1966-2016
CIMMYT

Systems Agronomy: From Fields to Farms and Farming Systems

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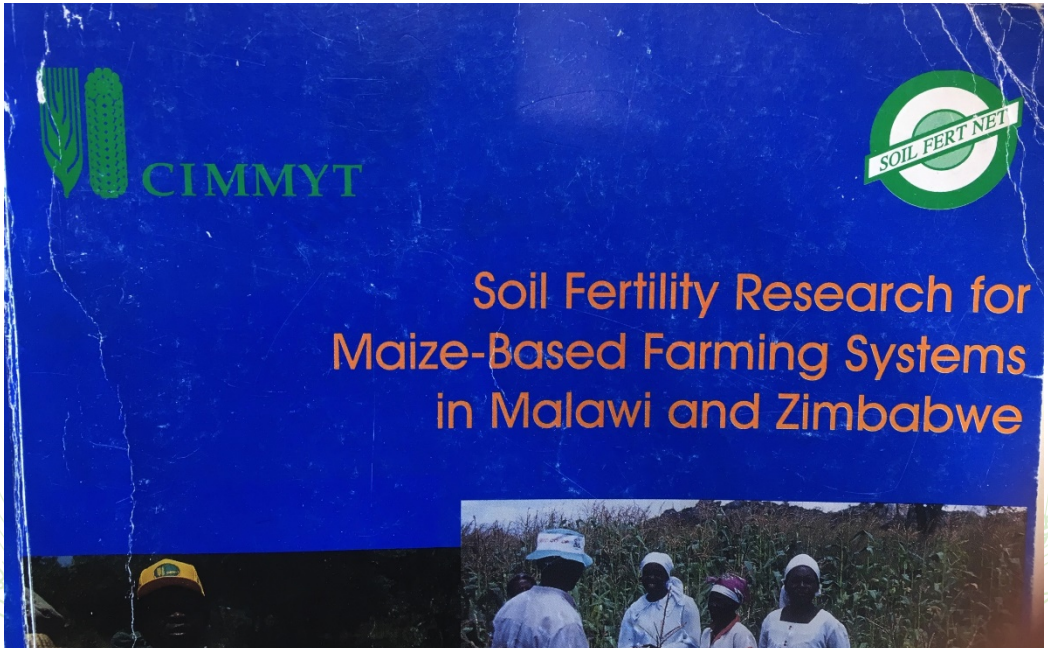
CIMMYT-Africa in the 1990s

- Building on a strong legacy of farming systems research
- Focus on diversification with legumes and crop-livestock integration
- Regional network supporting national research teams

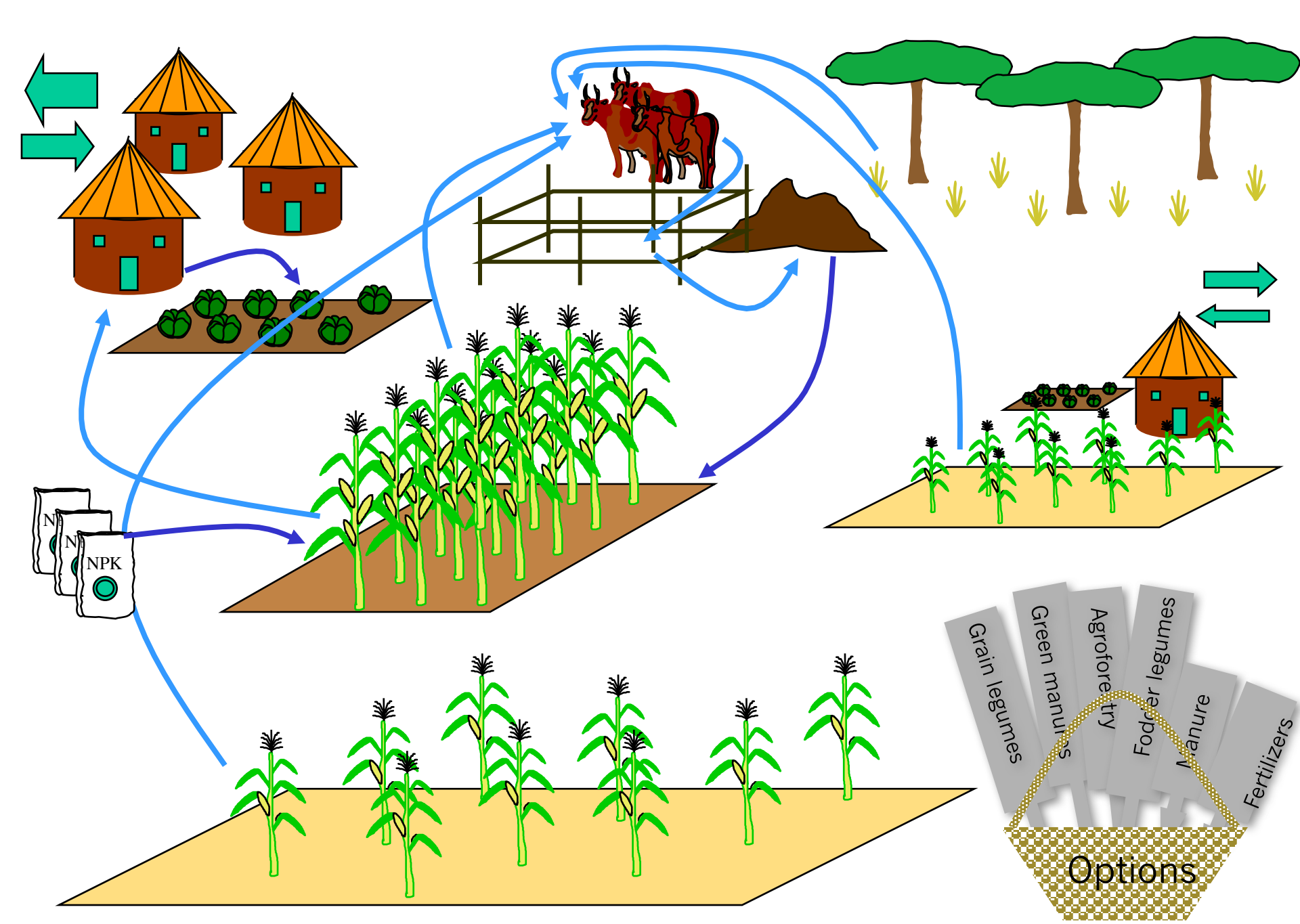


Waddington, Murwira, Kumwenda, Hikwa, & Tagwira (1998) SoilFertNet/CIMMYT-Zimbabwe,

The problem

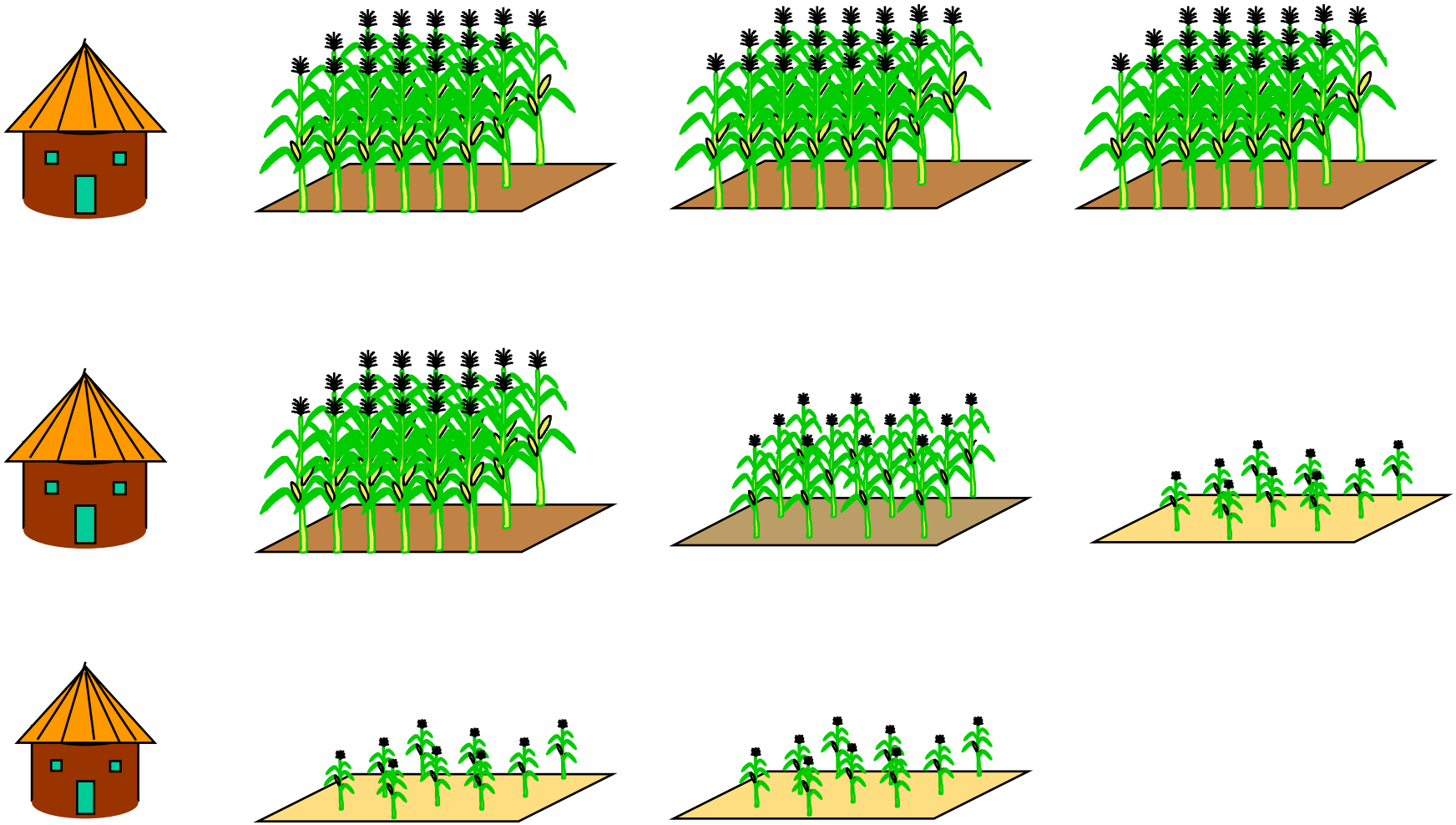
- Maize-dominated farming systems
- Declining soil fertility
- Need for diversification

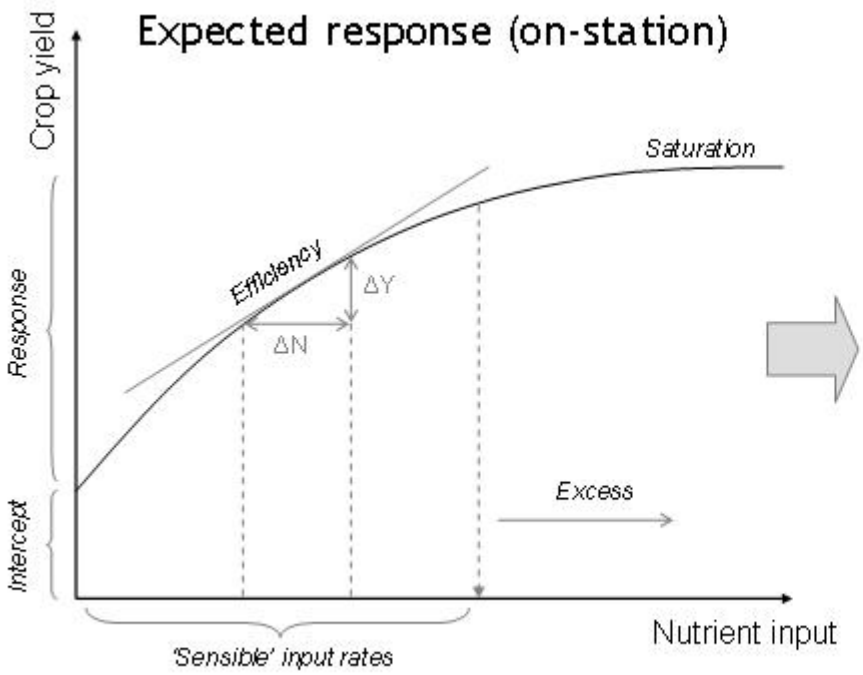
Green manures on smallholder farms

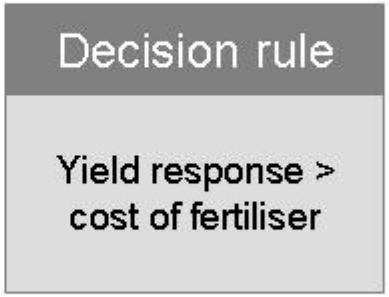


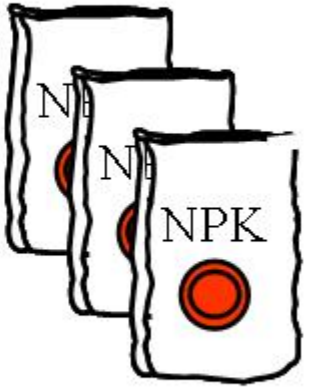
Giller et al. (2006) *Agricultural Systems,* **88,** 8-27.

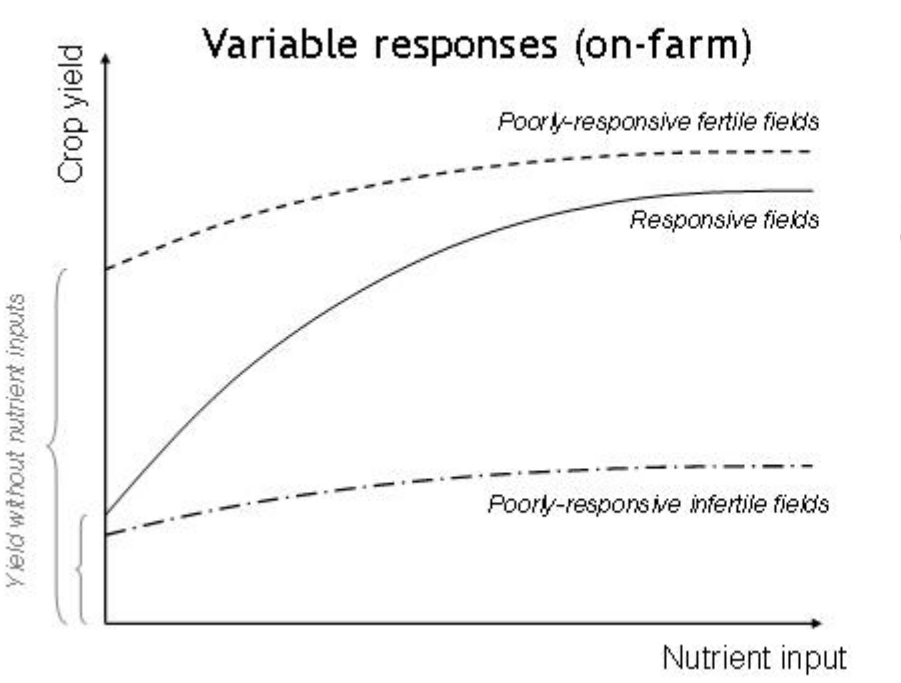
Reducing complexity – farm and field types

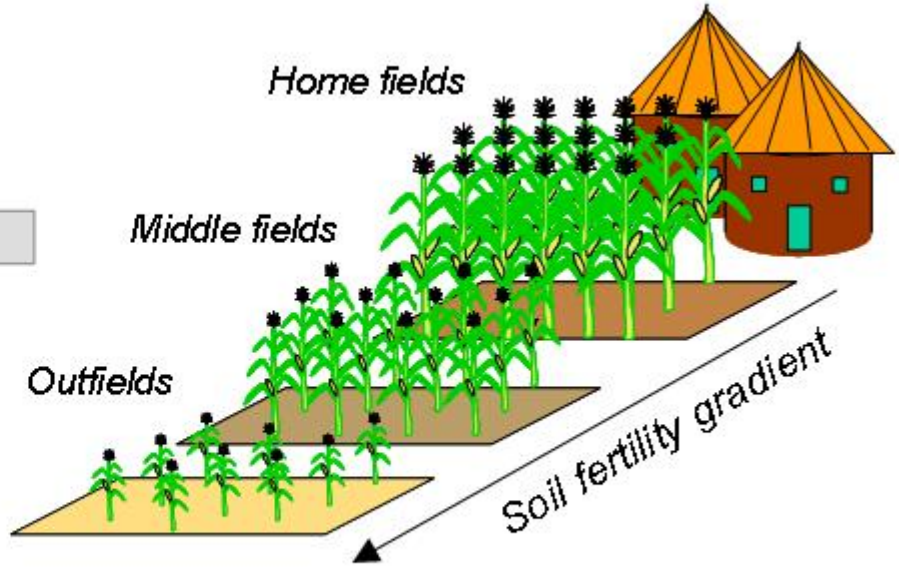






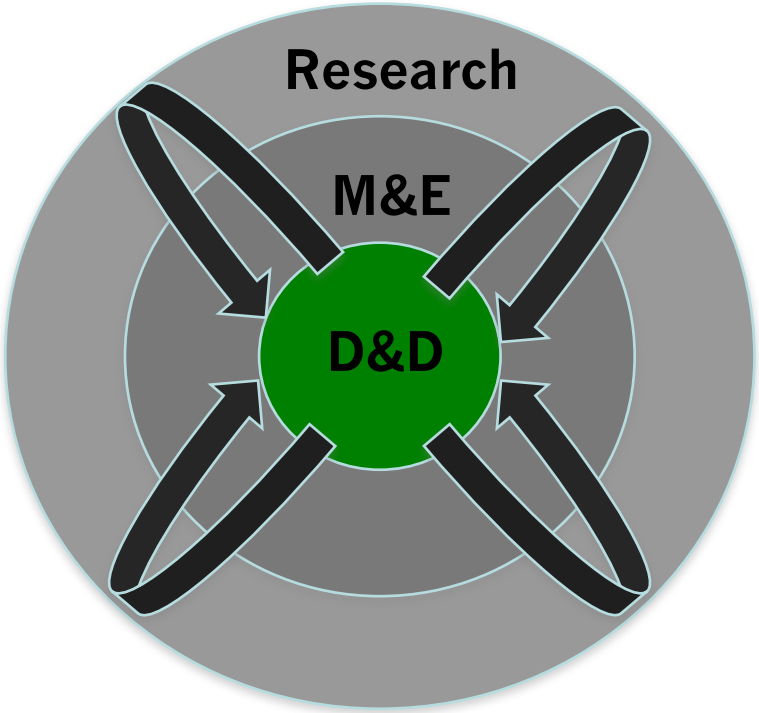






Tittonell & Giller (2013) *Field Crops Research,* **143,** 76-90.

N2Africa is a development to research project



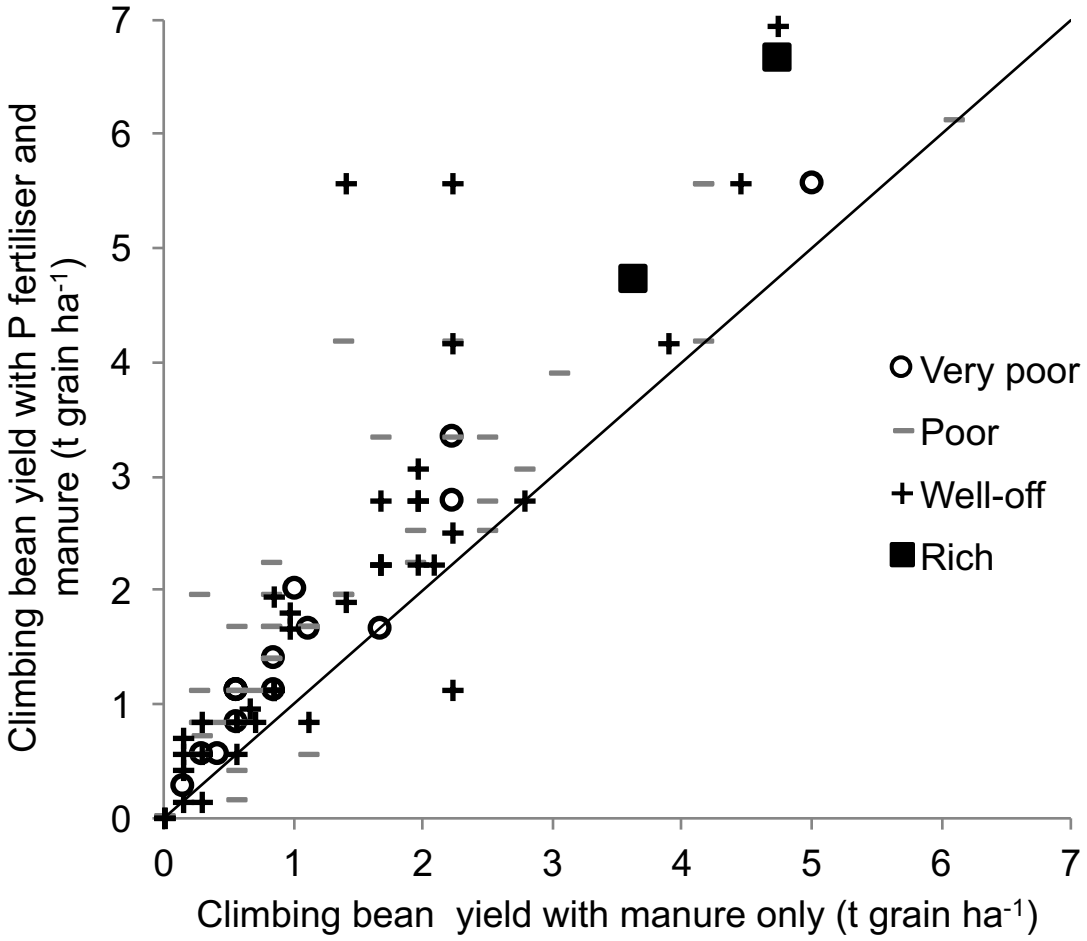
- Delivery and dissemination are the core
- Monitoring & evaluation provides the learning
- Research analyses and feeds back

Climbing beans in Rwanda

No manure

With Manure and P

Response of climbing bean to P fertiliser, segregated by wealth category in N Rwanda



	Without P fertiliser (kg/ha)	With P fertiliser (kg/ha)
Very poor	**683**	**1061**
Poor	**1256**	**1891**
Well-off	**1356**	**2006**
Rich	**4167**	**5694**

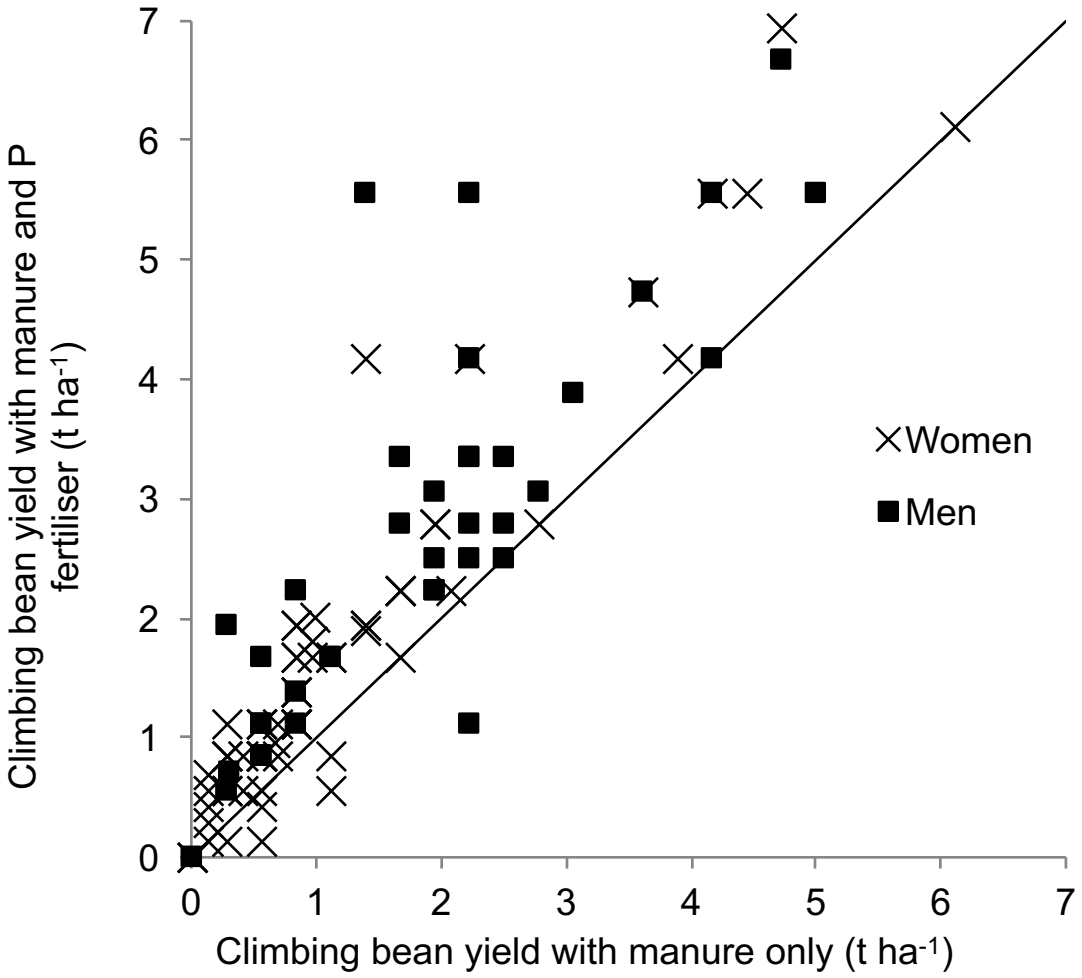
Franke, Baijukya, Kantengwa, Reckling, Vanlauwe, Giller (2016) *Exp. Agric.* online

Soil fertility in climbing bean trials affected by resource endowment

Variable	Very poor	Poor	Well-off	Rich	Significance
pH	5.4	5.7	5.5	6.0	*n.s.*
C (%)	**1.3**	**2.5**	**2.5**	**4.2**	*0.018*
N (%)	**0.12**	**0.25**	**0.24**	**0.43**	*0.020*
Avail. P (mg/kg)	**6.7**	**20.5**	**19.1**	**35.9**	*0.005*
Sand	**40.6**	**31.9**	**30.6**	**34.6**	*0.002*
Silt	**27.3**	**35.3**	**35.7**	**43.3**	*0.002*
Clay	32.1	32.8	33.7	22.2	*n.s.*

Franke *et al.* (2016)
Exp. Agric. online

Yields segregated by gender

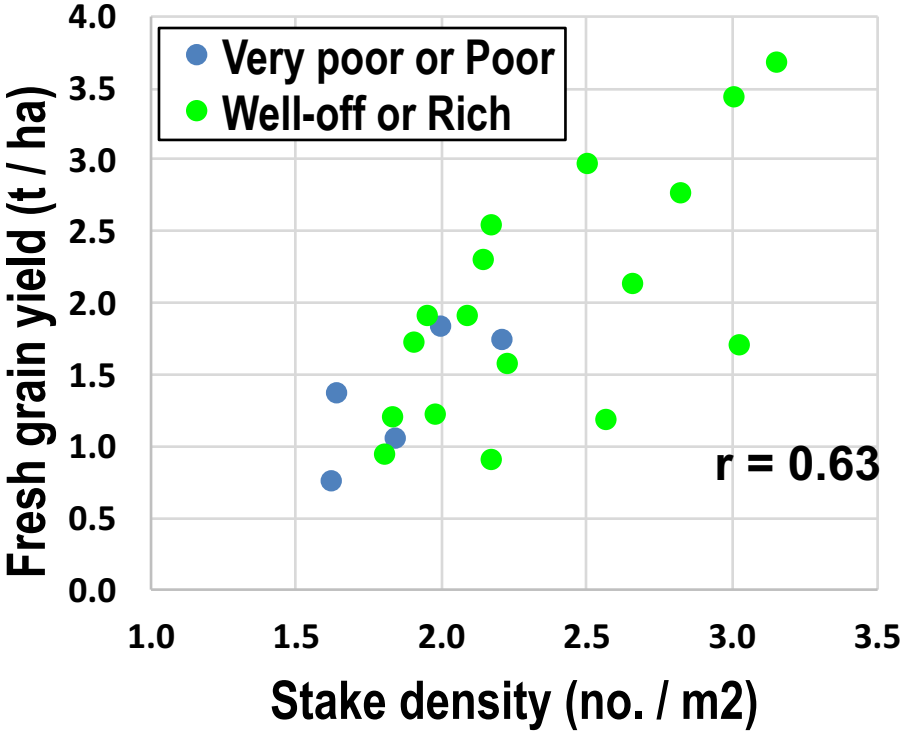


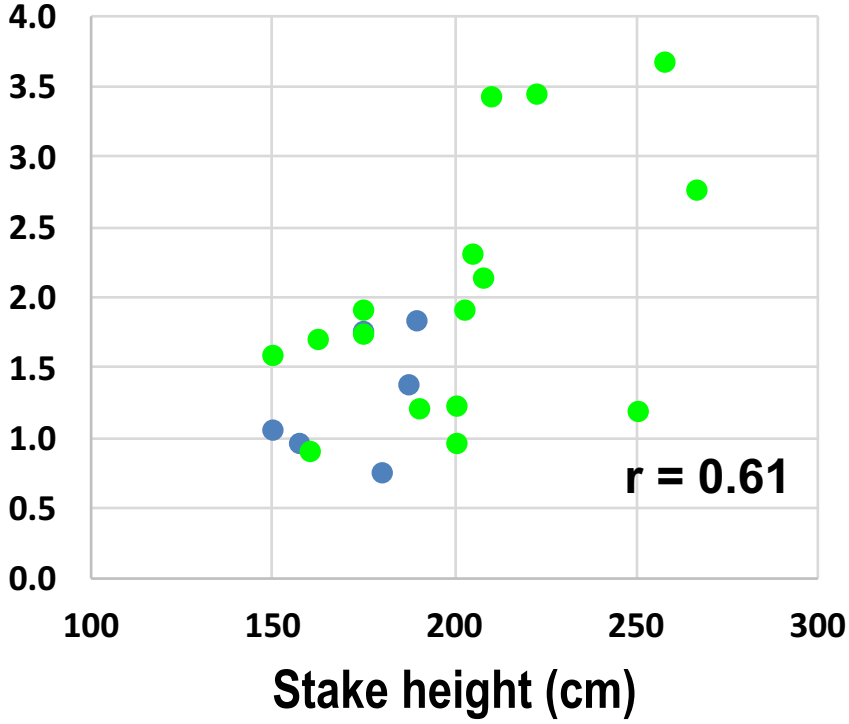
	Without DAP (kg/ha)	With DAP (kg/ha)
Women	**1107**	**1659**
Men	**1733**	**2517**

Franke *et al.* (2016) *Exp. Agric.* online

Climbing bean yields depend on the length, number and quality of stakes

Poorer farmers have fewer, shorter stakes of inferior quality





Franke *et al.* (2016) *Exp. Agric.* online

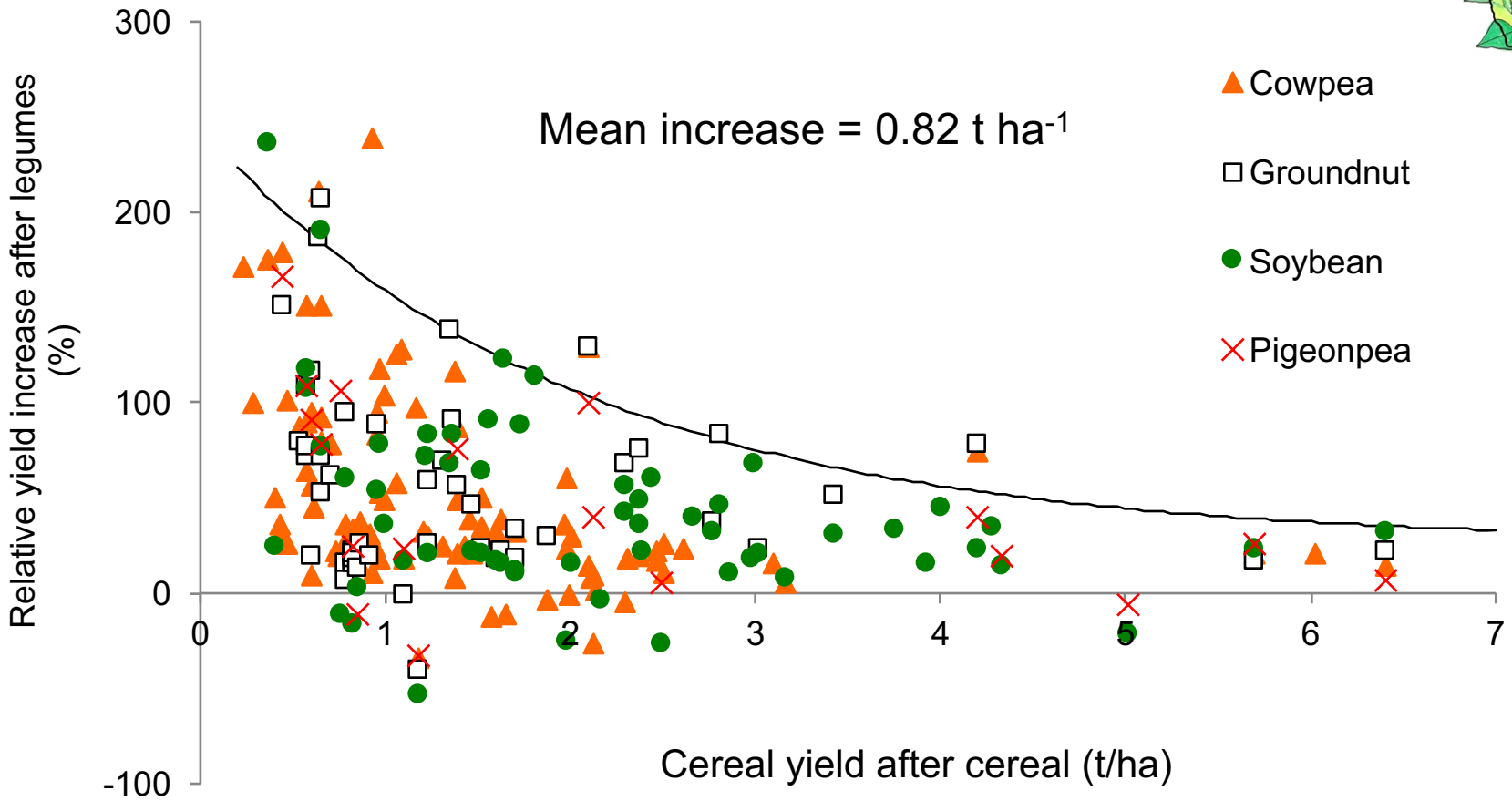
Crop management factors that determine climbing bean productivity

- Planting time
- Timing of 1st weeding
- Staking density
- Stake length
- Organic input use
- P fertiliser use
- Labour input

The poorest farmers are very hard to reach!

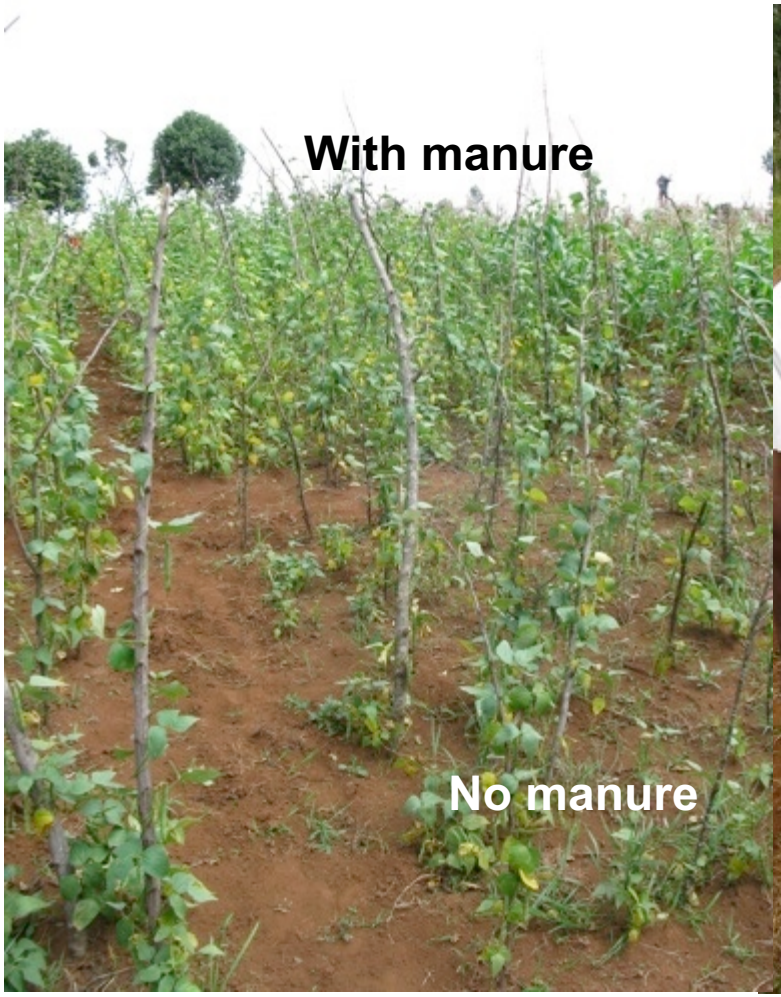

maize following maize
maize following climbing beans

Meta-analysis of grain legume residual benefit to cereal crops in Africa

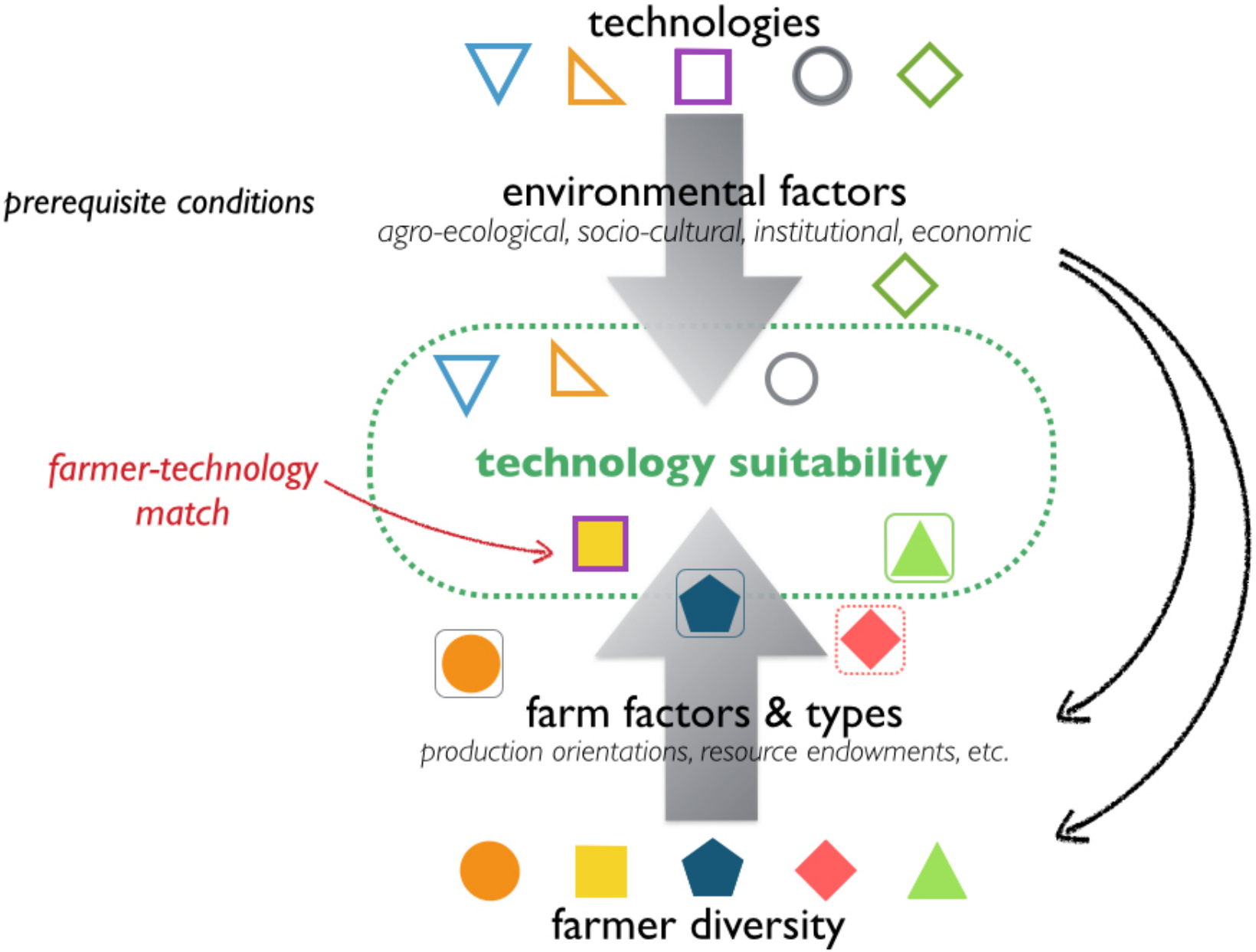


Franke, van den Brand, Vanlauwe & Giller (2016) *Agric Ecosyst Env* (submitted)

Improving food self-sufficiency – climbing beans in DRC



Long rains season 2010 in Sud Kivu, DRC



Giller et al. (2015) Beyond Conservation Agriculture, *Frontiers in Plant Science 6: 870*

Science

AN ECONOMY FOR THE 1%

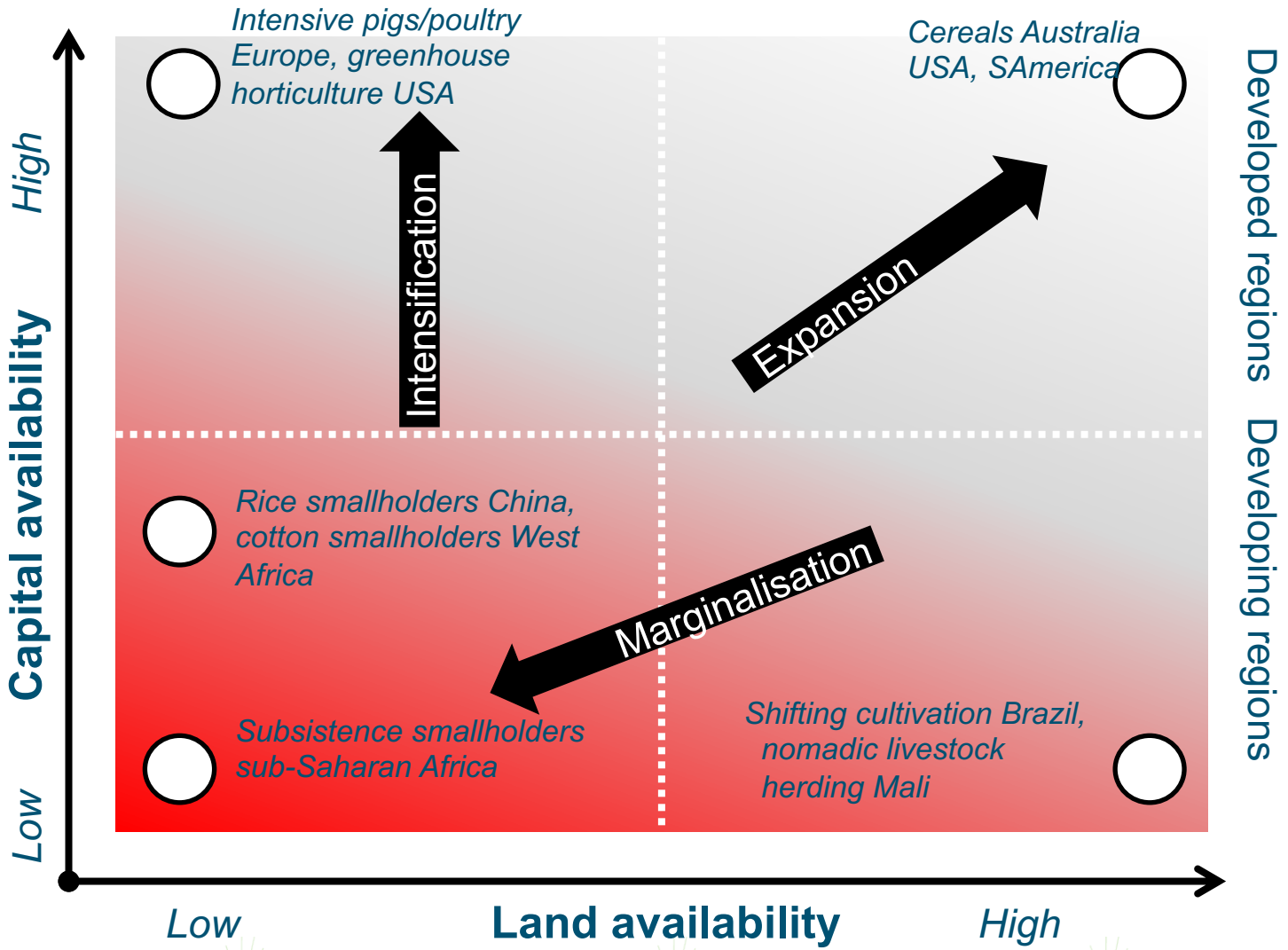
How privilege and power in the economy drive extreme inequality and how this can be stopped

The global inequality crisis is reaching new extremes. The richest 1% now have more wealth than the rest of the world combined. Power and privilege is being used to skew the economic system to increase the gap between the richest and the rest. A global network of tax havens further enables the richest individuals to hide $7.6 trillion. The fight against poverty will not be won until the inequality crisis is tackled.

OXFAM

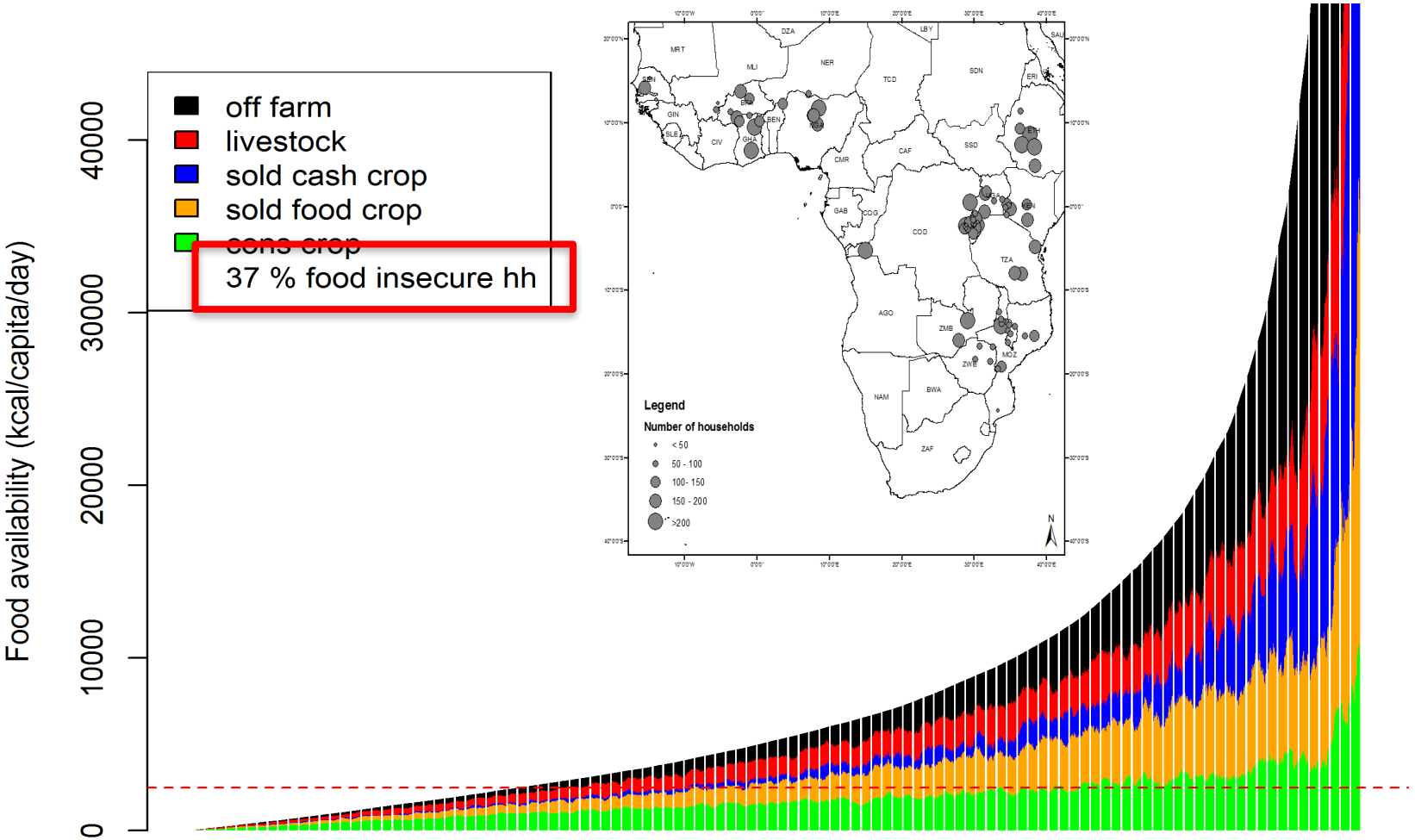
www.oxfam.org

Diversity and trends in global farming systems



van Vliet, Schut, Reidsma, Descheemaeker, Slingerland, van de Ven & Giller (2015) *Global Food Security*, 5, 11-18.

Food availability across >13,000 small farms

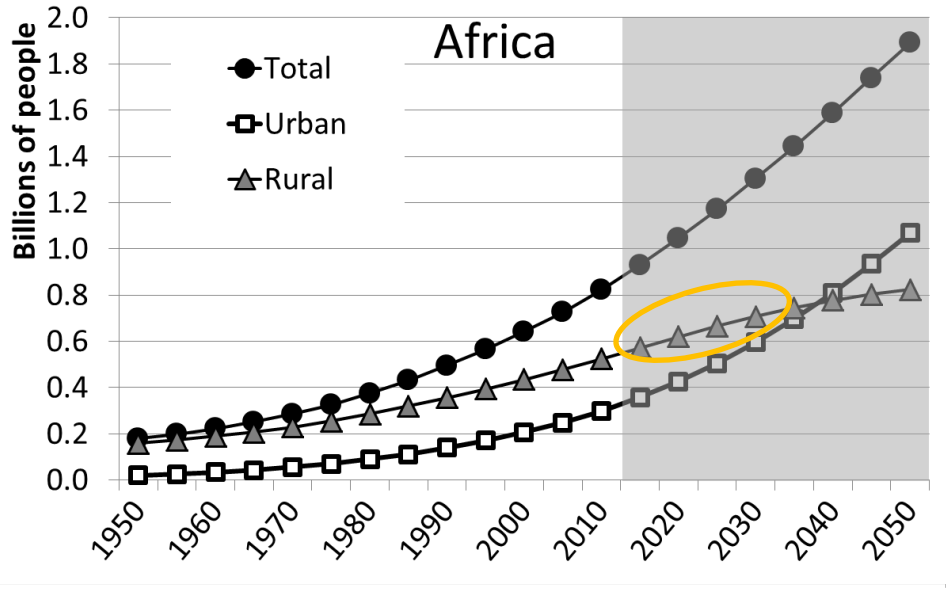


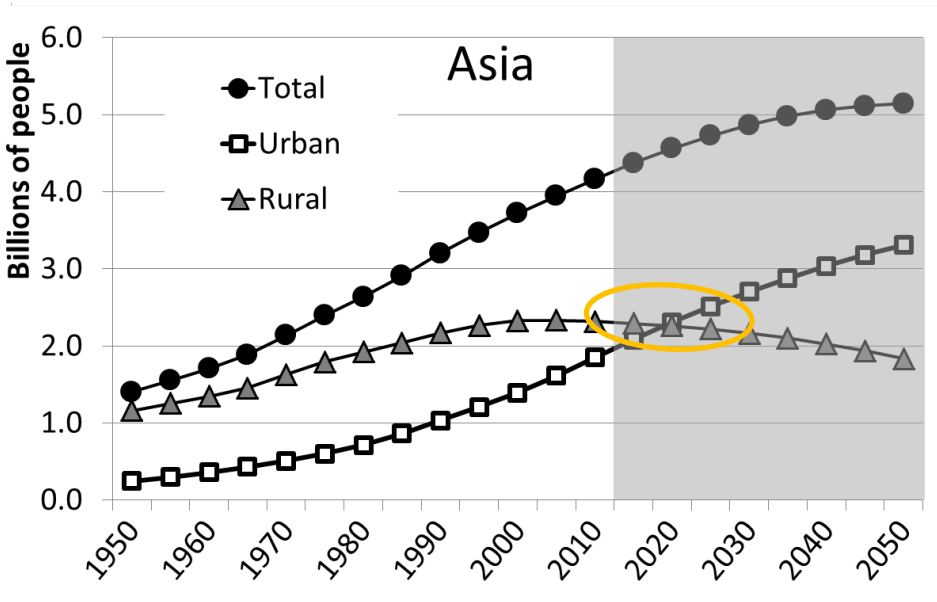
93 sites
17 countries

Frelat *et al.* (2016) *PNAS*, **113,** 458–463

Changes in population 1950-2050

Average farm sizes are starting to grow in Asia, but will continue to shrink in Africa





Masters *et al.* (2013) *Global Food Security,* **2,** 156-165.

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Conclusions and Challenges

- Smallholder farmers unable to realise yield gains from new varieties – soil fertility is key!
- Need “best fit” (legume) technologies with a basket of options for all – rich and poor
- Productivity gains rapidly overtaken by population growth
- Concerns of small farm size, poor economic gains, ageing of farmers
- Need to focus on future farming systems rather than on technologies at field level
  - Diversification for nutrition
  - Mechanisation (both small-scale and contracted services)
  - Transitions out of agriculture and land consolidation
- Agricultural development depends on development outside agriculture (and *vice versa*)