Feed the Future Innovation Lab for Food Security Policy

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New Alliance Policy Acceleration Support: Malawi Project (NAPAS: Malawi)

Making Fertilizer Use More Effective and Profitable: The Role of Complementary Interventions

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Summary

Increased use of nitrogen fertilizers is crucial to achieving Malawi's food security and agricultural development goals. Fertilizer use in Malawi is constrained by many factors, including high transport costs, smallholder farmers' limited cash resources to buy fertilizer and unstable agricultural output prices. Until recently, however, the role of land degradation and unsustainable land management practices in depressing crop response to fertilizer has been under-appreciated. Low crop response to fertilizers diminishes its profitability and hence depresses farmers' demand for fertilizers. Programs to enable farmers to increase the quantity of crop output obtained per kg of fertilizer applied are becoming increasingly critical to achieve Malawi's national food security and increased income goals. But meeting these challenges will require more effective public agricultural research and extension programs. Sustainable increase in fertilizer use will also depend on enabling farmers to use fertilizer more efficiently and profitably.

Key Messages

- Fertilizer use can be made more profitable with the inclusion of complementary interventions such as integrated soil fertility management practices that include integrating legumes in farming systems, crop rotation, application of organic manure in combination with inorganic fertilizers, and application of lime on acidic soils, among others.
- By raising the efficiency of fertilizer use, these complementary interventions can expand the effective demand for fertilizers in a sustainable manner without dependence on subsidy programs.
- Extension programs featuring good agronomic practices such as timely planting, correct and timely fertilizer application, timely weeding and proper plant spacing will also raise the efficiency of fertilizer use.
- Effective implementation of these interventions will require public investments in agricultural research and responsive extension systems.
- While typically considered outside the range of fertilizer promotion policies, public investment in road, rail-way and rural infrastructure and competitive behavior of the Malawi transport sector is another powerful way to boost fertilizer access by farmers.

Introduction

The Government of Malawi (GoM) has been implementing the Farm Inputs Subsidy Program (FISP) since the 2005/06 growing season, whereby farmers are provided with subsidized inorganic fertilizers and improved seeds. Malawi has been highly heralded as pioneer in the implementation of "second-generation" input subsidy programs in Africa following initial success of the FISP (Jayne et al., 2018). However, the success was not sustained. Malawi remains a relatively poor country and agricultural productivity growth over the period of the FISP program has been modest.

It has become increasingly evident that it is not enough to give fertilizer to farmers without focusing on how they can utilize it more effectively. One of the major ironies emanating from applied research is that many smallholder farmers find inorganic fertilizer to be marginally profitable or even unprofitable on the main staple food crops (such as maize), in the SSA region, unless it is moderately or heavily subsidized. Uncompetitive behavior in the transport sector also contributes to the high cost of fertilizer that farmers face in Malawi (Ncube et al., 2015 and Asfaw et al., 2017). Consequently, there is need for indefinite continuation of

subsidy programs to maintain needed levels of fertilizer use unless programs can be implemented to help farmers raise the quantities of crop output obtained from fertilizer application. Regulating the transport sector to remove uncompetitive behavior can be one way of making fertilizers accessible and profitable to Malawi farmers. Inclusion of complementary farming investments (such as fallowing, legume integration, crop rotation, timely planting and weeding, timely and correct fertilizer application rates and proper crop residues management) also promotes higher crop responses to fertilizers, making fertilizers effective and profitable to farmers (Snapp et al., 2014).

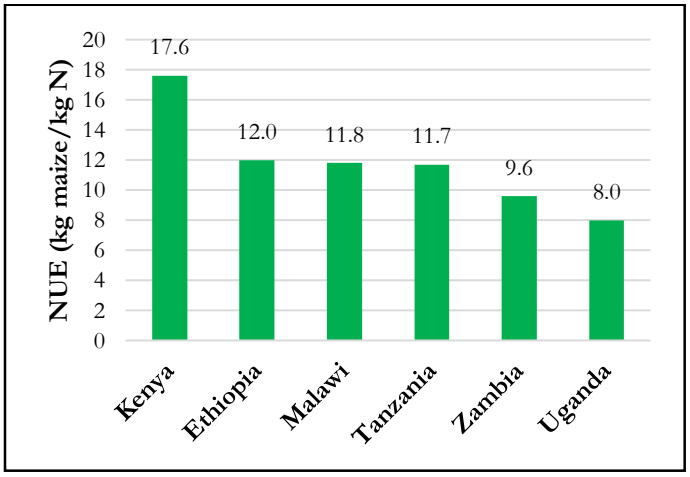
Malawi's Fertilizer Application Rate and Nutrient Use Efficiency

Malawi's inorganic fertilizer application rate has increased from below 10kg/ha in 2005 to 55.8 kg/ha in 2016[1], mainly due to introduction of the FISP. This rate surpasses the 2006 Abuja declaration recommendation of 50kg/ha but is still lower than application rates in developed countries such as China, which applies about 500 kg/ha on average. This makes Malawi the highest in Africa in terms of fertilizer applied, and is said to have caused an increase in maize yields from below 1Mt/ha in 2005 to about 2 Mt/ha in 2016/17. While smallholder farmers obtain highly varying levels of additional maize output per kg of fertilizer applied (nutrient use efficiency or NUE), Malawi's average NUE remains low at around 11.82 kg of maize per 1 kg of nitrogen applied (Darko et al., 2016). Figure 1 shows NUE rates in some of Malawi's neighbors.

The Role of Complementary Interventions

Researcher-managed trials in Malawi typically obtain NUE of over 20 and often over 30, clearly showing that it is possible to double or triple the contribution of fertilizer to national maize production if effective interventions are put in place to overcome the constraints that Malawian farmers face. By raising NUE, farmers will also find fertilizer use to be more profitable, thereby raising the commercial demand for chemical fertilizers. Public sector interventions to increase NUE are varied, but generally focus on farmer

Figure 1: Maize agronomic response rates to Nitrogen application in several SSA countries.



***Source**: Jayne and Rashid, 2013 and Darko et al., 2016.*

management practices that improve soil quality over time. Research evidence shows that NUE is often raised by increasing organic matter in the soil, reducing soil acidity, timely weeding, and timely fertilizer application, among other things. These complementary interventions are crucial for enabling profitable use of fertilizer by farmers.

Integrated Soil Fertility Management (ISFM)

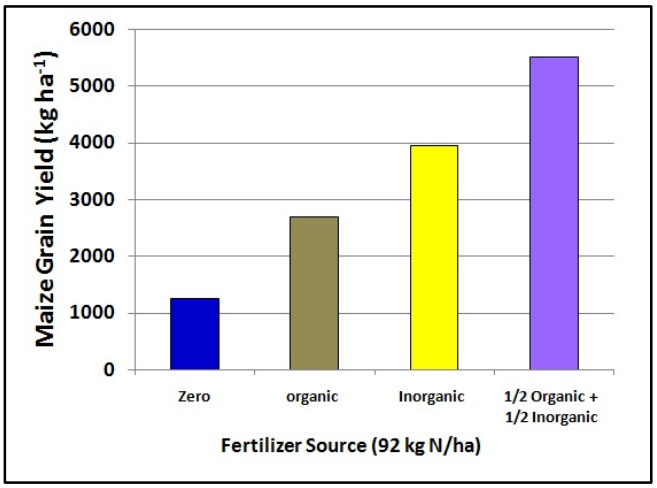
According to Vanlauwe (2015), one of the sustainable intensification strategies that have shown potential to raise the efficiency of inorganic fertilizer use and improve smallholder farm productivity growth while preserving the natural resource base is Integrated Soil Fertility Management (ISFM). Fairhurst (2012; p. 2) defined ISFM as a "set of soil fertility management practices that essentially include the use of inorganic fertilizer, organic inputs and improved germplasm, combined with the knowledge on how to adapt these practices to local conditions aimed at optimizing agronomic use efficiency of the applied nutrients and improving crop productivity". Among others, the integration of legumes in crop-based farming system is key to ISFM implementation

Several studies (e.g. Snapp *et al.* 2014 and Mather *et al., 2016*) show that the efficiency of fertilizer use is greatly enhanced if it is complemented by other sustainable intensification

[1] Malawi Country Biennial Review report on progress made for achieving the Malabo Declaration Goals and Targets, 2017

strategies such as ISFM. For instance, Figure 2 shows that integrated nutrient use from both organic and inorganic fertilizer sources results in higher maize grain yields as compared to using organic and inorganic fertilizers separately.

Figure 2: Effect of integrated organic and inorganic fertilizer on maize grain yields in Malawi



Source: *Munthali (2013)* ***Note:*** *Zero represents no organic and no inorganic fertilizer applied*

There is also considerable evidence that that farmers who apply ISFM practices experience greater crop response to fertilizer application than those who do not (e.g. Vanlauwe et al., 2014; Tittonell and Giller, 2013). Thus, with farmers facing more or less the same maize price and input cost, the profitability of smallholder maize production is likely to be higher when farmers apply ISFM practices. Promotion of ISFM is therefore encouraged in the National Fertilizer Policy that is currently being developed. It is also promoted in the NAP, the National Agricultural Investment Plan (NAIP) and the Malawi Growth and Development Strategy (MGDS) III.

Farm Input Subsidy Program (FISP) Reforms

To increase effectiveness of fertilizer use, the Ministry of Agriculture, Irrigation and Water Development has embarked on reforming the FISP. Notable reforms include increasing beneficiaries' contribution to the cost of purchasing the fertilizers, increasing private sector participation in sourcing, distribution and retailing of fertilizers and targeting of productive poor farmers that was piloted in 2016/17 season in the two districts of Rumphi in the North and Dowa in the Central. According to the Centre for Development Management (CDM, 2017), the share of total fertilizer distributed by private sector increased from 27% in 2015/16 to almost 60% in 2016/17. According to the report (CDM, 2017), the private sector achieved more timely delivery of fertilizer as compared to public institutions (particularly Smallholder Farmers Fertilizer Revolving Fund of Malawi (SFFRFM) and Agricultural Marketing and Development Cooperation (ADMARC)). Another evaluation of the pilot, done by Farmers Union of Malawi (FUM), found that the pilot targeting of productive poor farmers resulted in higher crop productivity gains from the FISP, with the pilot districts realizing higher average maize yields (2,186 kg/ha) than other beneficiary farmers (1,284 kg/ha) (FUM, 2017).

Doing Business in Agriculture Indicator for Malawi's Fertilizer Industry

The World Bank rates countries on their enabling environment for doing business in Agriculture. Among the indicators measured is a fertilizer indicator that measures the laws and regulations on registration, import and quality control of fertilizer products, all of which are crucial to increasing fertilizer access. Malawi was ranked 44 out of 62 countries. Some of Malawi neighbors scored higher: Zimbabwe 29; Tanzania 37; Rwanda 38; Zambia 39; and Uganda 40. The score rank was low mainly due to lengthy and costly processes involved in registering a fertilizer product. Malawi had the fourth lengthiest and most expensive fertilizer registration process taking 913 days to register a fertilizer product and costing 3030.48% of income per capita, while the average is 171.7% of income per capita for the 62 countries. Therefore, the regulatory environment and the efficiency of the regulatory bodies needs to be improved to reduce these inefficiencies and to improve performance of the fertilizer industry.

It is against this background that the Government of Malawi is currently developing the National Fertilizer Policy (NFP) to facilitate sustainable agricultural production and productivity, which will be critical in delivering the agricultural transformation goal envisioned in the National Agriculture Policy (NAP). Among others, the NFP promotes: investments in adoption of ISFM practices; development of fertilizer blends based on periodic soil

testing and hence abandonment of Malawi's blanket[2] fertilizer recommendation; improvement of road and rail infrastructure to reduce transportation costs; and developing a semi-autonomous fertilizer regulatory body that is more efficient than the current government-run system.

Conclusion and Recommendations

In this brief, we have argued that any successful fertilizer policy should aim at promoting efficiency (improving the returns to fertilizer relative to costs) and sustainability (improving agricultural production and productivity while at the same time sustaining soil quality for future generations). While inorganic fertilizer use has generally increased in Malawi, ignoring efforts to raise crop response rates to applied nutrients will continue to undermine the cost-effectiveness and thus profitability with which fertilizer is used and thus hinder the sustainable development of commercial input markets. Achieving fertilizer use efficiency will involve improving crop response rates to applied nutrients, through the application of ISFM practices that include crop rotation, legume intercropping, organic matter (manure) application, availability of transport and efficient fertilizer distribution systems to smallholders. Development of commercial input markets through increased private sector participation in the fertilizer industry and effective research and extension support systems are critical to achieving more sustainable commercial use of fertilizer among stallholder farming households. Further FISP reforms such as requiring recipients of subsidized inorganic fertilizer and improved seed to implement best bet soil fertility management practices could greatly improve the effectiveness and profitability of inorganic fertilizer use in the country. Development of area specific fertilizer blends guided by sound soil research is also vital. Achieving these benefits will require periodic updating of soil maps and crop suitability maps across the country, preferably at the extension planning area (EPA) level for use by the local farming community and other stakeholders.

[2] This has been touted as one of the causes of low fertilizer use efficiency where 23:21:0+4S and UREA/CAN are applied across the whole country

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This brief was written as part of background paper to the development of Malawi's National Fertilizer Policy. The Fertilizer Policy is in final stages of development. The finalized copy of the policy will be posted on the Feed the Future Innovation Lab for Food Security Policy website and the Ministry of Agriculture Irrigation and Water Development website.

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