

# **POTASSIUM STATUS IN THE MAJOR AGRICULTURAL SOILS OF LAKE AND WESTERN ZONES OF TANZANIA AND ITS ROLE IN SUSTAINABLE CROP PRODUCTION AND FOOD SECURITY**

- ***Bagarama, F.M.<sup>1</sup>, E.L. Kaboni<sup>2</sup>***

**1 =** *Principal Agricultural Research Officer at Agricultural Research and Development*

*Institute (ARDI) Tumbi, Tabora – Western Zone; P.O.Box 306, Tabora*

*Email: [zdrdwz@yahoo.com](mailto:zdrdwz@yahoo.com); [bagaramaf@gmail.com](mailto:bagaramaf@gmail.com).*

**2 =** *Principal Agricultural Research Officer at Agricultural Research and Development*

*Institute (ARDI) Ukiriguru, Misungwi, Mwanza – Lake Zone; P.O.Box 1433, Mwanza*

*Email: [lzardiukiriguru@iwayafrica.com](mailto:lzardiukiriguru@iwayafrica.com); [elmenslkaboni@yahoo.com](mailto:elmenslkaboni@yahoo.com); [elkaboni@gmail.com](mailto:elkaboni@gmail.com).*

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# Presentation layout

- Introduction
- Importance of Potassium in plant nutrition
  - Plant and Pest disease control in crops(Lake and Western Zones)
  - Status of Potassium in soils of the Lake zone
  - Status of Potassium status in soils of the Western zone
  - Discussions
  - Acknowledgements

# Potassium (K) deficiency in maize reduce plant healthy



## Materials and methods

- This paper was prepared based on the available soil names and soil laboratory data from various soil assessments conducted from year 2002 to 2014.
- English soil names were based on the names reflected by soil characteristics such as colour, soil particle size distribution or texture, rooting depth, influence of water, soluble salts, organic matter and other properties.

# Materials and methods cont..

- Scientific names presented in this paper were adopted from soils maps produced by National Soil Service (NSS)/ARI Mlingano (ARI Mlingano, 2006).
- The ratings or interpretation of K status in various agricultural soil types of Lake and Western Zones pilot areas was done by using guidelines to soil fertility rating produced by ARI Mlingano (1991) and ILACO (1981).

# **RESULTS BASED ON THE PREVIOUS STUDIES**

- **Potassium (K) status in the Lake Zone regions**
- The following are major agricultural soils found in the Lake Zone districts:
  - Deep sandy soil (scientifically Cambisols/Arenosols)
  - Sandy soil with hardpan within 100 cm from the soil surface (Planosols)
  - Black clay forming crack during dry period (Vertisols)
  - Black to brown clay to clay loam with soluble salts (Calcisols)
  - Reddish sandy loam (Ferralic Cambisols)

## Results cont..

- Red clay soil (Rhodic Ferralsols)
- Red volcanic soils of Tarime Highland (Rhodic Nitisols)
- Soils along Rivers/Flooded soils by Rivers (Fluvisols)
- Shallow soils/ soils with limited depth (Leptosols)
- Soils with water saturation at some periods of the year (Gleysols)
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## Results cont..

- Potassium status of the deep sandy soil (Cambisols/Arenosols) type in Mwanza, Simiyu and Mara regions
- A total of 27 soil samples analyzed for different soil profiles in different villages of the above mentioned regions had a K-rating of very low to low with one sample rated as medium for soil available exchangeable Potassium(0.03 – 0.31 cmol(+)/kg of soil
- Major farming system cotton – maize-rice-cassava dominated farming system zone, note the high potassium demand of crop grown in this farming system.
- (**Source:** *Kaihura, et al., (2013); Kaboni, et al. (2002)*).
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# Results cont..

- Potassium status of the sandy soil with hardpan within 100 cm (Planosols) type in Misungwi (Mwanza) and Rorya (Mara regions) .
- Out of 19 soil samples collected on Planosols 17 samples are rated very low to low and only two samples were rated as medium with respect to exchangeable K(cmol (+) kg/soil.
- Planosols are used for Rice and sorghum production
- **Source:** *Kaihura, et al., (2013); Kaboni, et al., (2013 a, b, g); Kaboni et al., (2002)*
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# Results cont..

- Potassium status for the black clay to clay loam with soluble salts (Calcisols) in Meatu Simiyu region.
- Out of 6 soil samples collected on Calcisols 5 samples are rated very low to low and only one samples were rated as High with respect to exchangeable K(cmol (+) kg/soil).
- Calcisols are used for cotton, sorghum and Pearlmillet production these crops have moderate to high K demand.
- **Source:** *Kaboni, et al.,( 2013 f)*

# Results cont..

- Potassium status for reddish sandy clay to SCL (Ferralic Cambisols/Arenosols) in Biharamuro and Ngara Districts in Kagera region
- A total of 22 soil samples analysed had potassium soil status rated as very low and low (0.04 – 0.23 Cmol(+) kg/ soil
- Major crops include, banana, coffee, beans, sorghum and maize all crops are K demanding.
- **Source:** *Kaihura, et al., (2013); (2013); Kaboni, et al.,( 2013 a and c); Merumba, et al. 2013 c-e.*
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# Results cont..

- Potassium soil status of the red clay to clay loam soil (Rhodic Ferralsols) in (Ngara District) Kagera and (Misungwi District) Mwanza regions
- A total of 22 soil samples analysed had a potassium soil status rated as very low and low (0.03 – 0.28 Cmol(+) kg/ soil
- Major crops grown include maize, beans, tobacco, cassava, rice, and banana which remove high levels of K in soil.
- **Source:** *Kaihura, et al., (2013); Merumba, et al. 2013 a;*

# Results cont..

- Soil potassium status for red volcanic soils (Rhodic Nitisols) of Tarime highland in Mara region
- A total of 10 out of 16 analysed soil samples had a potassium soil status rated as very low and low (0.01 – 0.31) Cmol(+) kg/ soil
- Major crops: Banana, coffee and maize all K-phillic crops
- **Source:** *Maro and Mbogoni (2009);*

# Results cont..

- Potassium status for flooded soils (Fluvisols) in Sengerema(Mwanza region), Misenyi district(Kagera region) and Ngara district(Kagera region)
- A total of 18 soil samples analysed had a potassium soil status rated as very low and low (0.01 – 0.17 Cmol(+) kg/ soil)
- ***Source: Kaboni, et al., 2013 g-h; Merumba, et al. 2013 a;***
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# Results cont..

- Soil potassium status for shallow soils/ soils with limited rooting depth (Leptosols) in Misungwi(Mwanza); Ngara(Kagera) and Musoma Rural (Mara)
- A total of 10 soil samples analysed out of which 6 soil samples had a potassium soil status rated as very low to a low (0.18 – 0.34 Cmol(+) kg/ soil K- rating)
- ***Source:*** Kaboni and Kataballo, 2003; Merumba, et al. 2013 a; Kaboni and Habai, 2013 i.
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# Potassium (K) status in the Western Zone regions

- The following are major agricultural soils found in the Western Zone districts:
- Deep sandy soil (Cambisols/Arenosols)
- Sandy soil with hardpan within 100 cm from soil surface (Planosols)
- Black clay soil which forms big crack during dry season (Vertisols)
- Black to brown clay to clay loam with soluble salts (Calcisols)
- Reddish sandy loam (Ferralic Cambisols)
- Red clay soil (Rhodic Ferralsols)
- Soils along Rivers/Flooded soils by Rivers (Fluvisols)
- Shallow soils/soils with limited depth (Leptosols)
- Soils with water saturation at some periods of the year (Gleysols)



# Results cont..

- Potassium status of the top soil of sandy soil (Cambisols/Arenosols) in Nzega and Inala(Tabora Municipal District)
- A total of 23 soil samples analysed all of which had a potassium rating of very low to a low (0.06 – 0.14) Cmol(+) kg/ soil.
- Major crops, maize, tobacco, sorghum and cotton
- ***Source: Jaspa et al., 2011***

# Results cont..

- Soil potassium status for the sandy soil with hardpan (Planosols) in Tabora Municipal and Nzega Districts
- A total of 17 soil samples analysed all of which had a potassium rating of very low to a low (0.03 – 0.20) Cmol(+) kg/ soil.
- Major crops rice and sorghum
- ***Source: Jaspa et al., 2011; Bagalama, et al., 2010***

# Results cont..

- Soil potassium status and topsoil for the black clay (Vertisols) in Nzega and Tabora Municipal Districts
- A total of 28 soil samples analysed of which 24 soil samples had a potassium rating of very low to a low (0.03 – 0.21) Cmol(+) kg/ soil.
- Major crops: Rice
- ***Source: Jaspa et al., 2011; Bagalama, et al., 2010***

# Results cont..

- Soil potassium status for the reddish sandy clay to SCL (Ferralic Cambisols/Arenosols) in Nzega and Kigoma rural districts
- A total of 16 soil samples analysed of which 14 (87.5%) soil samples had a potassium rating of very low to a low (0.05 – 0.28) Cmol(+) kg/ soil
- ***Source: Jaspa et al., 2011***

# Results cont..

- Soil potassium status for the topsoil of the red clay to clay loam soil (Rhodic Ferralsols) in Nzega district
- A total of 4 soil samples analysed all of which had a potassium rating of very low to a low (0.15 – 0.21) Cmol(+) kg/ soil
- Major crops: Maize and cotton
- ***Source: Jaspa et al., 2011***

# Results cont..

- Soil potassium status of the flooded soils (Fluvisols) in Kibondo district (Kigoma region)
- A total of 12 soil samples analysed of which 7(58.3%) soil samples had a potassium rating of very low to a low (0.04 – 0.21) Cmol(+) kg/ soil
- Source: Kaboni *et al.*, 2014 – Unfinalized technical report
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# Results cont..

- Soil potassium status for the shallow soils/ with limited rooting depth (Leptosols) in Kibondo District
- Three out of four soil samples analyzed had very low to low K-rating(0.01-0.21) Cmol(+) kg/ soil
- Major crops: Cassava, sweet potato and beans
- Source: Kaboni *et al.*, 2014 – Unfinalized technical report

# Results cont..

- Soil potassium status for the water saturated soils (Graysols) in Kibondo and Kigoma rural districts.
- Two out of twelve soil samples analyzed had very low to low K-rating(0.02-0.08) Cmol(+) kg/ soil
- Major crops: Rice, vegetables
- **Source:** Kaboni *et al.*, 2014 – Unfinalized technical report



# Cassava growth on K deficient Leptosols in western Tanzania



## Discussions

- **Potassium (K) status in the Lake and Western Zones**
- From the results indicated above, the K status in many major agricultural soils varied from very low to low. Few soil types indicated the presence of medium K. Very few sample indicated the presence of high to very high K. Therefore, for sustainable land productivity, crop yield and food security improvement, management of K need to be taken care.

# Discussions cont..

- The following crops have been reported to demand high K supply for good growth and better yield (Sys *et al.*, 1993): coffee, banana, beans, cabbage, cassava, citrus (orange, lemon, lime, mandolin), cotton, pineapple, Irish potato, sunflower, sweet potato, tobacco, sugar cane and tomato.
- It is important to note that the K-deficiency has negative implications on the plant up-take of Mg and Ca

# Discussions cont..

- The current build up of plant diseases in rice, banana, and cassava all of which are heavy K feeders should draw our attention to improve the level of K in soils.

# 5. Conclusion and Recommendations

## a) Conclusions

- Many crops being grown in the LZ and WZ need high K supply.
- The major soil type found in these zones include: Cambisols/ Arenosols, Planosols, Vertisols, Calcisols, Ferralic Cambisols, Rhodic Ferralsols, Rhodic Nitisols, Fluvisols, Leptosols and Graysols.
- Results from the review of various soils assessments have indicated presence of very low to low K in many soils types. Few soil types indicated presence of medium K. Very few soil types indicated high to very high K.
- Therefore, for sustainable land productivity, crop yield and food security improvement, management of K is needed.

# **5. Conclusion and Recommendations**

## ***(continues)***

### **b) Recommendations**

- **Manufacturing of mineral fertilizers potential for K supply e.g. Muriate of potash (KCl) and make easily available in the LZ and WZs' districts and at farmers' environment.**
- **Conduction of more K-mineral fertilizers experimentations to find effective and economic K response rates in major soils types**
- **Detailed studies related to low K supply and crop disease incidences e.g. in banana, cotton and cassava.**
- **Farmers and other stakeholders training through demonstration plots on crop performance under different treatments of K fertilizers rates.**

## Acknowledgments

- We wish to thank the organizers of this workshop for availing our people in the Lake and western zones an opportunity for demonstrating potassium nutrition constraint to crop production

Asante sana..

