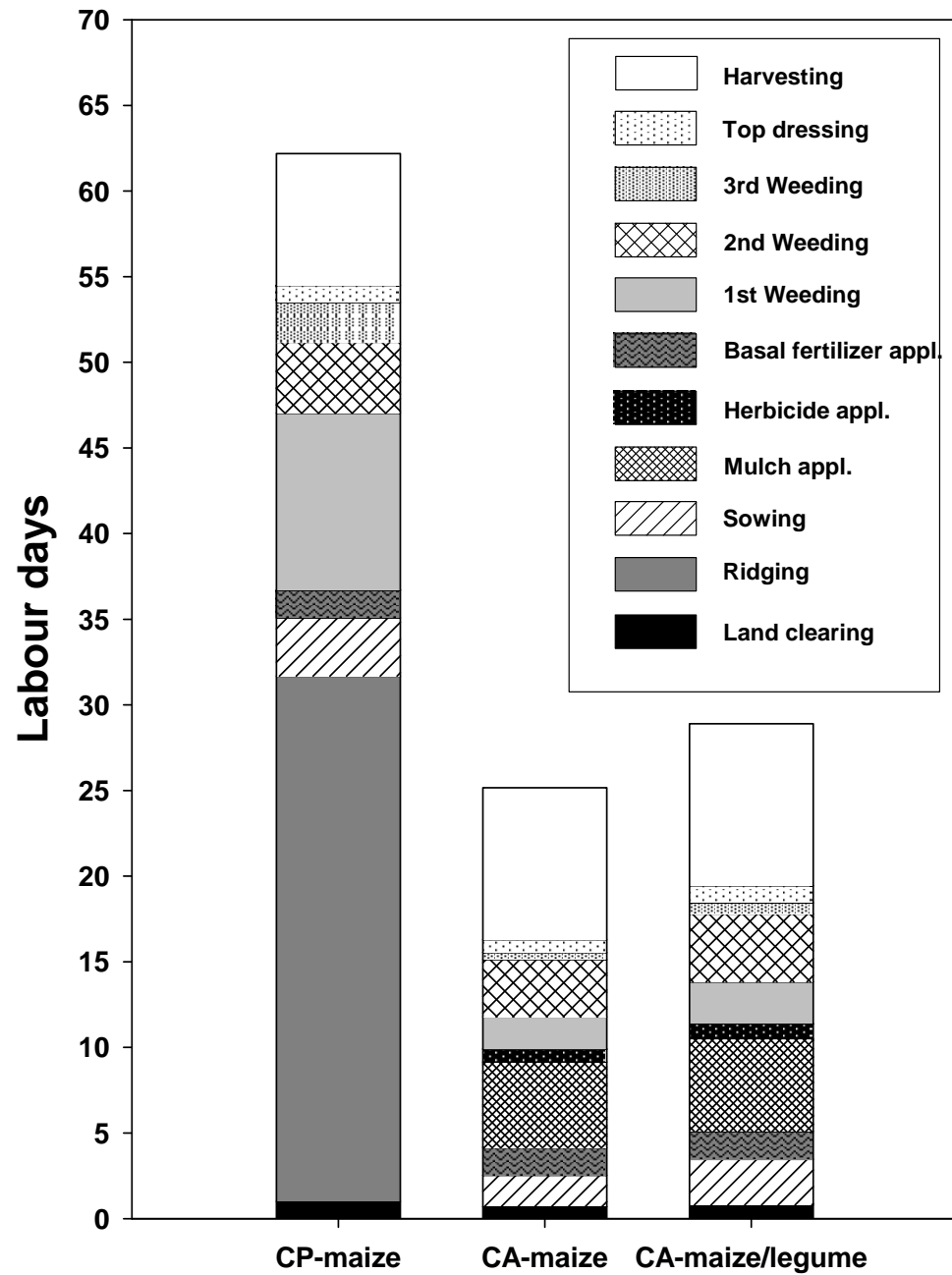
Thierfelder et al. 2015b

Manual Sustainable Intensification Practices - Net Benefits (2012-2016), Eastern Zambia



Mechanised Sustainable Intensification Practices Net Benefits (2012-2016) Eastern Zambia





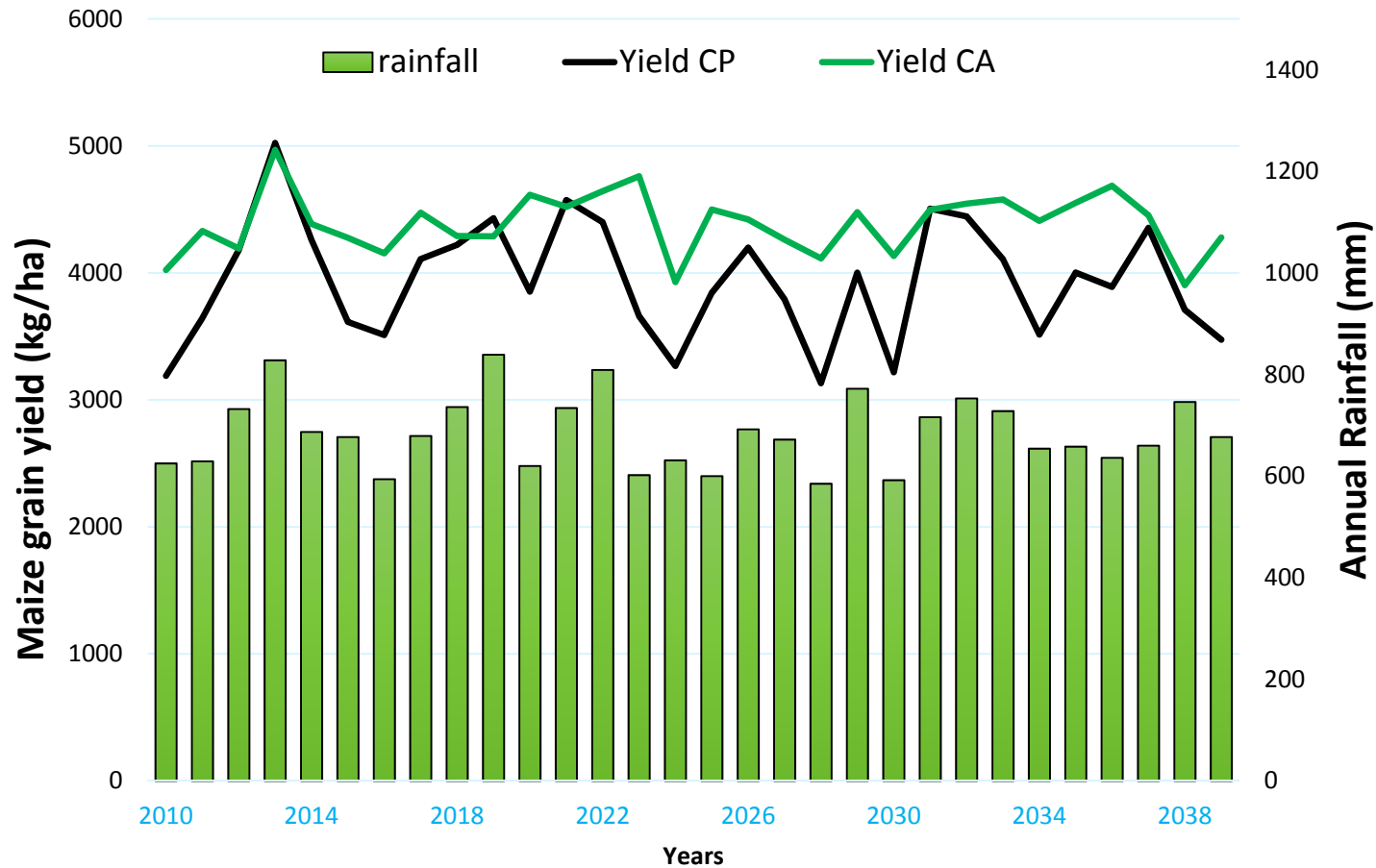
Thierfelder et al. 2015b

El Nino response potential

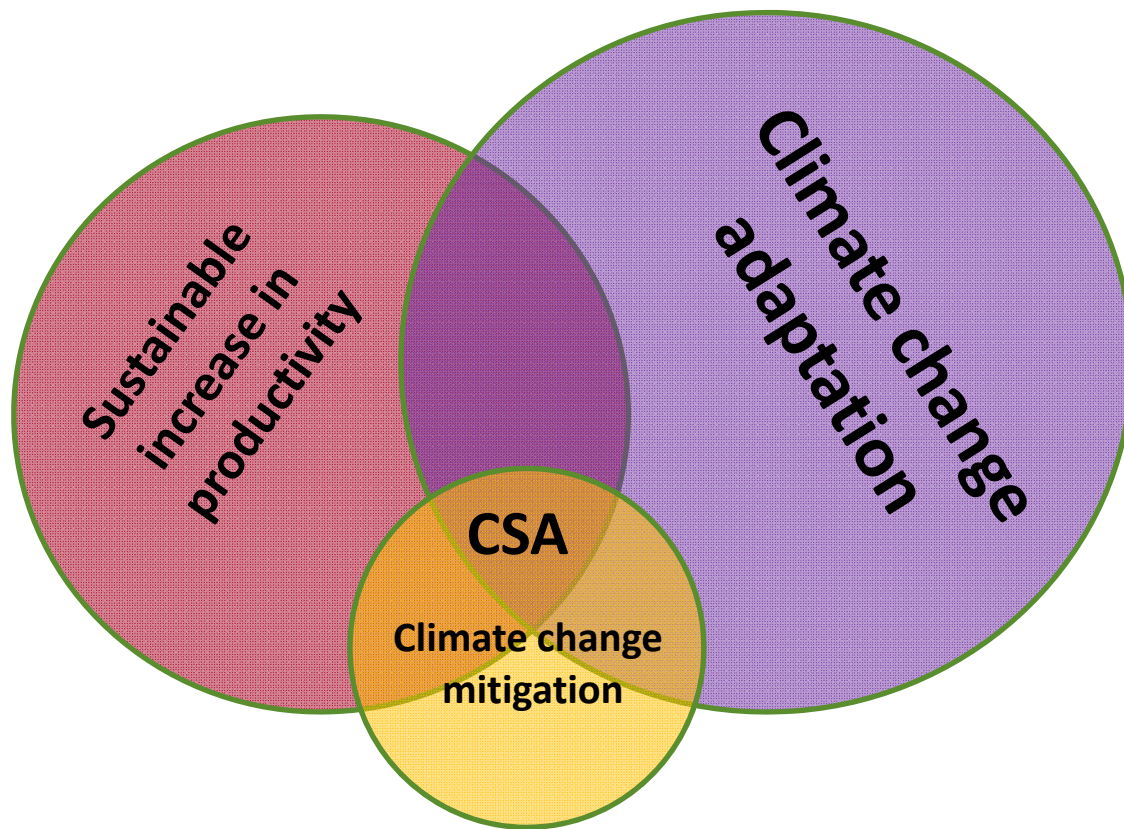
- CA responds better to seasonal dry-spells leading to **yield benefits of 30-60%**
- Combined use of drought-tolerant maize with CA can improve the performance of maize by **more than 80%**
- CA can **improve incomes by 40-100%** under drought

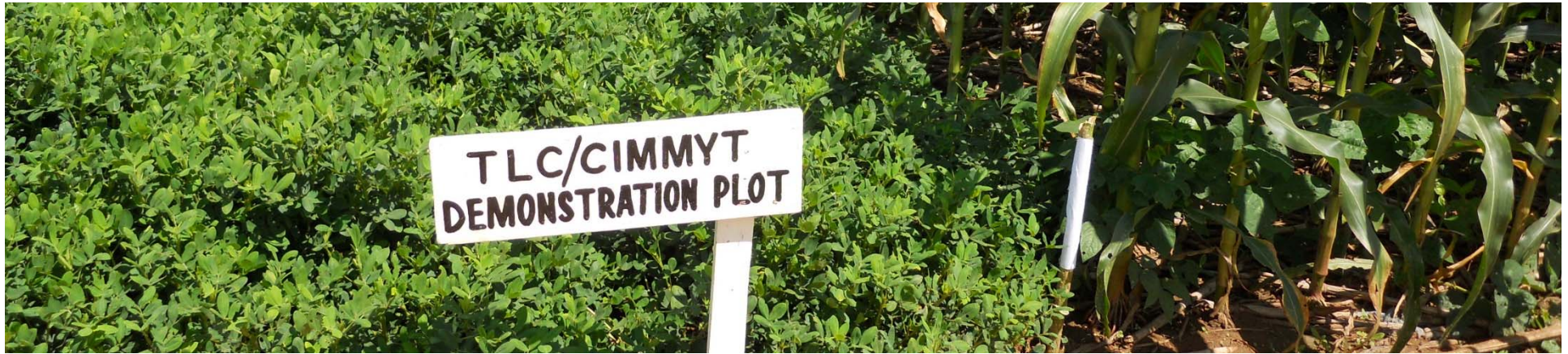


Reduced yield variability under conservation agriculture



Is Conservation Agriculture really “climate-smart”?





Challenges still persist....

- **Residues:** How can we feed both livestock and crops?
- **Weeds** if no herbicides are used
- Lack of **fertilizer** – what are the alternatives?
- Donor driven **adoption** - one-size fits-all approaches
- (S)low adoption – **understanding** the issues

- **Knowledge** gaps and perceptions amongst farmers
- Lack of **evidence** and data taking – believe in myths
- **Targeting** the wrong systems to the wrong farmers
- Ignoring farmers rationale and **decision making**
- The need for **co-development** of technologies



What are the Gaps and Needs for the coming years?

- What is the climate-smart agriculture **potential of CA** at a larger scale (4p1000)
- The need for more **system's research**
- What **kind of CA** is actually adopted (quality assessment)- why is it disadopted?
- How can we overcome **barriers** to adoption?



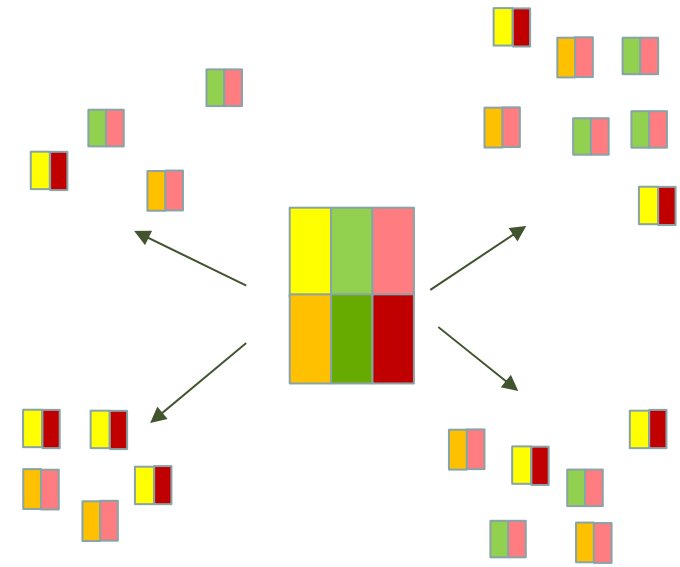
More Gaps and Needs....!

- What are the socio-economic impacts of CA on **livelihoods, nutrition and gender**
- How can **farmer-decision-making** be better understood
- **Targeting of CA** (e.g. to different farmers, farm types, agro-ecologies)?
- **Research on Scaling** – how can we increase the uptake beyond small plot levels?



Expanding the niche – through successful scaling

- ✓ Lead farmer approach
- ✓ Demonstration and field days
- ✓ Mother and baby trials
- ✓ Innovation systems approach
- ✓ Participatory extension approaches
- ✓ Farmer-to-farmer exchange
- ✓ Farmer field schools
- ✓ ICT







Thank you
for your
interest!

