Policy Brief

partnership for economic policy pep

No 284 October 2024

Improving maize productivity by adressing soil health issue through Malawi's input subsidy programs.

Levison Chiwaula, Sarah Tione, Christone Nyondo, Dinah Salonga, Maggie Munthali, Readwell Musopole and Moses Munthali

Key messages

- **Despite two decades of input subsidies, maize productivity in Malawi has remained endemically low, and that is mainly due to the poor health status of the soil.**
- **Integrating complementary soil fertility management interventions (SFMIs), such as organic fertilizer and agricultural lime, into the Affordable Inputs Program (AIP) can improve maize yield through better fertilizer responsiveness.**
- **Adoption and use of SFMIs in maize produciton should either become a mandatory condition for farmers to access AIP subsidies, or alternatively be promoted through the program's existing extension services. It should also be packaged with accessible soil testing service to sustain and guide the correct application of complementary inputs.**

Strategies and challenges of maize production in Malawi

Since independence in 1964, Malawi's agricultural and food policy has focused mainly on supporting maize production to promote food self-sufficiency at the household and national levels.

Over the past two decades, the core strategy has been to support production by subsidizing agricultural inputs, consisting mainly in inorganic fertilizer and improved seeds. A strategy which is currently implemented through the **Affordable Input Program (AIP)**, and targeting all registered smallholder farmers. Yet, despite 20 years of input subsidies, maize productivity in Malawi has remained endemically low, and that is mainly due to the poor health status of the soil.

Poor soil health, characterized by high soil acidity and low organic matter, has significantly constrained nutrient use efficiency and, ultimately, productivity. It is mainly caused by high rates of degradation from continuous cultivation and poor cropping practices (Omuto and Vargas 2018). Crop intensification and the use of inorganic fertilizers, accessed through the subsidy program, have diminished productivity in maize systems due to the damaging effect of chemical fertilizers on the soils (Willy et al. 2019). Over 40% of soils in Malawi are low in nutrition and strongly acidic (Munthali et al., 2017).

In other words, the government's strategy to improve agricultural production and mitigate food insecurity in Malawi must now aim to address the country's soil health issues.

Poor soil health can be improved by complementing inorganic fertilizers with alternative **soil fertility management interventions (SFMIs)** - such as organic fertilizers, compost manure, conservation agriculture practices, agricultural lime (for acidic soils), and legume-based interventions, among others - may improve crop productivity by improving the soil structure, and then optimizing crop response rates to inorganic fertilizers (Jayne and Rashid 2013; Snapp, et al. 2014; Kisinyo, et al. 2015).

Unfortunately, Malawi's input subsidy program does not directly support the integration of SFMIs; and while government does encourage farmers to use integrated soil fertility management techniques, the pracrtice of subsidizing inorganic fertilizer downplays this. Efforts and actions to promote integrated soil fertility management have been undertaken through localized projects and programs but never at a national scale.

Empirical evidence attesting to the impact of SFMIs in maize productivity

In order to provide reliable evidence to support debates and decisions related to the current AIP and maize-productivity interventions, an experimental study was conducted using a randomized control trial to assess the productivity impacts of complementing AIP-subsidized inputs with alternative SFMIs.

Specifically, the experiment tested the impact of integrating organic fertilizer (which increases organic matter in the soil) and agricultural lime (which helps mitigate the negative impacts of highly acidic soils), in three agricultural districts: Mzimba North, Mzimba South, and Nkhotakota - selected due to their acidic soils.

The experiment involved distinct "treatments" for three different groups of AIP beneficiaries:

1. **The "control group"** consisted of farm households that benefited from AIP subsidies and extension services for good agricultural practices, but were NOT provided with SFMIs.
2. **The "AIP + organic fertilizer" treatment group** – in addition to standard AIP inputs, this group of farm households was provided with organic fertilizer, as well as extension services on how to supplement organic fertilizers with improved maize seeds and chemical fertilizers.
3. **The "AIP + organic fertilizer and agricultural lime" treatment group** - in addition to standard AIP inputs, this group was provided with organic fertilizer and agricultural lime, as well as extension services* on how to apply them.

Results from the experiment demonstrate that adding organic fertilizer and agricultural lime to inorganic fertilizer that is accessed through the AIP contributes to increasing maize productivity, and thus enhances the program's impact and benefits (see table 1, and detailed results in PEP working paper).

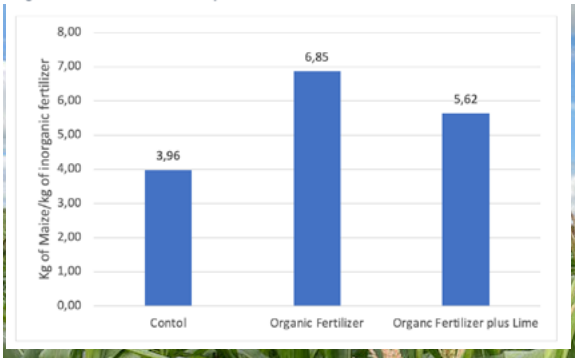
The evidence generated through the study, also reinfoced by findings from other studies (Wanjiru, 2018; Ndengu, et al. 2022), thus clearly supports the recommendation for the Malawi government to integrate soil fertility management inputs into the AIP.

** This was done through demonstration plots that were mounted at the agricultural extension level. Farmers mounted experimental plots where they applied the agricultural practices they learned at the demonstration plots.*

In addition, frontline government extension officers provided geenral extension services to the farmers.

However, the government must consider alternative potential strategies or pathways for the integration of SFMIs into the current national program.

Figure 1: Estimated fertilizer response rates for the treatment arms



Evaluation of alternative strategies to integrate SFMIs into the AIP

The researchers who conducted the experiment identified three possible pathways for the integration of soil fertility management inputs as part of a restructure of the current Affordable Input Program (AIP):

- **Option 1**: Including additional subsidies for organic fertilizer and agricultural lime directly into the AIP. The first proposed pathway is for the government to expand the scope of the AIP by including organic fertilizer and agricultural lime in the list of subsidized inputs.
- **Option 2:** Promoting the adoption of organic fertilizer and agricultural lime among AIP beneficiaries. The second option proposed is for the government to continue with the current scope of the input subsidy program (i.e. subsidizing inorganic fertilizer and improved seeds only), but using the existing agricultural extension services to systematically promote the adoption/use of SFMIs such as organic fertilizer and agricultural lime.
- **Option 3:** Making access to improved seeds and inorganic fertilizer through AIP conditional on the adoption and use of SFMIs. In this third option, farmers could only benefit from existing AIP subsidies (i.e. for inorganic fertilizer and improved seeds) if they adopt the soil management improvement technologies that are recommended for their specific agri-ecological zones. Specifically, this means that farmers in nearly all agri-ecological zones would be required to use organic fertilizer, and those zones that are highly acidic would also be require to use agricultural lime.

The options were then assessed and compared based on a set of criteria that are standardly relevant for government decision-making. In addition to the options' relevance in relation to the desired outcomes, these criteria include the relative efficiency and effectiveness, how equitable they are, their relative cost-effectiveness, as well as the feasibility from both a political and administrative point of view. The results are presented in Table 1 - using a low-medium-high rating scale - and further discussed on page 4.

Table 1: Evaluation of policy options for integrating Soil Fertility Management Interventions (SFMIs) into Malawi's Input Subsidy Programs (ISPs)

Evaluation Criteria	**Option 1** Including subsidies for SFMIs in AIP	**Option 2** Promoting use of SFMIs through AIP extension services	**Option 3** Making access to AIP subsidies conditional on adopting SFMIs
Effectiveness	Medium	Low	Medium
Efficiency	Low	Medium	High
Cost-effectiveness	Low	Medium	High
Equity	High	Low	Low
Political Feasibility	High	High	Low
Administrative Feasibility	Low	High	High
Recommended	No	Yes	Yes

Option 1 - Adding organic fertilizer and agricultural lime to subsidized inputs.

The effectiveness of this option is therefore expected to be negatively influenced by the current absence of markets for these inputs, especially agricultural lime, which is not easily accessible in Malawi.

The option's efficiency is also expected to be low, given the amount of resources that will be required for the government to deliver the inputs to the farmers. Indeed, the huge cost of this option makes it the least cost-effective, as the government will bear higher costs to attain the same productivity gains as with the alternative options.

Option 2 - Promoting the adoption/use of SFMIs through the existing AIP extension services.

The effectiveness of this approach is expected to be low, because of the ineffectiveness of the current government agricultural extension services, which is mainly due to a critical shortage of extension workers - i.e. or high farmer-to-extension worker ratio (Mangani et al., 2022).

Furthermore, this option implies that farmers would be required to access and use the inputs on their own. And while that makes is a more "efficient" option from a government perspective - as it would not require investment of "public resources" to increase the use of SFMIs - it cannot be considered as an "equitable" policy, given that the farmers' access to the inputs would depend on their capacity to buy them. Despite low expectations in terms of achieving the desired outcomes, the option can still be recommended as it would be relatively easy and inexpensive to implement.

Option 3 - Making access to AIP subsidies conditional on adopting agricultural lime and organic fertilizer.

While it may also be twarted by the undeveloped markets for SFMIs in Malawi, this option would be an effective way of promoting access and use of relevant SFMIs as it leverages the farmers' desire to access current AIP subsidies for inorganic fertilizer and improved seeds. Indeed, a review of the literature by Jayne et al. (2018) shows that smallholder farmers prefer input subsidies as an incentive to adopt soil conservation practices.

As for the previous option, considering that the cost of acquiring organic fertilizer and agricultural lime will be borne by the farmers, the option would also be efficient, administratively feasible, and cost-effective from the government's perspective, but again it cannot be considered as an "equitable policy".

Yet it is worth noting that, while excluding some beneficiaries from accessing AIP because they are not adopting SFMIs may seem unequitable and politically undesirable, the current AIP reforms implemented by the Ministry of Agriculture are already targeting productive farmers, most of whom will be able to afford the additional inputs.

Conclusions and policy recommendations

The primary recommendation of this paper (which is based on the results of the experimental study described on page 2) is for the **integration of organic fertilizer and agricultural lime into the government's input subsidy program**, in order to increase maize productivity in Malawi.

As a secondary recommendation, the authors suggest that the adoption and use of such inputs by farmers should either become a mandatory condition for farmers to access AIP subsidies, or alternatively be promoted through the program's existing extension services.

Furthermore, when implementing these recommended policy reforms, the government should acknowledge and take account of the fact that some SFMIs, such as agricultural lime, are area-specific. This requires a **continual update of soil information and soil maps by the government.** The study cited above used what were then the most recent soil maps available, which dated back to 2017, to select the districts of Mzimba and Nkhotakota for the experiment (which tested the use of agricultural liming). The maps identified these regions as being highly acidic, but the study's findings (including soil analysis and trial results) showed that the soils were not as acidic as presented in the soil maps. Therefore, to ensure that the soil fertility interventions promoted through the AIP achieve the best possible results, any strategy implemented should be based and rely on up-to-date soil maps.

References

Jayne, T.S., and S. Rashid. 2013. "Input subsidy programs in sub-Saharan Africa: A synthesis of recent evidence." Agricultural Economics 44 (6): 547 - 562.

Jayne, T.S., N.M. Mason, W.J. Burke, and J. Ariga. 2018. "Review: Taking stock of Africa's second-generation agricultural input subsidy programs." Food Policy 75: 1 -14.

Kisinyo, P.O., P.A. Opala, V. Palapala, S.O. Gudu, C.O. Othieno, and E. Ouma. 2015. "Micro-Dosing of Lime, Phosphorus and Nitrogen Fertilizers Effect on Maize Performance on an Acid Soil in Kenya." Sustainable Agriculture Research 4 (2): 21 -30.

Ndengu, G., Mponela, P., B. Chataika, L.T. Desta, R. Chirwa, and G.G. Dileshi. 2022. "Effect of combining organic manure and inorganic fertilisers on maize–bush bean intercropping." Environmental Agriculture 58 (e29): 1 - 12. doi:10.1017/S0014479722000102.

Omuto, C.T., and R.R. Vargas. 2018. Soil nutrient loss assessment in Malawi. Technical Report. Lilongwe: FAO, UNEP and UNDP.

Snapp, S., T.S. Jayne, W. Mhango, T. Benson, and J. Ricker-Gilbert. 2014. Maize-nitrogen response in Malawi's smallholder production systems. Malawi Strategy Support Program Working Paper., Washington, DC: International Food Policy Research Institute (SFPRI).

Wanjiru, K.W. 2018. Lime, Manure and Inorganic Fertilizer Effects on Soil Chemical Properties, Maize Yield and Profitability in Tharaka-Nithi County, Kenya. Unpublished Master of Environmental Science Thesis, Nairobi: Kenyatta University.

Willy, D. K., M. Muyanga, J. Mbuvi, and T. Jayne. 2019. "The Effect of Land Use Change on Soil Fertility Parameters in Densely Populated Areas of Kenya." Geoderma 343: 254 - 262. doi:https://doi.org/10.1016/j.geoderma.2019.02.033.

This work was carried out with financial and scientific support from the Partnership for Economic Policy (PEP) through funding provided by the William and Flora Hewlett Foundation.

To find out more about the scientific research methods and findings, read the full PEP working paper.

WILLIAM + FLORA Hewlett Foundation