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Feed the Future Innovation Lab for Food Security Policy

Policy Research Brief 3 December 2014

Road Map towards The Malabo Declaration: Increasing Smallholder Farm Productivity through Improved Farm Management Practices

Prepared by the Regional Network of Agricultural Policy Institute (ReNAPRI)[1]

The importance of a holistic approach to sustainable agricultural productivity growth

The FAO's "Year of Soils" highlights a growing recognition that soil degradation is a massive problem that is threatening the sustainability of farming systems throughout the world. In most of sub-Saharan Africa, it is increasingly clear that goals related to agricultural input intensification and higher levels of agricultural productivity will require much greater attention to sustainable land and soil fertility management practices.

Agricultural intensification's impact on soil

Numerous studies point to unsustainable land management practices in densely populated rural areas of Africa where land pressures have contributed to soil degradation (e.g., Stoorvogel and Smaling, 1990; Drechsel et al, 2001; Tittonell and Giller, 2012)[2]. Continuous cultivation of existing plots would not necessarily pose problems for sustainable intensification if soil quality were maintained or improved over time. Instead, loss of micronutrients and soil organic matter are creating unique challenges: the soil cannot be improved by conventional inorganic fertilizers application and the depleted soil tends to depress the efficiency of inorganic fertilizer in contributing to crop output (Shaxson and Barber, 2003; Marenya and Barrett, 2009; Vanlauwe et al, 2011). Giller et al (2006) and Tittonell et al (2007) conclude that many smallholder farmers are largely unable to benefit from the current yield gains offered by plant genetic improvement due to farming on depleted soils that are non-responsive to fertilizer application. The problem of soil mining has the classic elements of a "social trap" (Platt, 1973), in which people adopt behaviours consistent with their short -term livelihood objectives, but which produce unsustainable and potentially disastrous long-term consequences (Jayne et al, 2014).

Key Messages

- The sub-Saharan smallholder farmers' productivity challenge is multi-dimensional in nature; therefore, the solution needs to be multifaceted.
- Population growth in densely populated smallholder farming areas is contributing to growing land pressures and unsustainable forms of agricultural intensification.
- Loss of micronutrients and soil organic matter depress the efficiency of inorganic fertilizer in contributing to crop output.
- Despite the combined use of fertilizer and hybrid seeds, maize yield levels are low for many African farms when compared to Chinese smallholder farms.
- Improved farm management techniques can mitigate the impact of soil degradation, contribute to efficient use of fertilizer, and promote productivity growth for smallholder agriculture in Africa.

[1] Also published as ReNAPRI Brief number 1

[2] Common forms of soil degradation include declining nutrient balances ("soil mining"), erosion and loss of topsoil, acidification, and loss of organic matter. An important contrasting study by Tiffen et al (1994) argues that population pressures between 1950 and 1980 in the Machakos District of Kenya induced households to make land-augmenting investments that contributed to sustainable intensification. However, in a more recent revisit to these same areas in 2014, Kyalo and Muyanga (forthcoming) note that population densities during the period studied by Tiffen et al., were generally below 400 persons per km2, that densities of some divisions have risen well over 800 km2, and that there is now widespread evidence of soil degradation and unsustainable forms of intensification.

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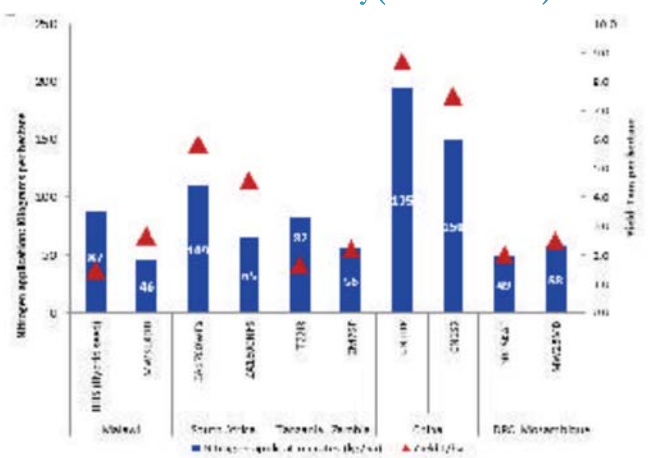
Rising rural population density and associated land pressures are important underlying drivers of these processes, yet they are within the scope of policy to ameliorate (Snapp et al, 2010; Powlson et al, 2011).

ReNAPRI's study on improved farm management and productivity

The Regional Network of Agricultural Policy Research Institutes (ReNAPRI) conducted a study of the determinants of variations in maize production costs on various proto-typical farms in Kenya, Tanzania, Malawi, the Democratic Republic of the Congo, Zambia, Mozambique and South Africa (ReNAPRI, 2014). The study found that despite the combined use of fertilizer and hybrid seeds, maize yield levels were low for many African farms when compared to Chinese smallholder farms.

Comparison of nitrogen application and yield levels from ReNAPRI study(1000 tonnes)



Source: ReNAPRI

Notes:

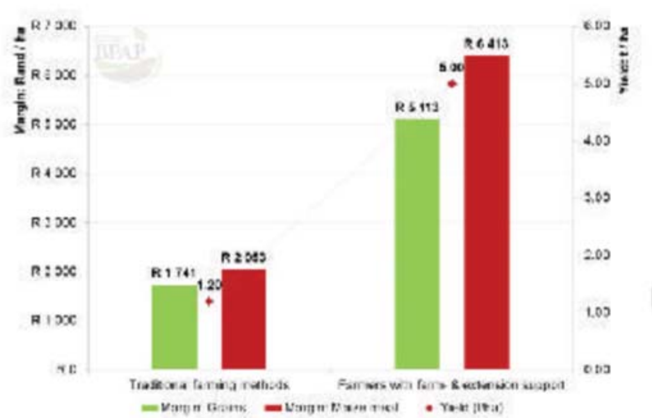
HHS	Household Survey Small-scale farm
MW3LADD	Malawi, 3 ha, Lilongwe
ZA1700WFS	South Africa, 1700 ha, Western Free State
ZA1600NFS	South Africa, 1600 ha, Northern Free State
TZ2IR	Tanzania, 2 ha, Iringa
ZM7SP	Zambia, 7 ha, Kalomo
CN1HP	China, 1 ha
CN1SX	China, 1 ha
DRC5KAT	Democratic Republic of the Congo, 5 ha, Katanga
MW25MD	Mozambique, 25 ha, Moamba

[2] The Agri-Benchmark is an international network which utilizes a consistent methodology for measuring production costs, coordinated by the agri benchmark Centre at Thünen-Institute in Braunschweig, Germany.

For example, national survey data from Malawi indicates an average nitrogen application rate of approximately 87kg per hectare. However, maize yields are significantly lower when compared to South African commercial and Chinese smallscale maize producers. The study recommended more research was needed to understand factors affecting maize response to inorganic fertilizer and concluded that specific farm management practices that contribute to fertilizer use efficiency should be integrated holistically into agricultural extension programs alongside the use of fertilizer (ReNAPRI, 2014).

To further investigate this conclusion, a case study[3] in South Africa tested the impact of farmer training alongside fertilizer application (ReNAPRI, 2014). The study compared the productivity of two small-scale maize farms operating within the KwaZulu-Natal Province. One farm used traditional methods of farming and fertilizer application. The other used fertilizer, while also participating in GrainSA's mentorship program. The mentoring program included training on: lime application, land preparation, fertilizer use, and plant protection. The farm with the mentoring training component produced more than four times that of the farm using traditional methods[4] ; thereby demonstrating the positive impact of farm management on farm productivity.

Difference in yield and gross margin per hectare for traditional farming versus the farm management protocols recommended by GrainSA



Source: ReNAPRI 2014

[3] Conducted in partnership with BFAP and GrainSA.

[4] The mean yield for the improved farming system was 5 t/ha versus 1.2 t/ha for the traditional system

Working hand-in-hand: fertilizer and farm management

The smallholder farmers' productivity challenge is multidimensional in nature. To address these challenges the solution needs to be multifaceted. Increased use of inorganic fertilizer is indeed crucial for achieving agricultural productivity growth and food security in Africa. Yet soil degradation is increasingly recognized as depressing many farmers' ability to generate much additional production from the use of fertilizer, which then depresses farmers' willingness to continue to use it. Improved farm management techniques can mitigate the impact of soil degradation, contribute to efficient use of fertilizer, and promote productivity growth for smallholder agriculture in Africa.

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