



Surmounting Soil Health Challenges: Practical Solutions for Enhancing Agricultural Productivity in Line with MW2063 Aspirations

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Scenario on the ground

- Agro-based economy
- Agriculture sector contributing close to a quarter of country's Gross Domestic Product (GDP)
- Employing more than 85% of the total rural population
- Accounting for more than 90% of total export earnings
 - ❑ limited land holdings
 - ❑ limited access to extension services due to high staff:farmer ratio
 - ❑ Farming systems dominated by maize
 - ❑ Variable agroecological characteristics (temp; rainfall; soil quality)



Common Challenges faced

- Soil degradation and declining soil health
- Low crop productivity
- Low uptake of technologies by smallholder farmers

The major causes of soil fertility decline in Malawi include

- Nutrient removal through entire crop removal
- Soil erosion, low soil organic matter (Annual soil loss currently estimated at 30 ton/ha/year (Omuto & Vargas, 2018))
- Inherent low soil fertility
- Limited application of appropriate types of fertilizers, and
- Inappropriate land management practices (Agegnehu & Amede, 2017; Kihara et al., 2017; Omuto & Vargas, 2018).

(Malawi loses in excess of 108 g/ha of N, 350 g/ha of available P, and 16.6 g/ha of exchangeable K annually. This is equivalent to a loss of 3% of a 50 kg-bag of NPK fertilizer per hectare annually through soil erosion)

Aspirations – Malawi 2063

..... vital to attainment of Malawi 2063 is transforming agriculture sector to achieve country's vision of creating an *inclusively wealthy and self-reliant nation*. **Through:**

- Enhancing good and appropriate agricultural production interventions
- Promoting the adoption of climate smart agricultural technologies (CSAT),
- Good land management practices, and
- Environmental management

Aspirations – Malawi 2063 cont'

- MW2063 first 10-year Implementation Plan (MIP-1) from the year 2021-2030,
 - To increase the share of agriculture in the country's GDP from around 23% in 2020 to about 30% by the year 2030
 - Through sustainable access to high quality affordable agricultural inputs and modern production technologies



Practical interventions for improving soil health in Malawi: Level of preparedness and direction

- Subsidy Program since 2005 in the agricultural sector (selected resource constrained smallholder farmers are supported with farm inputs)
- DARS through Agricultural Technology Clearing Committee (ATCC) has cleared and released several soil fertility improvement technologies for adoption and practice by farmers in Malawi
 - Some of the released technologies, with a consideration of an integrated approach include **legume intensification**, **use of biofertilizers (inoculants)**, **bio-inorganic fertilizers**, soil and water conservation management practices that include **Conservation Agriculture (CA)** and **organic resources** (organic fertilizers) that *encompass compost manure, livestock manure and live mulches.*

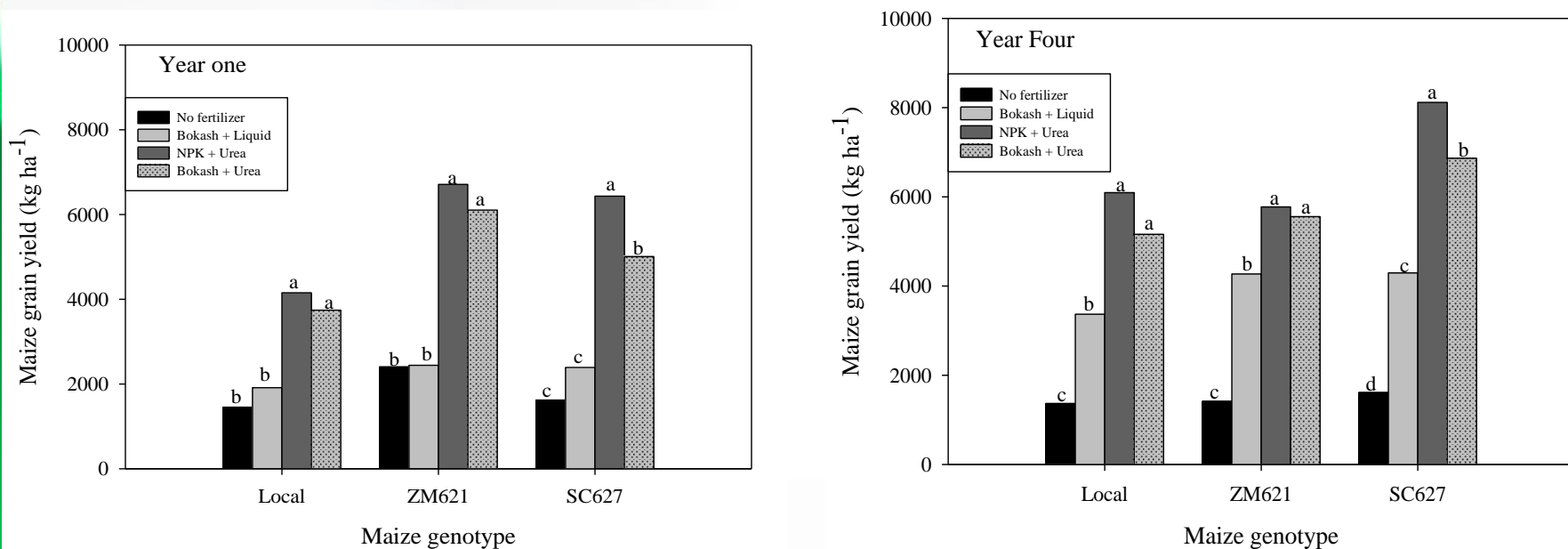
Practical interventions for improving soil health in Malawi: *Manures and organic fertilizers*

- These have an important advantage over inorganic fertilizers
 - Give the farming system sustainability as they:
 - supply essential plant nutrients,
 - contribute to building up soil organic matter and soil structure,
 - improve nutrient use efficiency
 - Improve soil physical properties
- Integrated use of livestock manure and inorganic fertilizer leads to maize yield varying increases depending on soil types and maize varieties (Tamene et al. 2015). (However, use of livestock manure is affected by dwindling herd size and not many farmers own livestock).
- Compost manure use has also been highly promoted in Malawi



Practical interventions for improving soil health in Malawi: *Manures and organic fertilizers*

- Some encouraging results have been reported on improved soil health and crop yields (Figure 1)



- Figure 1.** Maize grain yield (kg ha⁻¹) as affected by Fertility Inputs x Variety at various study locations in Malawi during 2007-2008 and 2010-2011 seasons. Bars designated by same letter belonging to same variety are not significantly different from each other (Ngwira et al., 2013)

Practical interventions for improving soil health in Malawi: *Manures and organic fertilizers*

- Challenges with compost though promising:
 - Adoption of compost technology by farmers still remains low.
 - Some studies conducted in Malawi indicated adoption of compost manure technology by farmers to be at 32% (Mustafa-Msukwa et al., 2011).
 - Some of the major reasons cited by a few farmers include **lack of labour, inadequate water, lack of interest, inadequate skills and inadequate and poor availability of composting feedstock** (Mustafa-Msukwa et al., 2011).
 - Most of the composts produced by farmers are of low nutritional quality as this influenced by materials used.

Legume intensification and agroforestry systems

- Leguminous crops and agroforestry plant species improve soil health through *biological nitrogen fixation* and *addition of soil organic matter*
- Studies on evaluating intercropping systems and effects of legumes short-rotations indicate positive soil health and increased yield results.
 - Maize yield increases of above 50% have been reported from integration of legume residual effects and half the rate of recommended fertilizer with implication on reducing the costs incurred on inorganic fertilizer (Njira et al., 2020).
- Results obtained from a number of studies under Agriculture Sector Wide Approach (ASWAp) and other projects show that maize yields and soil fertility status significantly improved with the integration of agroforestry fertilizer trees and inorganic fertilizers applied at reduced rate (Akinnifesi et al., 2007; Makumba et al., 2009; Mng'omba & Akinnifesi, 2019).

Legume intensification and agroforestry systems

Challenges with these technologies:

- ***lack of stable markets*** for the legumes and ***seed availability***
- On the other hand, non-edible agroforestry species are faced with **adoption challenges**



Biofertilizers/inoculants

- Microbial-based materials that improve soil fertility through *biological nitrogen fixation* and *solubilization of various nutrients* such as phosphorus, potassium, zinc and Sulphur
- Rhizobial inoculants have been used for some time in Malawi and recently the private sector has been involved in multiplication and marketing
- More collaborative research (DARS & LUANAR) is underway in this area to come up with more effective inoculants that target balanced plant nutrition ***but progress is always hampered by funding challenges***

Conservation agriculture (CA)

- CA is an integrated farming system that considers three major principles including minimum soil disturbance, mulching/soil cover and crop rotations/intercropping systems
- The Malawi National Conservation Agriculture Task Force in 2016 published a national guideline book on implementing CA that covers the major CA principles plus complementing technologies such as:
 - agroforestry and
 - natural regeneration
 - organic manures
 - planting methods and
 - improved seeds



Conservation agriculture (CA)



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Conservation agriculture (CA)

- Though some evidence has been generated of long-term positive effects of CA on soil health and crop yields in both Malawi and elsewhere, adoption of CA in Malawi is still a challenge. FAOSTAT (2014) data indicates 1.7 % uptake of CA in Malawi
- On the other hand, Chinseu et al. (2019) reported widespread dis-adoption of CA in Malawi. (*This shows that a lot still needs to be done to ensure increased and sustained adoption of CA by farmers in Malawi*)

Thank You

