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Lilongwe University of Agriculture and Natural Resources
LUANAR

# FERTILIZERS

## POLICY BRIEF

ORGANIC VS CHEMICAL

January 2025


***Figure 1**: CARD officers learning how to make liquid biofertilizers with locally available materials from smallholder farmers in Zambia. The main ingredients are fresh manure, wood ash, sugar cane molasses, leaves (e. g. from tithonia diversifolia), bone and blood meal and rain water.*


## ABSTRACT

This policy brief explores the potential of organic fertilizers as a sustainable alternative to chemical fertilizers in Southern Africa, with a focus on Malawi. The region faces significant agricultural challenges, including soil degradation, food insecurity, and climate change impacts. Overreliance on chemical fertilizers has led to environmental and health issues, while the Affordable Input Programme (AIP) has proven inefficient[41, 31, 22] for smallholder farmers. Organic fertilizers, derived from local resources like compost, manure, and biofertilizers, offer benefits such as improved soil health, increased water retention, reduced environmental pollution, and cost-effectiveness. However, challenges like limited awareness, policy gaps, and insufficient research hinder their widespread adoption. This brief recommends policies that prioritize agroecology, support organic input production, enhance extension services, and foster market development to create a more resilient, inclusive, and sustainable agricultural system. Transitioning to organic fertilizers could improve food security, mitigate climate change, and promote long-term soil health across Southern Africa.


## 1. INTRODUCTION

Southern Africa, including Malawi, faces continuously growing agricultural and socioeconomic challenges like soil degradation and infertility, deforestation, under- and malnourishment, declining crop yields, disease and pest pressure, limited access to organic inputs and relevant information, leading to a steadily increase of crop failures resulting in food crises and malnutrition. Climate change, which is becoming an existential threat, reinforces these issues considerably. Over the years, there has been considerable overreliance on and prioritization of chemical fertilizers to nourish the degraded soils, leaving behind the over 80% of smallholder farmers in Malawi. However, the increasing prices of chemical fertilizers lately and the inefficiency of the Affordable Input Programme (AIP), led to a growing interest in the use of organic fertilizers (e. g. compost, Mbeya),[38] biofertilizers[46] or inoculants from both smallholder farmers as well as government. Derived from a wide variety of natural sources like crop residues and (green) prunings, compost and manure, organic fertilizers enhance soil health, boost productivity, and minimize environmental harm. This brief highlights the potential of organic fertilizers in the region, identifies challenges, and offers policy recommendations.


***Figure 2**: Mixing ingredients to prepare Mbeya Fertilizer. While transitioning to agroecology, the amount of mineral fertilizer can be steadily reduced.*

## 2. CHEMICAL FERTILIZERS-BENEFITS & CHALLENGES

In general, the use of synthetic-chemical fertilizers results in higher yields and even higher microbial biomass and soil carbon in the short term. After a few years, however, these effects dwindle, and a series of environmental problems occur depending on the cropping system and its management.

If mineral fertilizers are well balanced and added to organic fertilizers as a supplement, a positive long-term effect can be observed.[18, 26] The application of nitrogen as in urea and ammonium proved to decrease microbial biomass and also diversity,[16] while good quality organic fertilizers increase both microbial biomass and diversity[8, 55] leading to both socioeconomic and environmental sustainability.[19, 13, 40]


***Figure 3***: *Mbeya Fertilizer stored in airtight bags during at least 4 weeks guarantees appropriate fermentation. Mbeya not only provides bioavailable plant nutrients, but also serves as valuable carbon source for the soil microbiome.*

In the long run, extensive application or inadequate dosage of chemical fertilizers and pesticides combined with poor farming practices such as little or no soil cover and monocropping have led to soil loss, health problems (e.g. exposition to pesticides and heavy metals,[43] pollution of water bodies through nitrates), loss of cultural heritage and biodiversity.[42, 53, 45] These dynamics particularly apply to fragile soils as found in Sub-Saharan Africa, and especially in Malawi,[34] which have been widely depleted over the past decades.
Furthermore, public policies such as the AIP in Malawi were ineffective,[41] crowded out organic fertilizers as well as hampered smallholder farmer's sovereignty.[7, 19, 31, 22]

A recent unpublished study[24] led by LUANAR and CARD underscore what similar studies[37, 44, 5, 28] have shown: a reduction of mineral fertilizer combined with high-quality organic amendments (e.g. Mbeya) in the first years stabilizes maize yields while rebuilding soil fertility and cutting costs for smallholder farmers.

## 3. THE NEED FOR ORGANIC FERTILIZERS

1. **Soil Health:** Organic fertilizers replenish depleted soils improving structure, nutrient availability, and water retention, critical for sustained productivity. A particular focus should lie on mineral composition and carbon availability for microbial activity and diversity when it comes to the quality of organic inputs, as they facilitate resilience towards diseases and pests, which results in better plant health and reduce the need for external inputs when agroecological principles are applied.[30] Nevertheless, controversy on the topic exists.[14, 9, 10, 15, 52]
2. **Environmental Sustainability**: Unlike chemical fertilizers, organic amendments reduce environmental problems such as soil acidification and water pollution, promoting ecological balance.[36, 47, 51] Furthermore, increased use of compost and soil cover and construction of swales on contour can increase water holding capacity (WHC) by up to 7 times[25, 50, 17, 1].
3. **Climate Resilience:** By enhancing soil carbon sequestration and improving soil health, organic fertilizers help crops withstand climatic shocks and mitigate climate change.[33, 20]

**MAIZE GRAIN YIELD (KG HA-1) AGAINST TREATMENT**

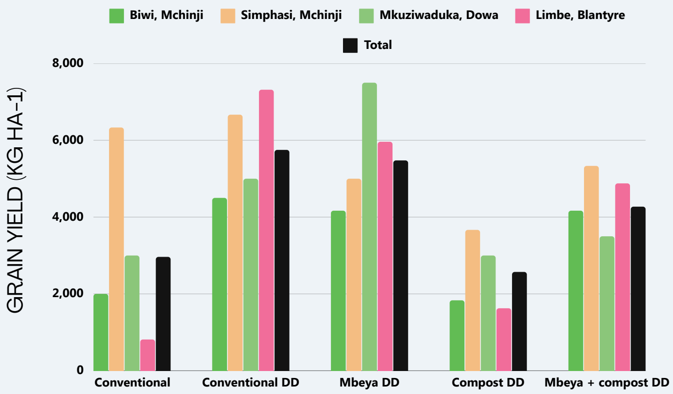


***Figure 4:*** *While in the two treatments 'Conventional' and 'Conventional DD' (=double digging; soil loosened up to 60 cm) mineral fertilizer was used, in the other three treatments Mbeya fertilizer and compost was used as well as double digging was carried out.*


***Figure 5****: Apart from long-term use of mineral fertilizer, monocropping and deforestation lead to increased pest pressure and soil health problems.*


***Figure 6:*** *Due to its high organic carbon content, quality compost can bind more than the double amount of water compared to normal soil.*

4. **Economic Benefits:** Locally sources amendments to produce organic fertilizers offer cost-effective alternatives to expensive synthetic-chemical inputs, reducing the dependencies of over 15 million smallholder farmers in Malawi and other at least 130 million smallholder farmers in Southern Africa. As improved soil health comes with improved water retention, costs for irrigation would decrease.[4] Despite large investments of Malawi like AIP, food crisis keeps persisting. Hunger in Malawi leads to costs corresponding to 10% of Malawi's GDP.[12]

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**"In Malawi, current practices lead to an average soil loss of 29 tons per hectare and year, resulting in a GDP loss of 3%'.**[2, 29, 3]

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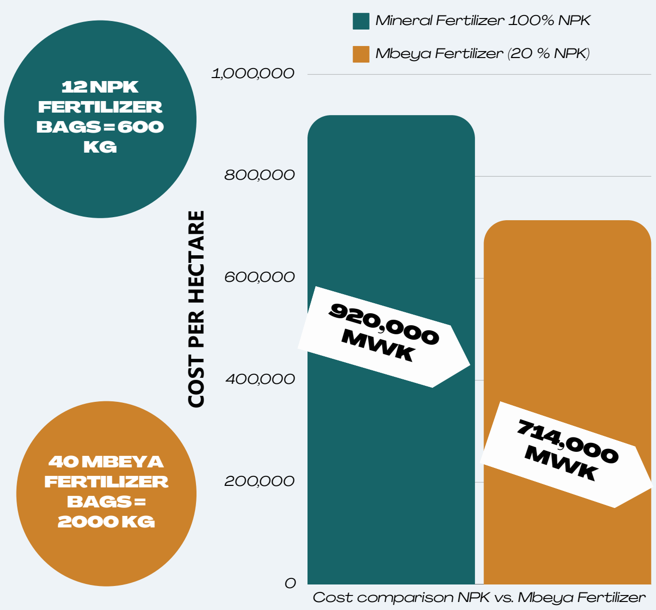
### WHAT DOES MINERAL FERTILIZER COST IN COMPARISON WITH MBEYA FERTILIZER?




## 4. CHALLENGES

1. **Limited Awareness and Accessibility of Information on Organic Amendments:** Many smallholder farmers lack knowledge of organic fertilizers' benefits and how to use them effectively and rely on advice and support from government and CSOs. Organic fertilizers are scarce, especially in rural areas, due to lacking awareness of the value of local resources, leading to extensive combustion of litter and organic matter. This not only contaminates the environment,[35, 54] but also reduces rainfall[21] and soil carbon storage,[49] which is crucial for soil health and climate resilience.[11]


***Figure 7:*** *Farmer group in Msamba, Nsanje learning how to prepare biofertilizer with local resources. Fresh Mphakasa leaves (Philenoptera violacea) were pounded and added to the mixture with 50kg of fresh cow dung, wood ash, molsses (from sugar cane) as well as bone and blood meal.*

2. **Policy Gaps:** There are few policies supporting organic agriculture or agroecology, and few policies addressing soil health issues.[27] All currently existing frameworks still favour chemical fertilizers and an industrial scale of farming, which has been proven to be unsustainable both socioeconomically and ecologically.[32, 23] Soil should be viewed as a living organism and laws should be put in place that recognize rights of a healthy soil ecosystem.

3. **Research and Extension:** Research on why farmers fail to adopt agroecological principles including organic fertilizers is underfunded. A driving factor is insufficient and inadequate extension services,[7] which fail to spread a clear and demand-driven message and strategy[39] concerning climate resilient farming practices. Farmers end up confused and frustrated.

## 5. POLICY RECOMMENDATIONS

1. **Awareness and Capacity Building:** Invest in information accessibility and education programs to teach farmers and policymakers about a variety of organic fertilizers and pesticides and how to prepare and use them locally. Moreover, regenerative, agroecological practices should primarily be disseminated.

2. **Supportive Policies:** Develop policies that prioritize the concept of agroecology, and with it the use of organic fertilizers. Policies should focus on a fast transition from mineral fertilizers to completely organic. Legal frameworks should include production standards, incentives, and integration into subsidy programs. Combustion of organic and inorganic (e.g. plastics) litter should be banned completely till 2030. Instead, their integration for compost-making, recycling and disposal should be encouraged. Facilitate timely and equitable access to (in)organic fertilizers during the transition period and eliminate subsidies for mineral fertilizers. Alternatives to overcome the dependency on external inputs should be overcome through highlighting the importance of microbial activity in the soil and how to boost it (e. g. biomass production in syntropic agroforestry systems).[48, 8]

3. **Strengthening Infrastructure and Markets:** Invest in infrastructure and markets to support and identify local production and distribution of different kinds of livestock, organic amendments and organic fertilizers. Availability and information of organic inputs to produce biofertilizers[46] such as livestock manure, crop residues (incl. green manure from legumes and tree prunings) as well as biopesticides and environmentally friendly technologies such as biogas or carbon 'negative 'cooking should be promoted and easily accessible.

4. **Research and Development:** Prioritize research on farmer knowledge systems (e. g. farmer to farmer), and the use and adoption of agroecology and forms of organic fertilizers, inoculants, and biopesticides, focusing on their effectiveness and dissemination through extension services. Ministry of Agriculture and a technical committee should conduct random tests of specific organic fertilizer formulas (allowing deviations based on local available resources) and issue recommendations. The following parameters should be tested as a minimum requirement: nutrient content, amounts per plant, microbial diversity and activity. The possibility of testing basic parameters at

district level should be facilitated. Field days for showcasing good practices should be conducted regularly.
Government, CSOs, the academic and private sector should work together to compile a map of demonstration and research sites that showcase the production and use of locally made organic fertilizers in each district of Malawi.

5. **Strengthen Extension Services:** Reorient extension services to clearly prioritize organic and regenerative farming, providing a participatory training and resources to farmers.

6. **Market Development:** Support the development of markets for organic products through certification systems and market linkages.


***Figure 8:*** *Smallholder farmer cooperative in Chimwala Mulanje.*

## 6. CONCLUSION

Adopting organic fertilizers together with agroecological principles in Southern Africa can lead to an inclusive, climate resilient and profitable agriculture in the long run by improving soil and human health, reducing environmental impacts, and enhancing food security. However, success requires coordinated efforts from governments, CSOs, academic institutions and the private sector to overcome barriers and create an enabling environment for the ongoing agroecological transition. Mineral fertilizers are useful in occasions, mainly as supplement for organic fertilizers and need to be managed carefully.


***Figure 9:*** *A Syntropic Agroforestry demonstration plot in Chimwala, Mulanje. A diverse planting design allows to source organic amendmends from tree leaves like White Acacia, Gliricidia, Moringa and Albizia*

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