



INTERNATIONAL
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Managing soils for increased productivity under a changing climate in southern Africa: What prospects for Conservation Agriculture (CA)?

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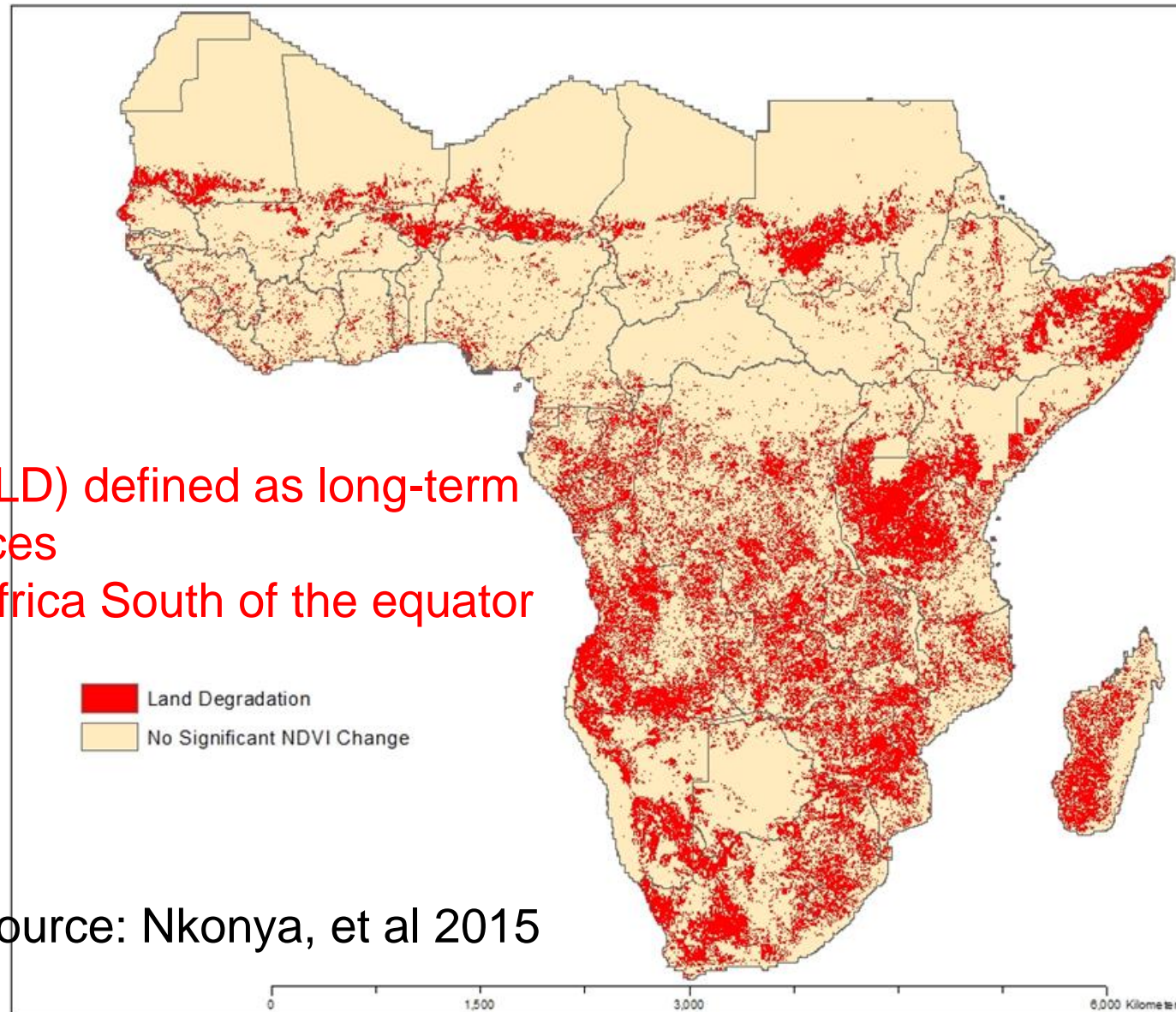
International Food Policy Research Institute

Presentation outline

- The state & cost of land degradation in Southern Africa & SSA
- Conservation agriculture as strategy for adaptation to climate change
- Potential and challenges of adoption of CA & ISFM in Southern Africa
- SACAU role in enhancing adaptation to CC
- Conclusions and implications

Extent of land degradation in SSA

Land degradation (LD) defined as long-term
of ecosystem services
LD most severe in Africa South of the equator



Source: Nkonya, et al 2015

Cost of land degradation due to LUC (US\$ billion) & MRR of taking action

	Central	Eastern	Indian Ocean	Southern	Western	SSA
LD Total cost (TEV)	11.09	13.43	1.6	13.38	18.9	58.4
Provisioning services as % of total loss	44.67	54	50.28	58.89	43.91	49.98
MRR of taking action	4.11	4.1	3.69	3.94	4.65	4.19

- Land degradation increases vulnerability to CC
- One solution to addressing LD is CA

On-farm & off-farm cost of land degradation (US\$ billion) on static maize, rice & wheat plots

Region	Grain yield loss	CO ₂ -seq loss	Total loss	CO ₂ -seq. loss as % of total loss
Central	0.02	0.144	0.164	88
Eastern	0.137	0.517	0.654	79
Indian Ocean	0.004	0.072	0.076	95
Southern	0.211	0.881	1.092	81
Western	0.442	0.938	1.38	68
Total	0.815	2.551	3.367	76

- CA & other organic soil fertility management practices significantly increase CO₂-sequestration
- Off-farm loss is much greater than on-farm loss – suggests need for PES

What is Conservation agriculture (CA)?

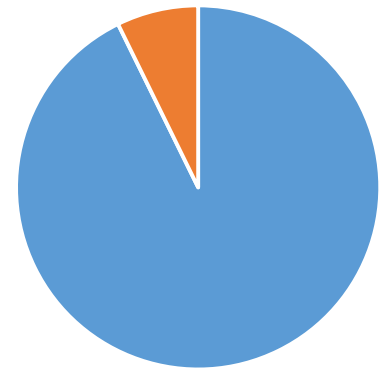
According to FAO (2009), CA is land management practice with:

- Minimum soil disturbance
- Permanent soil cover – largely thru retaining crop residues;
- Crop rotation, especially with legumes.

Adoption rate of CA in SSA

Country	CA area (000 ha)	CA area as% of cropland
Ghana	30	0.6
Kenya	33.1	0.6
Tanzania	25	0.2
Lesotho	2	0.7
Malawi	65	0.4
Mozambique	152	2.7
Namibia	0.34	0.0
South Africa	368	3.1
Zambia	200	5.3
Zimbabwe	332	3.5
Madagascar	6	0.2

Share of CA area



■ SACA region ■ Rest of SSA

Potential and challenges for adoption of CA in Southern Africa

Potential

- **Mixed cropping systems** – common among smallholder farmers in Southern Africa – tend to have greater soil cover than monocropping systems
- Crop rotation is a common traditional management practice used to break disease cycle in Southern Africa
- Crop-livestock production systems allows use of animal power to transport organic inputs
- Increasing promotion of CA by NGOs and SLM government programs

Constraints of CA

- Competition for crop residues – used for livestock feed, solid biofuel, construction material, etc
- Limited capacity of extension services to provide CA advisory services
- The need for use of herbicide limits CA use

CA need to be complemented with inorganic inputs & improved seeds to enhance adaptation to CC

→ Discussion below focuses on integrated soil fertility Management (**ISFM**) = organic inputs – such as CA Combined with inorganic fertilizer & improved seeds

Best land management practice appropriate for Southern Africa to address CC

Integrated soil fertility management ISFM

ISFM is a set of land management practices that combine use of organic inputs, judicious amount of inorganic fertilizer and improved crop varieties (Vanlauwe et al 2010).

Why is ISFM important?

Could reduce use of inorganic fertilizer by >50%

→ beneficial to the environment,

More appealing to smallholder farmers – especially in SSA where transaction costs for external inputs are high

Enhances mitigation & adaptation to climate change by increasing soil carbon

More sustainable than use of inorganic fertilizer only

More profitable than inorganic fertilizer only



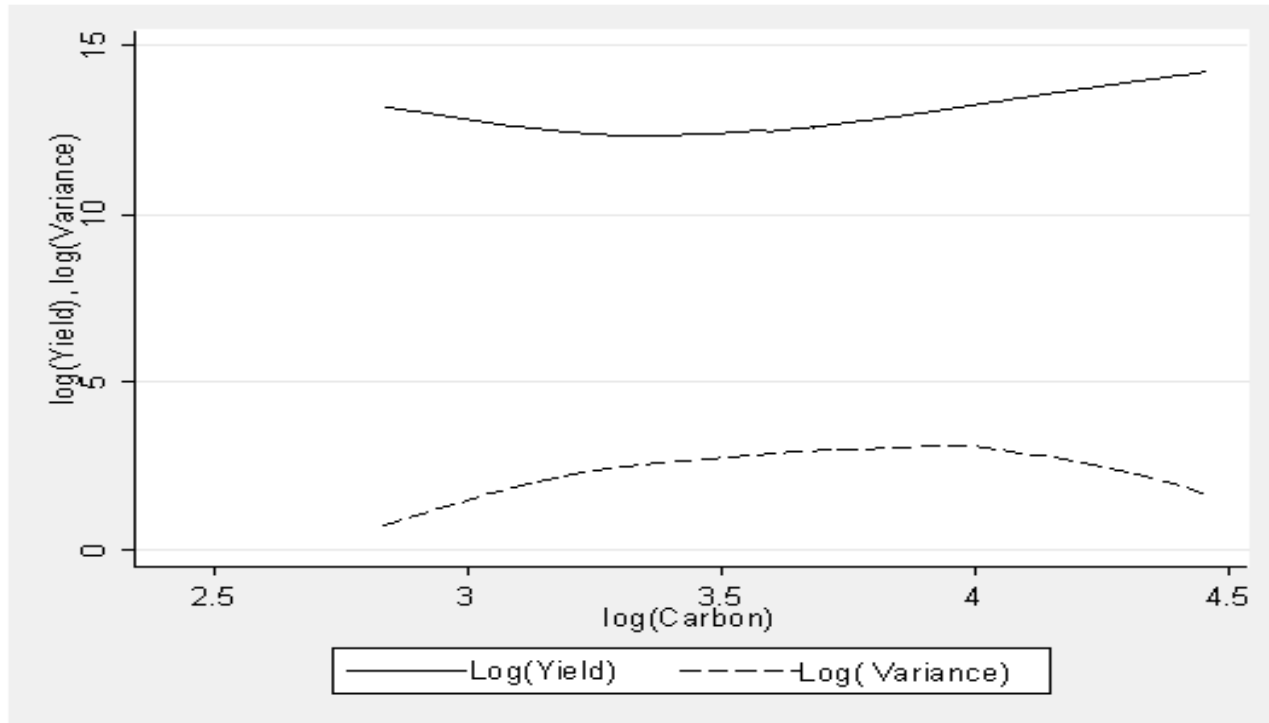
ISFM and climate-related production risks

Yield variance under land management practices which combine chemical fertilizers with organic inputs was **lower** than those which use either chemical fertilizer or organic inputs only (yield variance).

This suggests ISFM reduces climate change related production risks. This underscores the crucial role, which ISFM can play in reducing climate change related risks.

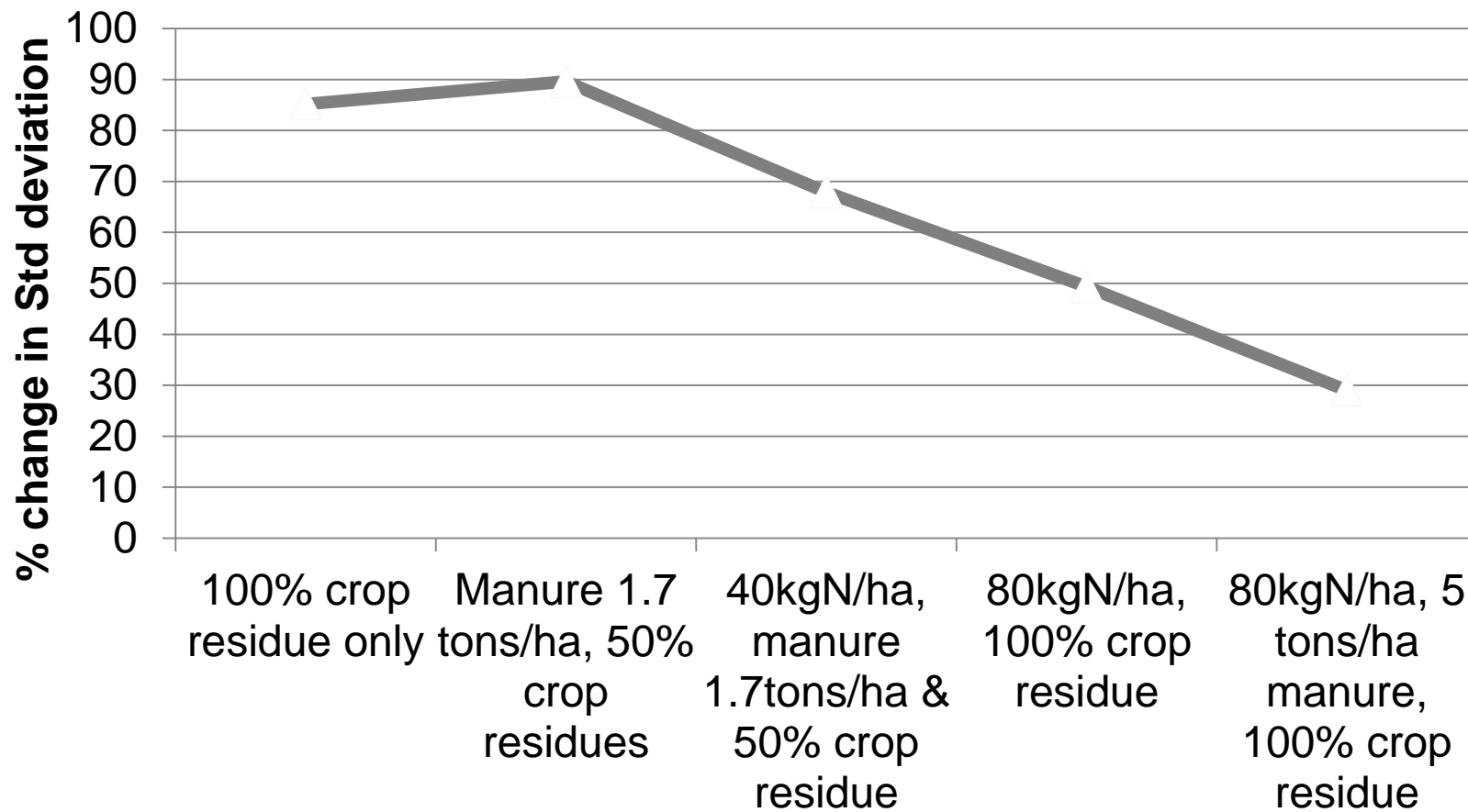


Relationship of soil carbon and yield & production risks, household survey data [Uganda](#)

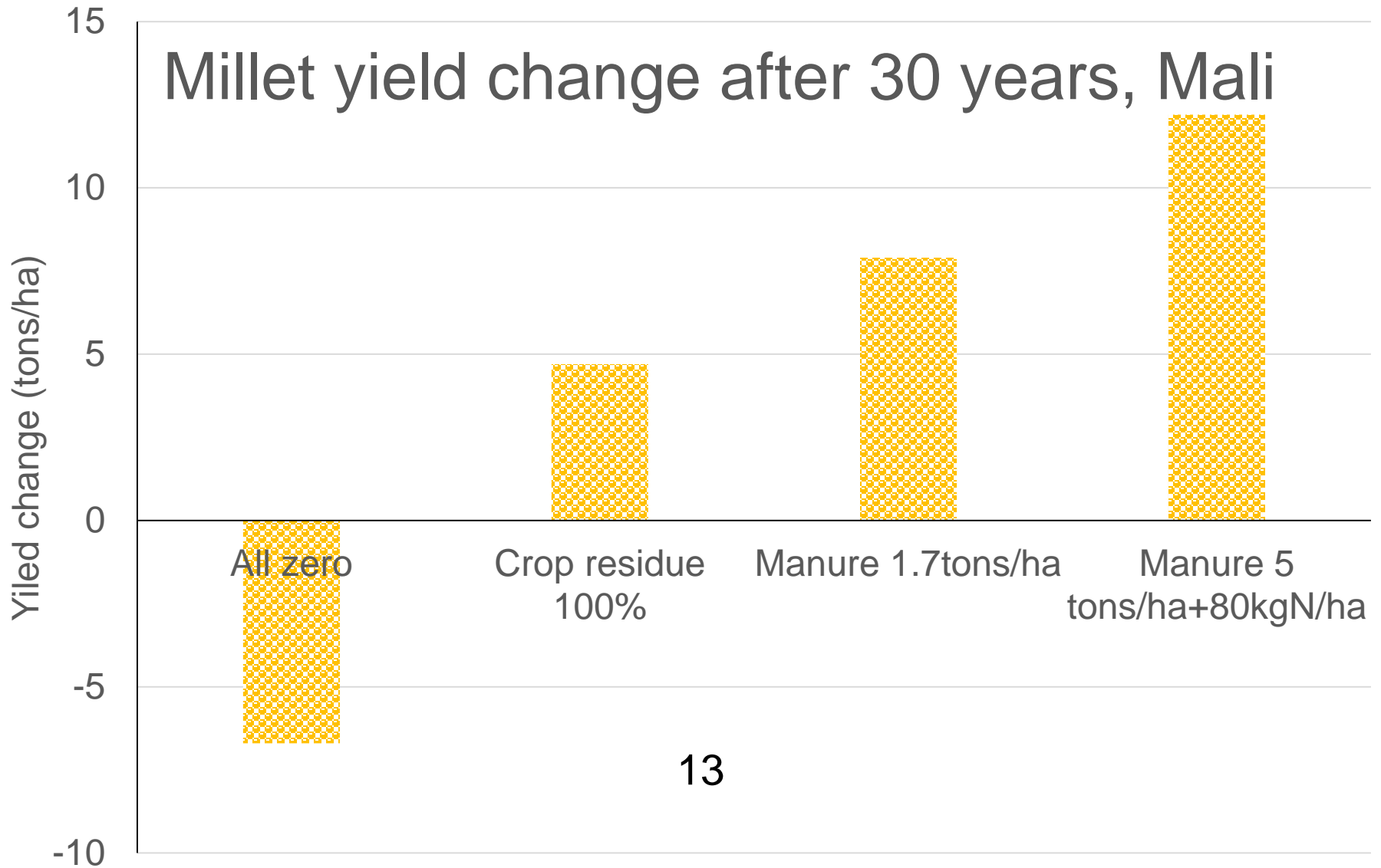


Land management practices that increase soil [carbon](#) reduce [production risks](#) & increase crop yield

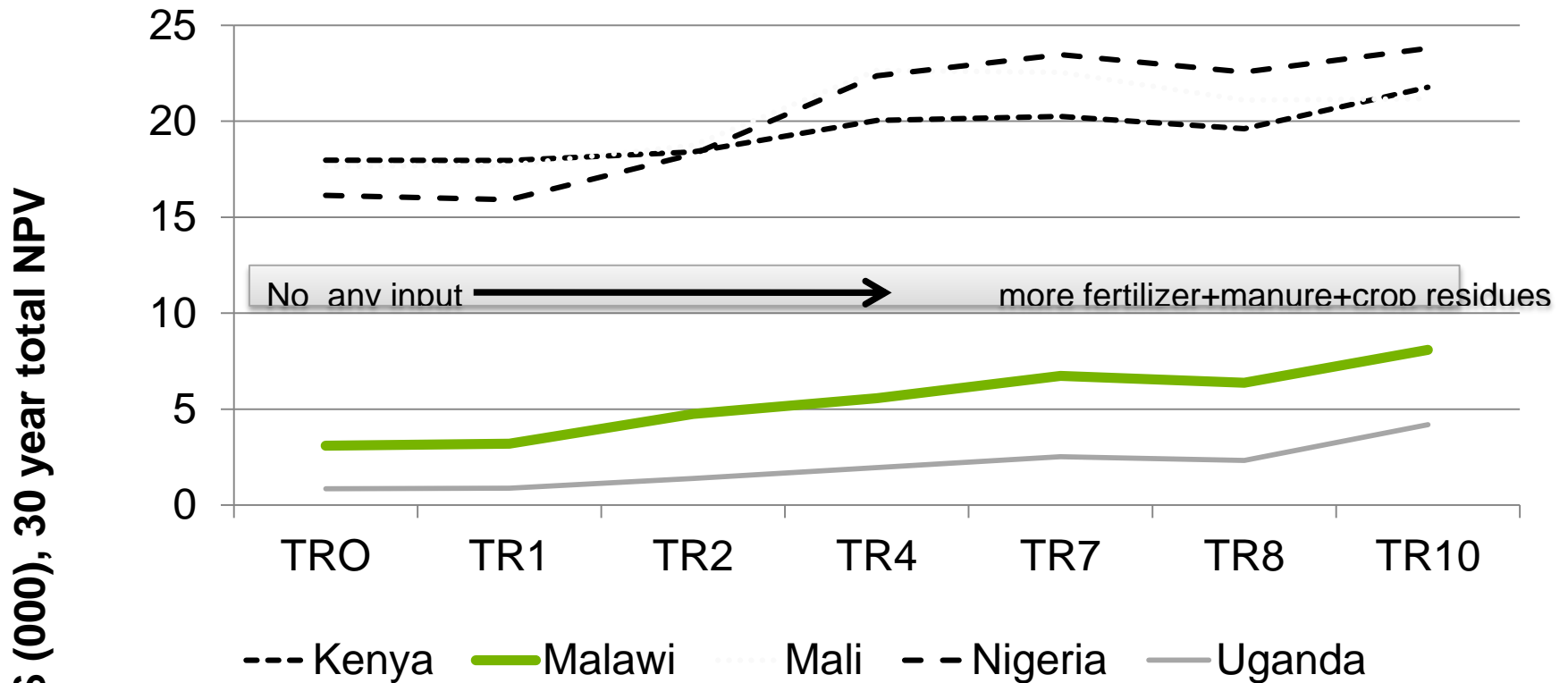
Change in millet yield variance (30 year period), Mali, DSSAT simulation



ISFM practices are more sustainable



ISFM most profitable, Maize



TR0 = No any input or crop residue

TR1 = crop residues only

TR2 = crop residues+ manure 5 tons/ha

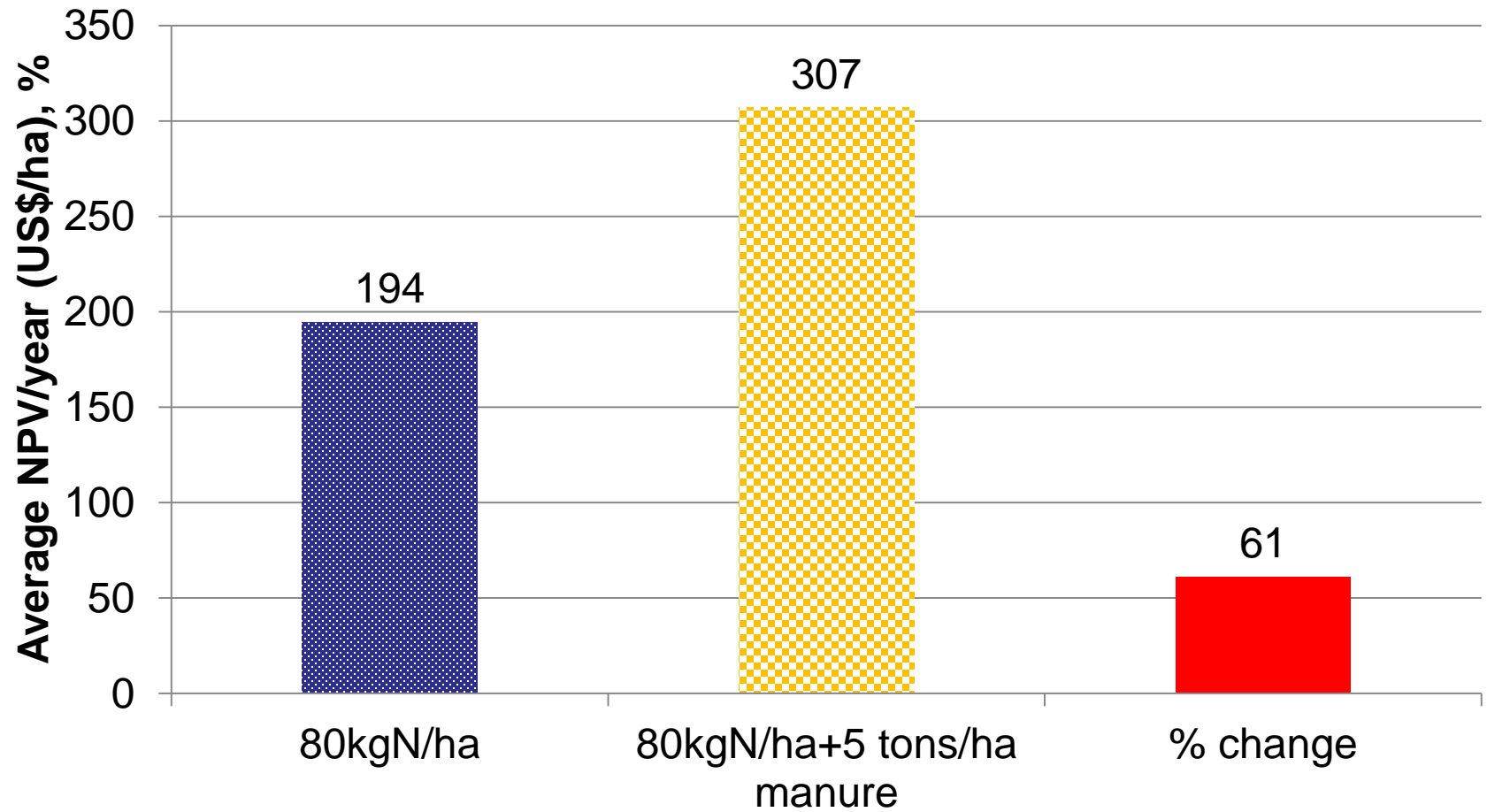
TR4= Crop residues+ 5 tons manure/ha+40kgN/ha

TR7= Crop residues+5 tons manure+80 kgN/ha

TR8= 80kgN/ha, no crop residues or manure

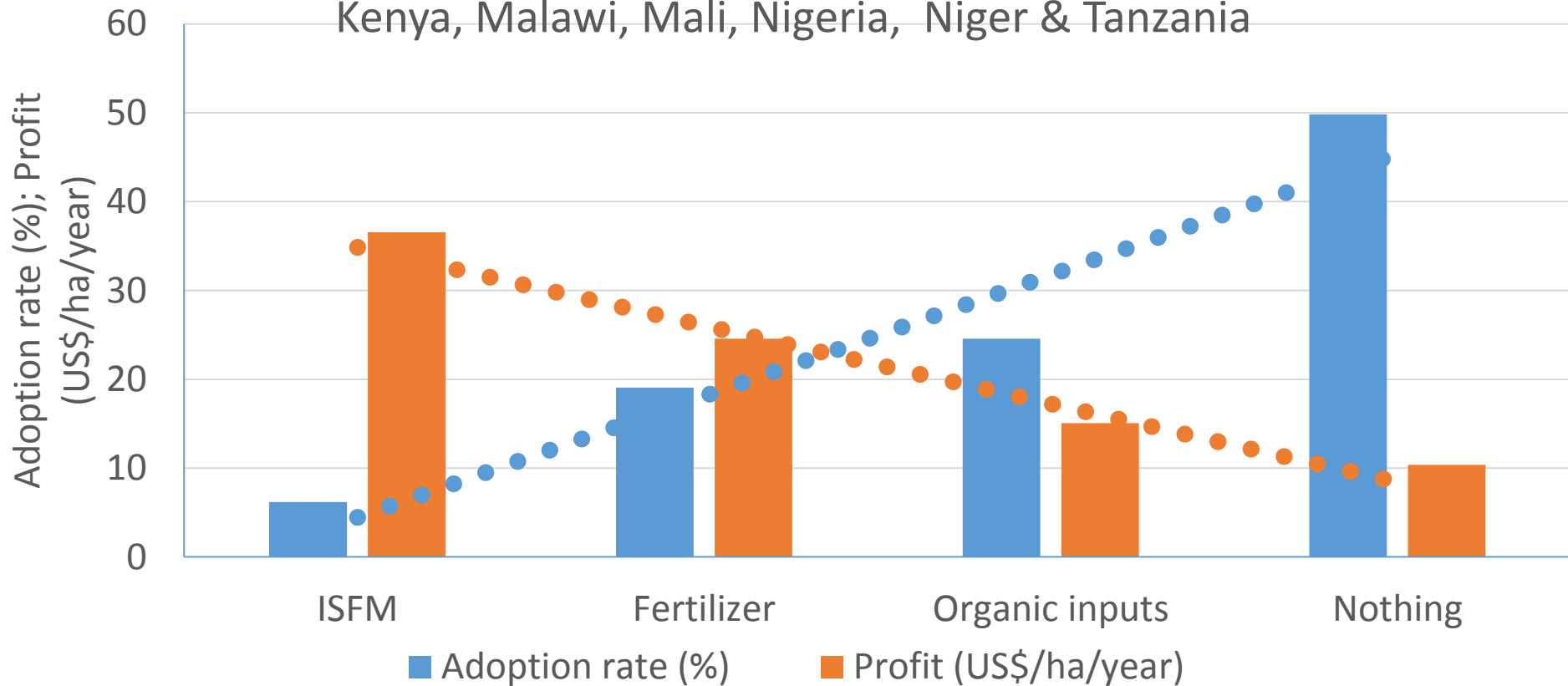
TR10=Crop residues+10 tons manure/ha+80kgN/ha

Returns to fertilizer much greater with ISFM



The unholy cross: Inverse relationship between profit and adoption rate

Average adoption rate & returns of land management practices, Kenya, Malawi, Mali, Nigeria, Niger & Tanzania



Why low adoption rate of ISFM?



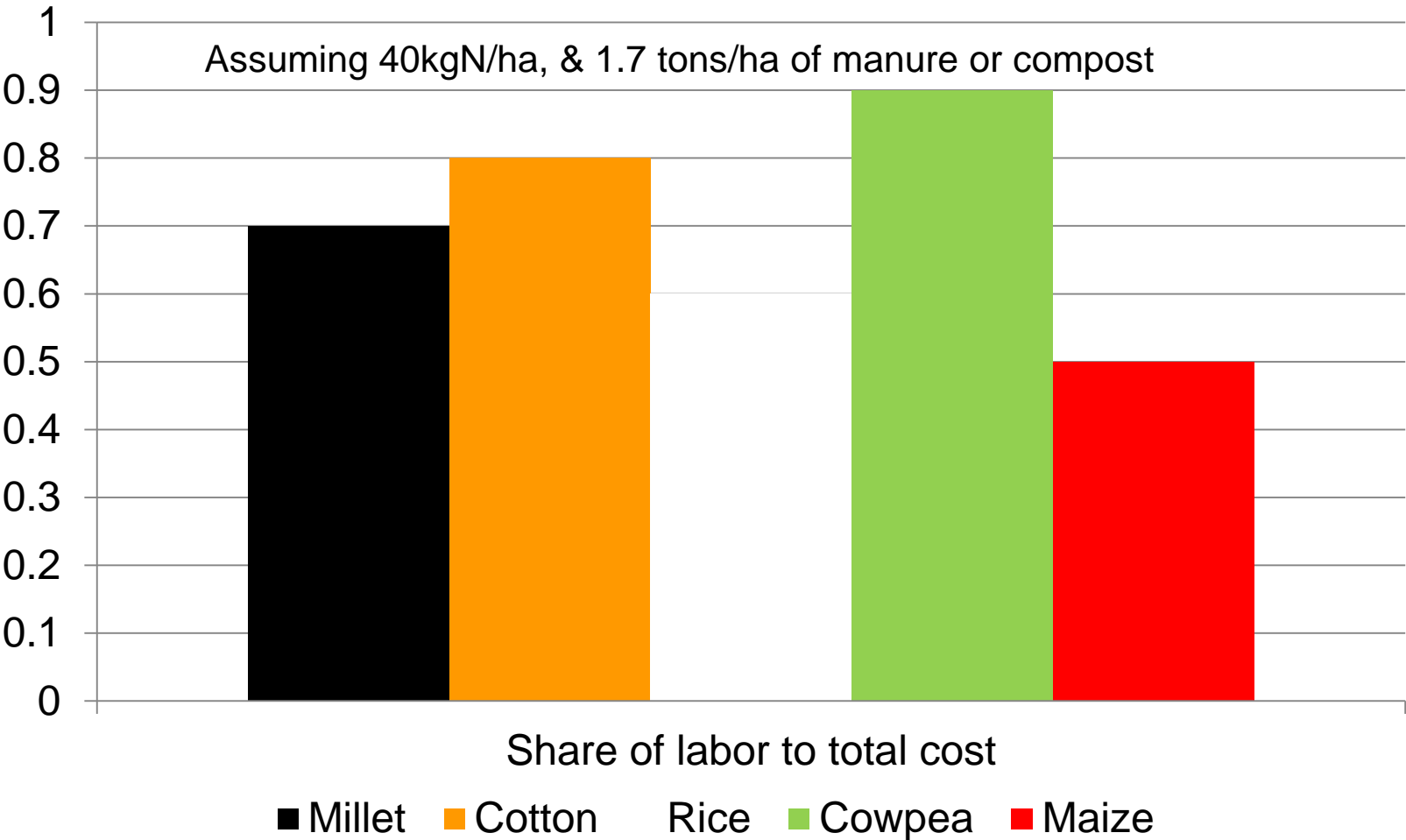
ISFM is labor intensive, requires
livestock to produce and transport
organic inputs

Land management practices using organic
inputs have high labor intensity

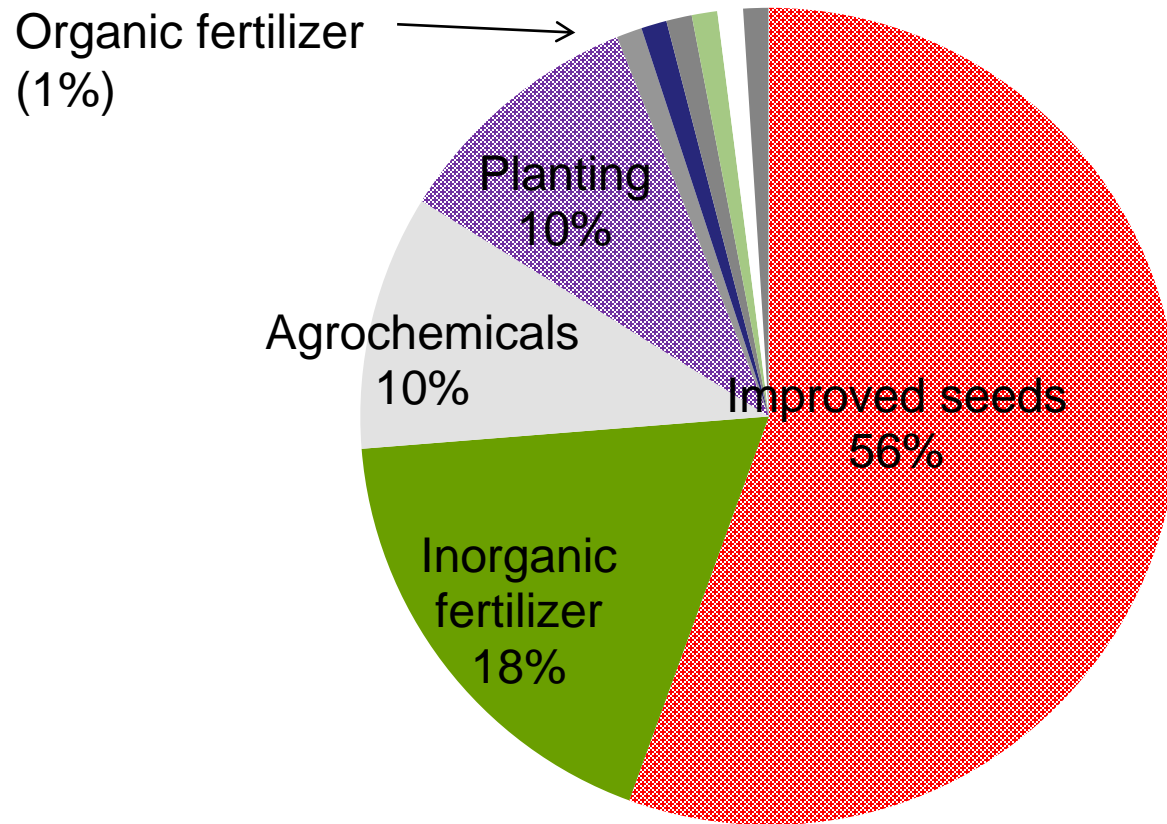
Labor accounts for 50% of the production
cost of combining chemical fertilizer and
organic inputs

Manure production & other organic inputs
need to be produced and transported to
crop plots

Contribution of labor to total production costs, Mali



Extension messages on organic inputs is low – case of Nigeria



Note: No advisory Services on CC
➔ Send back to School AEA

- Farmers closer to markets are more likely to adopt ISFM

Farmers with **horizontal & vertical** linkages more likely to adopt ISFM – role of SACAU to enhance the old (gold) cooperatives

Women less likely to adopt inorganic fertilizer but more likely to adopt organic inputs

Horizontal & vertical linkages

Horizontal

Trader groups for collective transportation, marketing, processing, grading, etc



Horizontal

Farmer groups for production, processing, transportation, marketing, or other collective farming activities

Vertical linkage

SACAU has overarching role in building horizontal & vertical linkages – just as cooperatives did

Reinventing the Horizontal & Vertical Linkages of Smallholder will enhance adoption of ISFM → adaptation to CC

The future belongs to the organized & Success belongs to the organized – Cooperative movement in 1930s-1970s followed a horizontally and vertically linked production, processing and marketing system that was well-organized
Cooperatives provided

- Input credit & timely delivery
- Organized transportation, grading, bulking and storage of crop produce
- Advisory services on both production & marketing knowledge
- Processing of export crops (coffee, tea, cotton, tobacco, pyrethrum, cashew nuts, etc)
- Marketing services – including direct export of commodity without passing thru a centralized & government controlled body

Cooperative leaders were democratically elected even during the traditional (chiefs) period – when election was uncommon.

What could be done to increase adoption of CA & ISFM?



Conditional fertilizer subsidy & other incentives : The case of Malawi

Targeted Vouchers conditional on adoption of ISFM

Choice experiment

Scheme 1:
FERTILIZER VOUCHER
Discount for a 50kg bag



Scheme 2:
RAINFALL INSURANCE VOUCHER



Scheme 3:
CASH
Direct Payment or
Credit from a revolving fund



Key results & implications

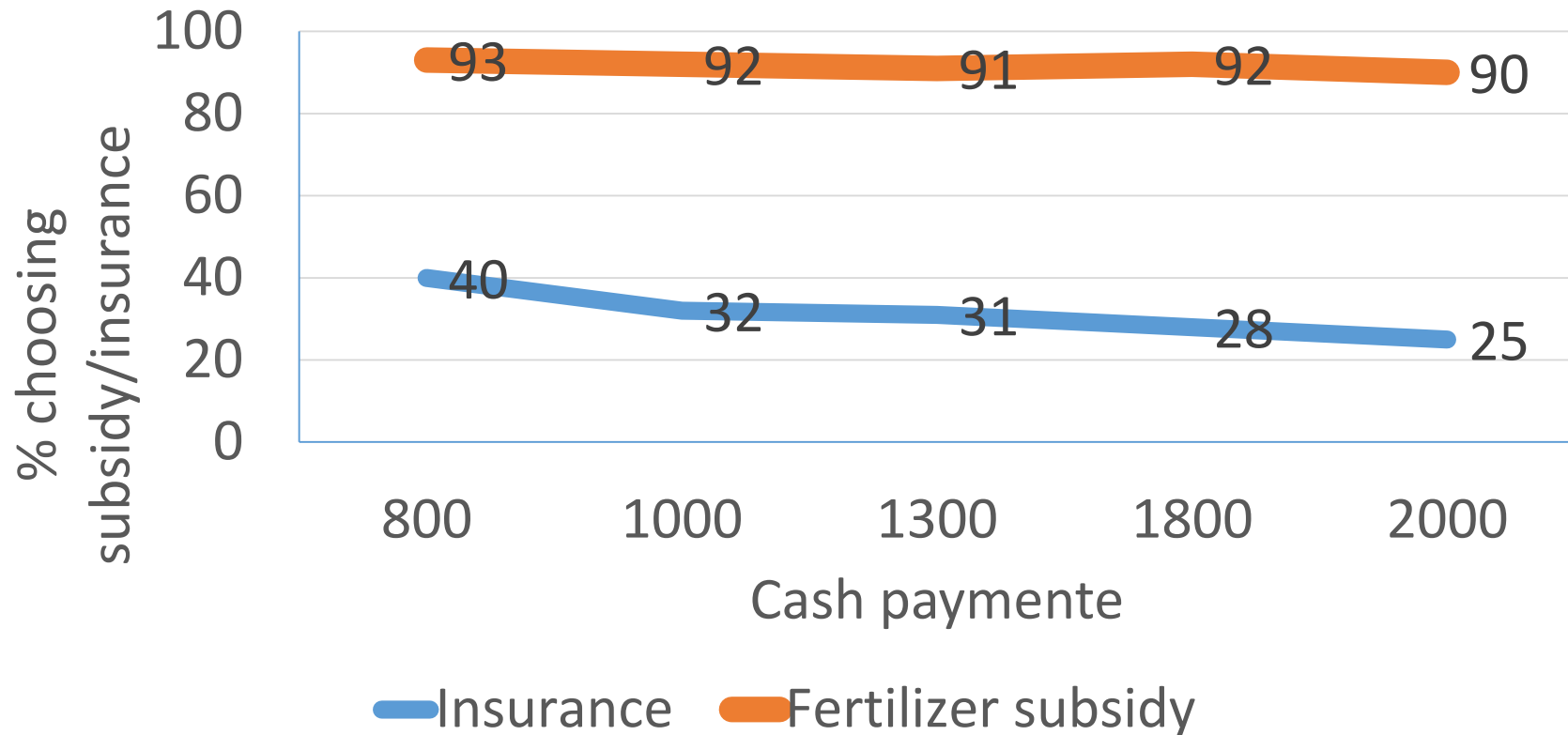
With no exception, all farmers responded to incentives to plant agroforestry trees!!

Cash Payments preferred to an ideal crop insurance contract by most farmers, even when the value of the ideal crop insurance contract was substantially higher

Fertilizer subsidies preferred to the ideal insurance contract



Choice experiment, Malawi



Source: Marennya P.; V.H. Smith; E. Nkonya. 2014. Relative Preferences for Soil Conservation Incentives among Smallholder Farmers: Evidence from Malawi. American Journal of Agricultural Economics 96 (3): 690-710

Conclusions & policy implications

- ISFM adoption could be increased by:
 - Offer **short-term training for agricultural extension agents** on ISFM, climate change, & other new changes
 - Use fertilizer subsidies as PES
 - Farmers strongly respond to **incentives**. → For countries that provide subsidies, conditioning such benefit to easily verifiable organic soil fertility management practices (e.g. agroforestry) will more than reduce current cost of subsidies, yet increase yield and profit
 - High labor intensity of ISFM could be addressed by promoting **agroforestry** and other plant-based organic soil fertility management practices
 - **Reinvent Cooperatives** to build horizontal and vertical linkages, processing, marketing & access to credit

Thank you

