Integrated Soil Fertility Management (ISFM) in Sub-Saharan Africa: Concepts and practice

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ISFM IS.... ISFM IS not....

This is not about 'rocket science'...



... or dogma's



Evergreen Agriculture

"Evergreen agriculture allows us to glimpse a future of more environmentally benign farming where much of our annual food crop production occurs under a full canopy of trees."

Dr Dennis Garrity, Director General, World Agroforestry Centre







... but about applying good soil management



THE LOGIC OF SCIENTIFIC DISCOVERY principles derived through the application of the standard rules of scientific discovery!

Farming in sub-Saharan Africa is a complex venture

Old and degraded soils...



Poor infrastructure... ... expensive inputs!



Many factors affect crop yield...



Small farms... ... poor people!





Small farms... ... eternally poor people?

Land (hectare) required to produce 1 USD/day as a function of net returns from crop production



Harris et al, 2012

Net returns from crop production, \$/ha

Variability in soil fertility...

- Same farm...
- Same variety...
- Same inputs...
- Same management...
- Same weather...







Variation in farmer's resources, ambitions and risk-taking abilities



Densely populated areas: Intensification





Forested areas: Intensification or expansion?



It is possible!





SFM: Potentia solutions based on good practices

No fertilizer, no intensification...



IFA, 2001

Universal principles of nutrient management



Improved germplasm: matching better nutrient supply with better demand

Maize yield in East DR Congo



Kasaï Kuleni BH140

Co-application of fertilizer and organic inputs



But fertilizer is often not enough...



Manure

+ N

N+P Fertilizer



Variability in response to fertilizer...



Integrated Soil Fertility Management

'The application of soil fertility management practices, and the knowledge to adapt these to local conditions, which maximize fertilizer and organic resource use efficiency and crop productivity. These practices necessarily include appropriate fertilizer and organic input management in combination with the utilization of improved germplasm'



Integrated Soil Fertility Management



ISFM works for maize-based systems!



Vanlauwe et al, PLSO, 2011

ISFM works for maize-based systems!



Vanlauwe et al, PLSO, 2011

Long term trials as essential components of an intensification strategy

Is fertilizer used in the context of ISFM a valid entry point towards sustainable system intensification?



ISFM VS CA

Complementarity steps towards sustainable

intensification?

Principles of Conservation Agriculture

- 1. Minimize soil disturbance by reduced or zero-tillage
- 2. Keep the soil covered with organic materials (crop harvest residues or cover crops)– at least 30% soil cover
- 3. Use crop rotations/associations

Important additional rule: No minimal tillage without mulch retention!



'Time to' CA

Transition Phases - Conventional to Conservation Agriculture



http://www.fao.org/ag/ca/5.html

Potential benefits of CA

SOM	1	Ion/water holding capacity	↑
Aggregation		Nutrient loss/	
Compaction	$\mathbf{\Psi}$	imbalance	¥
Surface crusting	↓	Pesticide carryover	$\mathbf{\Psi}$
Infiltration	1	Biological activity	^
Porosity		Woods insects	-
Runoff/Erosion/	↓	pathogens	V
Sedimentation	Ť	Air, water quality	1

Coordinated Research Project on CA, facilitated by IAEA (2005 – 2010)

[Various countries and continents, systems, climates, etc]

Overall conclusions:

1. CA does not



- necessarily improve crop yields in the short term
- 2. CA does not necessarily increase soil C stocks

3. CA systems appear to have more stable yields under varying rainfall conditions [\rightarrow climate change adaptation]

Niches for CA



Niches for CA

Tillage x residue management in Central Kenya





ISFM and Conservation Agriculture The common quest for biomass...



Take-home



This talk...

- 1. Smallholder farming in SSA is complex attempts to intensify need to work within that complexity
- 2. Literature and field evidence shows that ISFM addresses such complexity and provides immediate benefits to farmers (beware of non-responsive soils)
- 3. Long term ISFM trials are required to assess sustainability aspects of ISFM interventions
- 4. ISFM and CA could be considered as covering different phases along smallholder intensification pathways

And...

5. Creating an enabling environment for uptake of ISFM is certainly as important as developing ISFM interventions



Integrated Soil Fertility Management in Africa: From Microbes to Markets

hosted by CIAT-TSBF and the University of Nairobi

22-26 October 2012, Nairobi, Kenya



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