“Potassium is sufficient in soils of Kenya”

A long held misconception
A REVIEW OF THE POTASSIUM STATUS OF SOILS IN KENYA

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OUTLINE

• Introduction: Agriculture in Kenya
• Historical perspective of K fertilization
• Research highlights on soil analysis K status in Kenya
• Addressing the gaps
• Conclusions
INTRODUCTION
Agriculture and GDP trend 2010-2012

<table>
<thead>
<tr>
<th>Year</th>
<th>Overall Growth</th>
<th>Agricultural</th>
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<tbody>
<tr>
<td>2010</td>
<td>10.4</td>
<td>10.4</td>
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<tr>
<td>2011</td>
<td>6.1</td>
<td>2.4</td>
</tr>
<tr>
<td>2012</td>
<td>4.6</td>
<td>2.9</td>
</tr>
<tr>
<td>2013</td>
<td>5.7</td>
<td>5.2</td>
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<td>2014</td>
<td>5.3</td>
<td>3.5</td>
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Market Size
– Agriculture 30% of Kenya’s GDP ($4.5B), 75% of its labor force

Exports
– ~$2B pa agricultural exports, mainly tea, coffee, vegetables, and flowers

Farm profiles
– 75% small holder and 25% medium and commercial large scale farms
– Most small holders do mixed farming: mixed cropping, poultry and livestock

Major crops
– Food crops: Maize, rice, beans, Irish potatoes
– Cash crops: Tea, coffee, pyrethrum, sisal, tobacco and horticulture

Source: MOALF, 2015
ARABLE LAND 5.6 (Mil Ha)

NON ARABLE, 51.31 (Mil Ha)

Arable land 10-15% of total land area
Crop productivity within the country

Most soils are acidic
• Use estimated to be at an average of 24kg/ha of arable crop land
• Major types of Fertilizer: DAP, CAN, TSP, NP’s, UREA, some NPK’s
• Small holder (40% ); Commercial estates/large scale (60 %)
• Only 7% out of the total fertilizer usage is K based and limited to specialty crops
• Use estimated to be at an average of 24kg/ha of arable crop land
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Distribution of nutrient usage per crop

Source: MOALF, 2015
‘Crop productivity in Kenya on a gradual decline’

(ICRAF, 1997)
Causes of declining crop productivity

Net negative balance between nutrient losses and gains - Nutrient mining

- Intensified continuous cultivation without adequate nutrient replenishment
- Losses through leaching and erosion
- Sole continuous use of N and P based fertilizers
- Depletion of key nutrients like K, Ca and Mg without replenishment
Potassium in soils of Kenya

Historical perspective

• 1960-70’s:
  – none, low or negative responses to addition of K Fertilizers (MOA, 1969, 1970, 1975)
  – No benefit from K fertilization (Hinga and Foum, 1972)
  – Kenya fertilizer recommendations to date dominated by N and P
• 1980-90’s:
  – Soil analysis data showing K deficient zones in Kenya

70 kg ha\(^{-1}\) yr\(^{-1}\)

K-depletion rate

Source: (Smaling et al., 1993)
Potassium Deficiency in Kenya, 1980

KEY
- Potassium deficient areas
- County boundary
- International boundary
- Water body
- Towns
- Roads

Source: KALRO (Kenya Soil Survey)
RESEARCH HIGHLIGHTS ON SOIL ANALYSIS K STATUS IN KENYA
The trend of Exchangeable potassium levels based on long-term maize continuous study at the KARLO-Kabete Research station (1976-2005). (Kibunja, 2015, unpublished data)
2002: Map showing K adequate and deficient regions in high and medium potential zones of Kenya (30% sites with K deficiency)

(Gikonyo et al., 2002)

IPI – Ministry of Agriculture – Hawassa University – Ethiopian Agricultural Transformation Agency (ATA) joint symposium - The Role of Potassium in Balanced Fertilization.
24-26 November 2015, Hawassa University, Hawassa, Ethiopia
2002: efficient nutrient utilization in central Kenya
30% sites were K deficient
(Gikonyo et al., 2015)
2002: Situational analysis of rice production in Mwea irrigation scheme

— Almost 100% K deficiency (<0.2 meq/100g soil)

(Gikonyo et al., 2012)
• 2006: Study on mapping of K deficient zones and relationship between the geochemical and mineralogical properties of parent rocks, bases exchangeable Ca$^{2+}$, Mg$^{2+}$ and K$^{+}$ in soils, and K distribution in the soil phases at different sites

  — Identified two zones under different geochemical mineralogical properties for K response study

(Kanyanjua et al., 2006)
Mapping study identifies western Kenya as a potential K deficient region (Kanyanjua et al., 2006)
Northern geomorphic area (NGA) sites with significantly low levels of K than SGA

65-100% of different samples in sites within NGA showed K deficiency

(Kanyanjua et al., 2006)
Findings

- However, NGA with low K levels showed no response to K fertilizer
- Two out of six SGA sites with adequate levels showed response despite high exchangeable K levels

(Kanyanjua et al., 2006)
• Hypothesis on low K response in the NGA sites
  – Low exchangeable Ca and medium Mg
  – Higher probability of K fixation
  – High prevalence of witch-weed

• Recommendations
  – K fertilization at a rate of 25kg/ha for the area with K deficiency
  – Highlighted the need determine appropriate soil K analysis method that better reflect the crop needs
  – Highlighted critical interacting factors that should be considered in K responses in soils of Kenya

(Kanyanjua et al., 2006)
Recent relevant output on K

• As expected that N and P were limiting factors
• The survey revealed several regions in Kenya with K, Ca and S and some micro-nutrient deficiencies
• Recommended 200-300kg of NPK 17:17:17 in the regions found to be K deficient
• The results of the report triggered the start of blending and govt. campaign including fertilizer subsidies towards ‘balanced fertilization’ to include K in basal fertilizers for maize
Potassium deficient zones for maize production

Source: KALRO (Kenya Soil Survey)
Research gaps

• Need to understand the K dynamics in soils of Kenya i.e. interactions between different factors
• Need to carry out nutrient response studies to guide fertilizer recommendations towards balanced nutrition for different crops
• Refining the K-extraction methods to improve on recommendations
• Need to determine best sources of potassium in terms of practicalities
• Economic study on the best options of K fertilizations
Summary

• Studies show K status on the decline in many regions
• Need to rethink current fertilizer recommendations of major food crops from mainly N and P
• There is clearly a huge potential for research and development of K fertilization in Kenya
Acknowledgements

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