Soils Potash Status and needs and the role of balanced fertilization in Tanzania

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Introduction

- Declining soil fertility – the major constraints to majority of the farmers (Sub Saharan Africa, Tanzania)
- This constraint in soils caused: a multiple of nutritional deficiencies in crops, livestock as well as in human beings.
- Multiple of nutritional deficiencies observed include K deficiency symptoms in crops.
- Potassium is among the most utilized essential nutrient element after N and P.
- It is required for many important functions in plants including crop vigour, development of root system, resistance towards pests and diseases and preventing crop plants from lodging
- In Tanzania, K is applied to few crops (coffee, tea, tobacco and few vegetables).

Introduction (cont...)

- Multiple nutrient deficiencies on maize

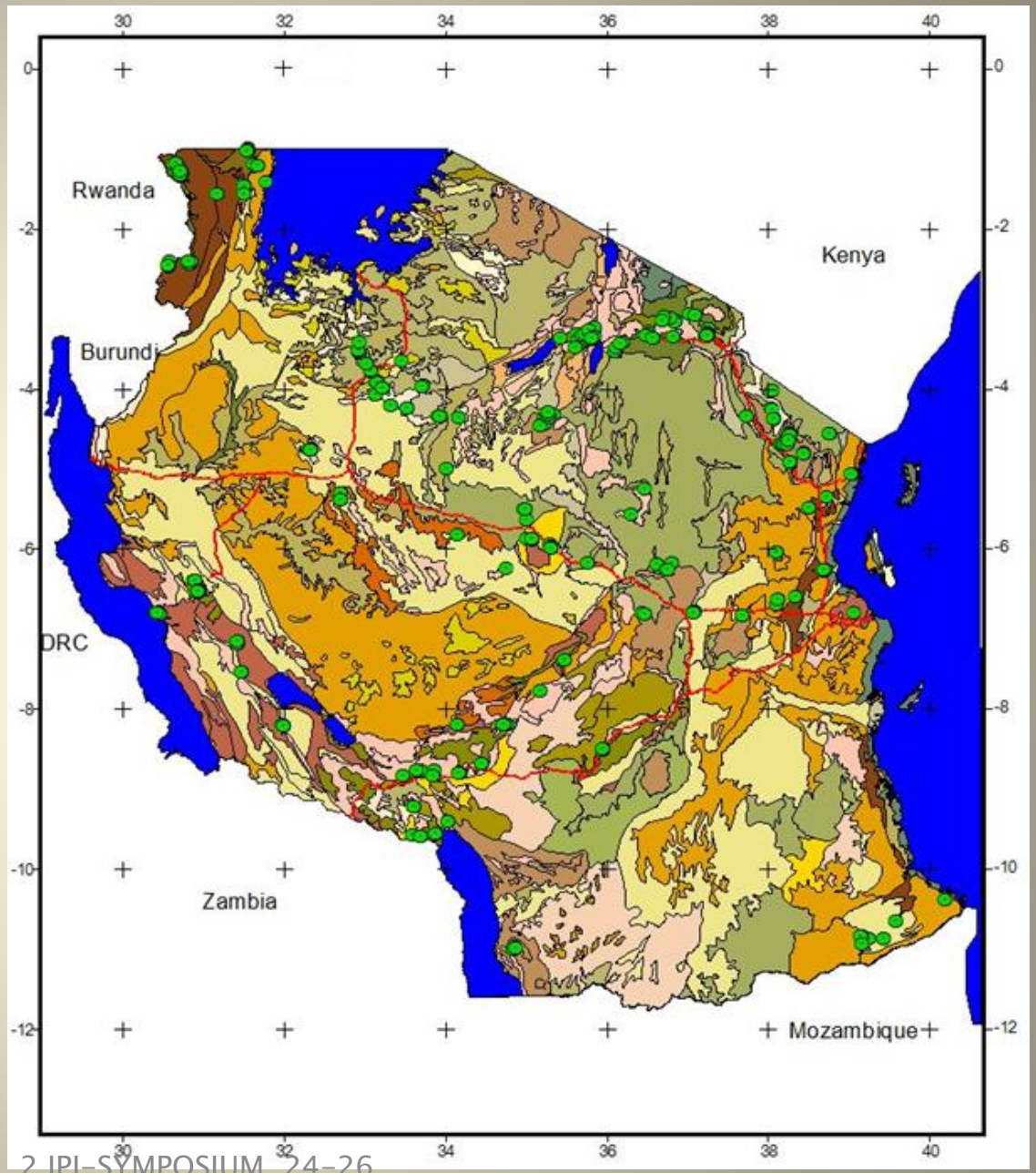
- K deficiency symptoms on sisal

- A healthy tomato plant

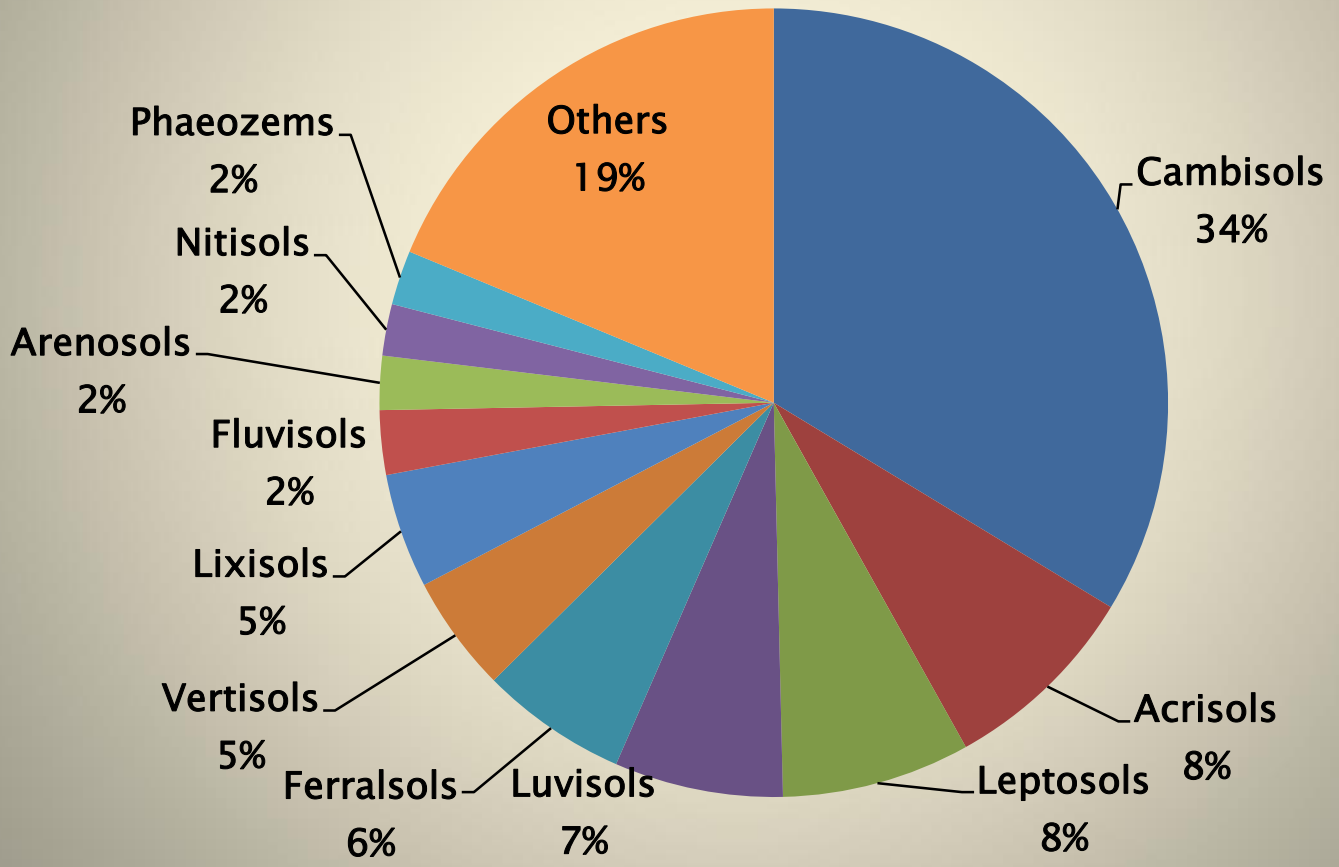
Location and crop coverage

Tanzania:

- a total area of 945,000 km^2
- In land lakes 6% of total area
- planted with annual crops 66% of the land is
- perennial crops occupy 15%
- mixture of annual and perennial crops 8%
- under fallow 11%



Coverage of major soil types of Tanzania



Major soil types in Tanzania

Cambisols -35.34%,

1. Are weakly to moderately developed soils showing signs of beginning soil formation.
2. Occur mainly in the mid-western and south-eastern parts of the country from sea level to the highlands and under all kinds of vegetation.
3. Make good agricultural land and are intensively cultivated with maize, sorghum, millet, cassava, groundnuts, beans, cowpeas, green gram, sunflower, cotton, coconuts, cashew, sisal and many other crops

Major soil types in Tanzania (cont...)

Acrisols (8.63%)

Characterized by:

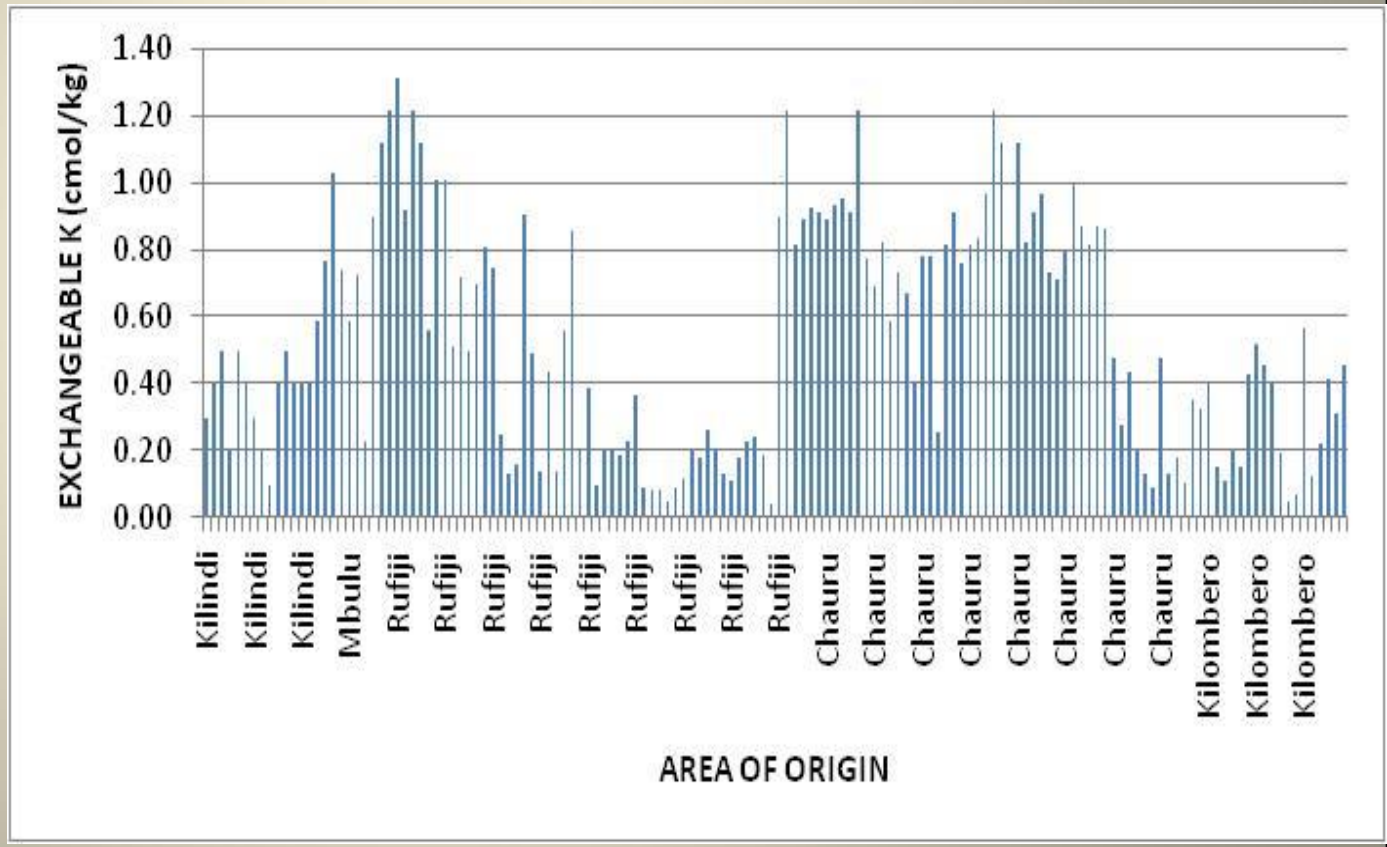
1. accumulation of low activity clays in an argic subsurface horizon, and
2. a low base saturation level. They are second most extensive soils in the country.
3. Acrisols occur mostly on old land surfaces with hilly or undulating topography.
4. Acrisols are used for smallholder cultivation of annual crops such as maize, sorghum, cassava, round potatoes and banana. Cash crops grown on these soils are pineapple, cashew, sisal, coconut, oilpalm, tea and coffee.

Potash status in Some Major Soils

Potash status of: Fluvisols, Vertisols, Cambisols, Ferralsols, Acrisols and Luvisols (represents 65.34 %)

FLUVISOLS –2.77%. (Source: Soil Survey reports–NSS)

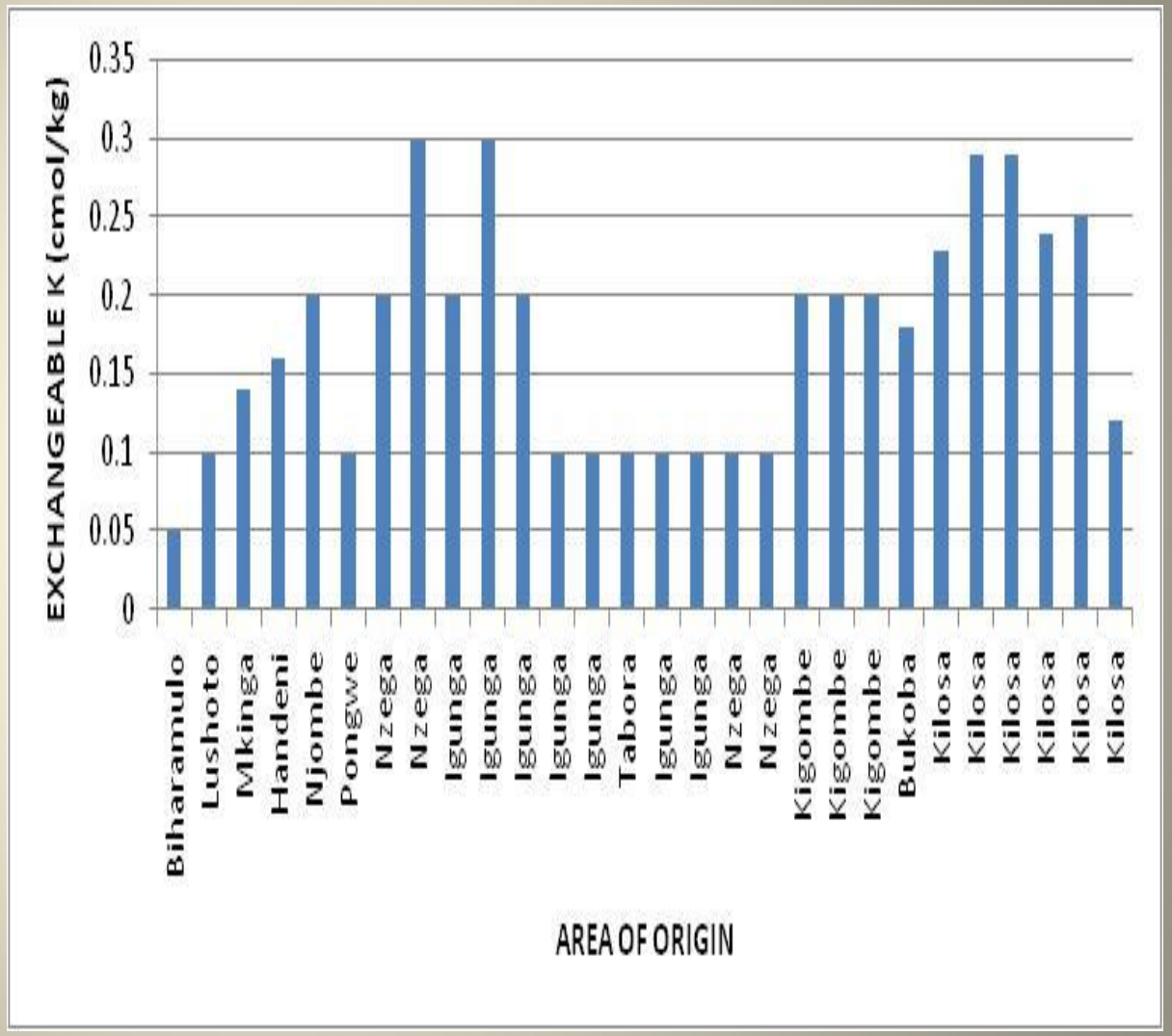
Fluvisols are known to be fertile due annual alluvial depositions of the area from the seasonally flooded or irrigated lands but these are seen to have K deficiency in some parts of farm lands.



CAMBISOLS-35.34%

(Source: Soil Survey reports-NSS)

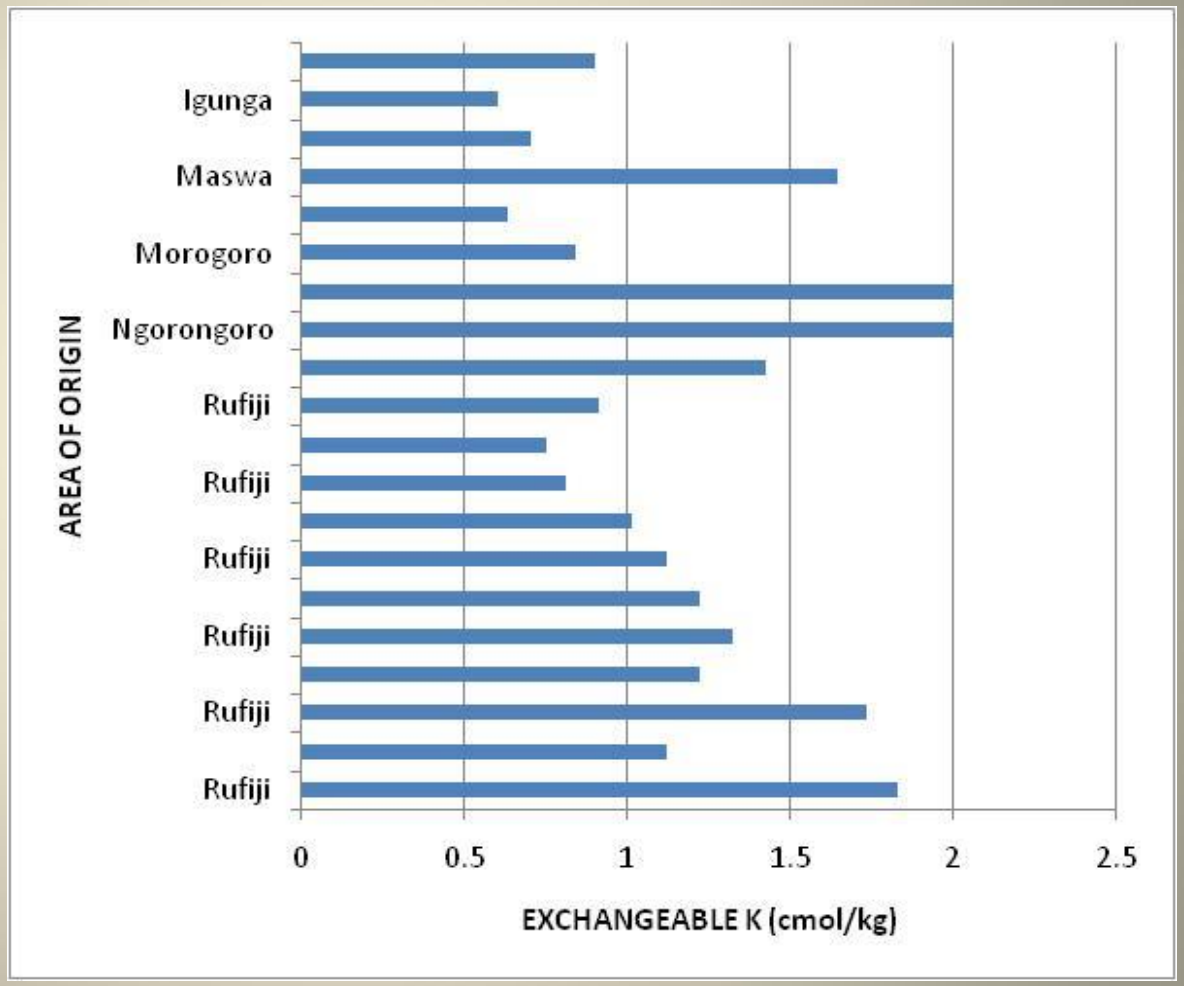
In all the surveyed sites with Cambisols, potash contents are less than 0.3cmol/kg **which are on lower side**, suggesting that application of potash containing fertilizers in conjunction with other nutrient elements is necessary for increased crop yields



VERTISOLS-5.02%

(Source: Soil Survey reports-NSS)

In many areas covered with Vertisols the potash **contents are adequate** and can support crop production for some time but it essential to monitor the contents with time of cultivation.



Potash status in some crop lands

(Source: National Soils Laboratory-NSS)

The soil samples collected from various farm lands in Tanzania for a period of 2009-2014.

The total number of soil samples were 319.

The data indicate that 40% of the soil samples have very low potassium contents.

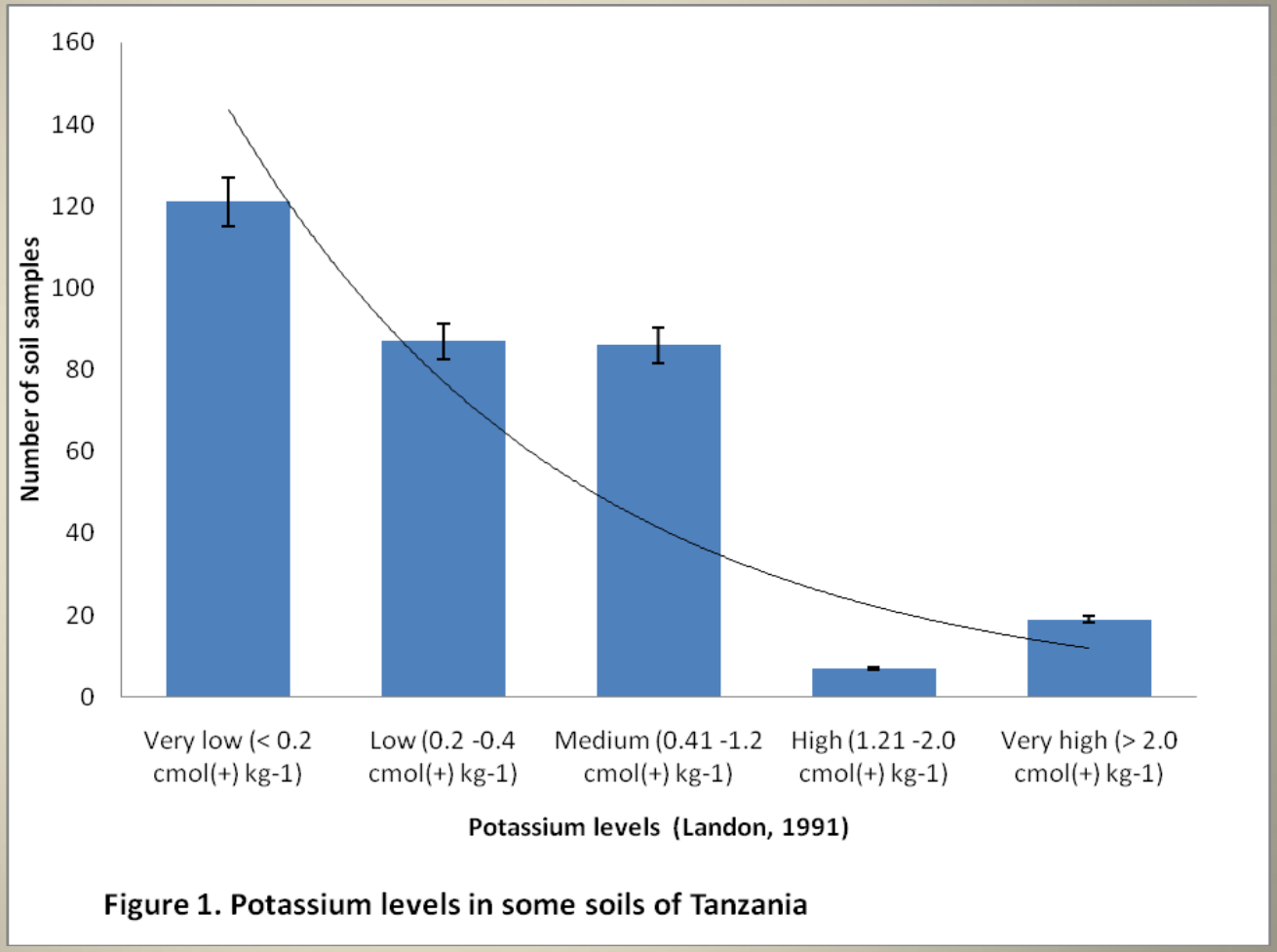
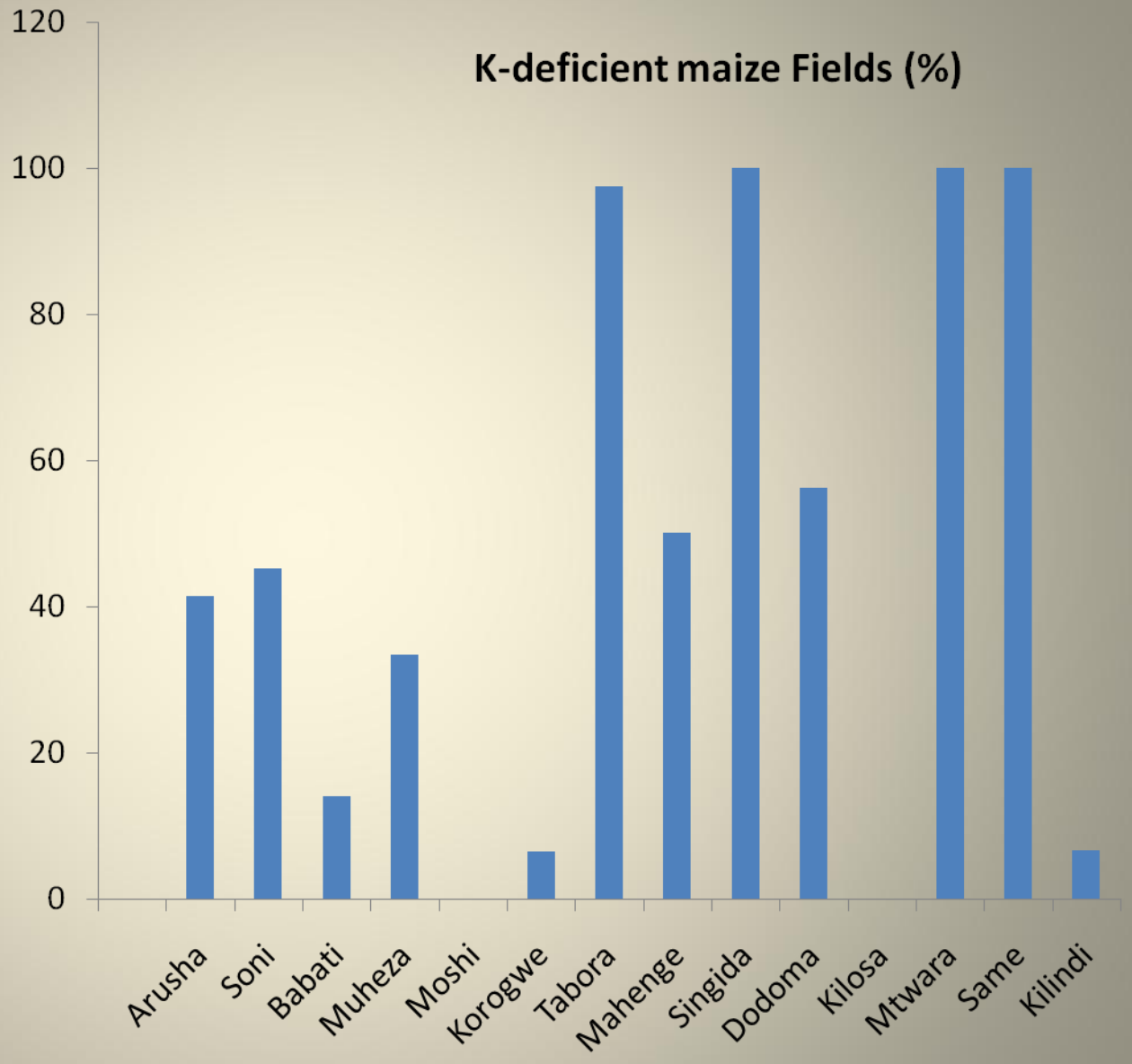


Figure 1. Potassium levels in some soils of Tanzania

Potash status in some maize fields

Figure indicate the proportions of farm land under maize crop which are K deficient (Source: National Soils Laboratory–NSS)



Potash fertilizer needs

- In general the use of potash fertilizers in Tanzania is very small, when compared to other fertilizers (Urea, DAP, MRP, TSP, CAN and SA).

- **NPK- 10:18:24; 20:10:10 (tobacco NPKs):**

An annual amount of 40,000 MT of NPK 10-18-24 on average is applied mostly by tobacco growers in Tabora, Mpanda, Chunya and Iringa. Around 20,000 MT of 20:10:10 are used by tobacco growers in Ruvuma but also by other crop growers.

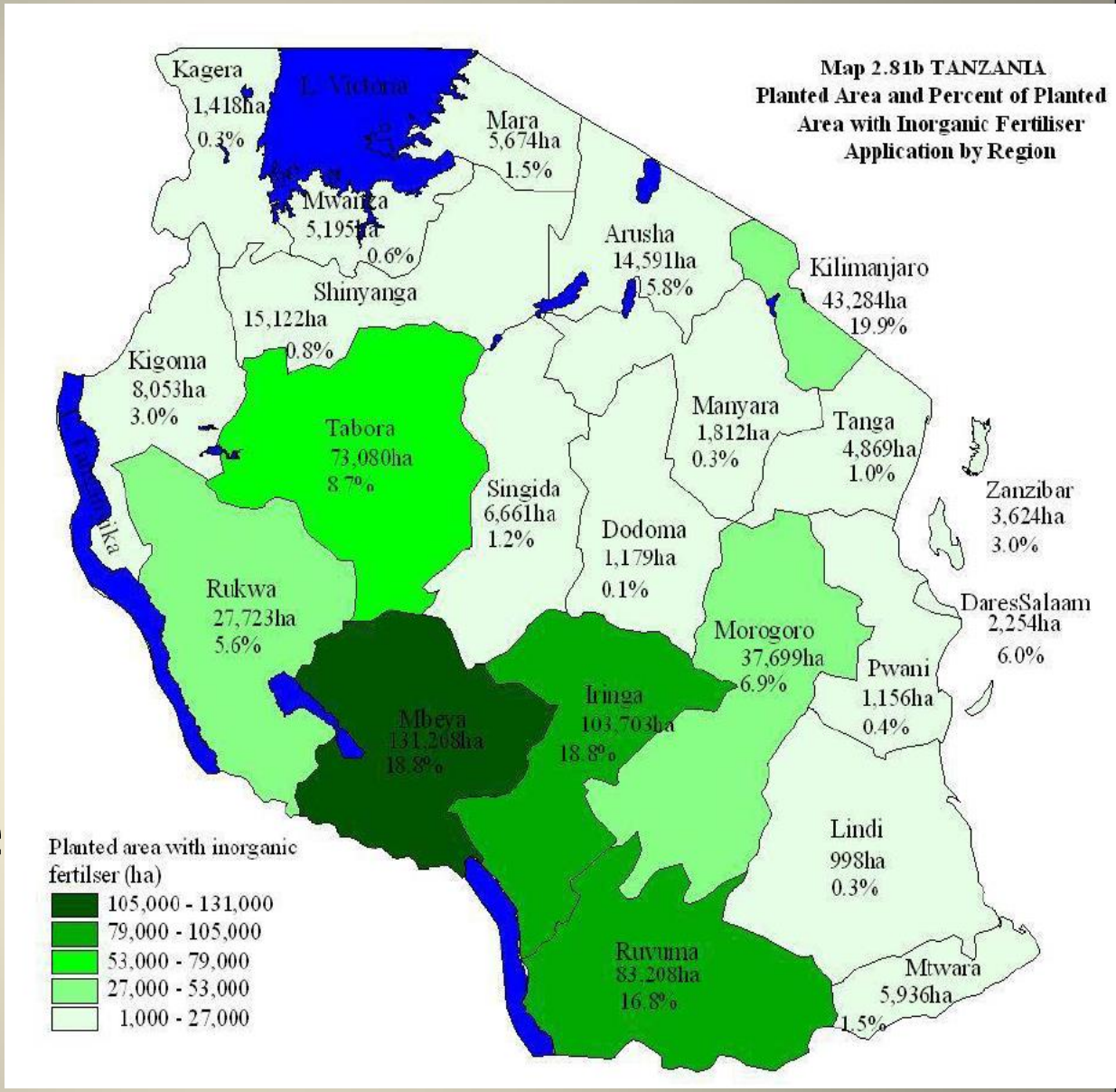
- **NPK 25: 5: 5 + 5S** Mainly used in the tea production with annual consumption at 2,000 – 3,000MT

- **NPK 17:17:17** Used in sugarcane growing and annual consumption is estimated at 1,000MT other types in very small quantities.

- NB: With observed potash deficiencies in a number of major soil types and farm lands across the country, the need for inclusion of K fertilizer is apparent.

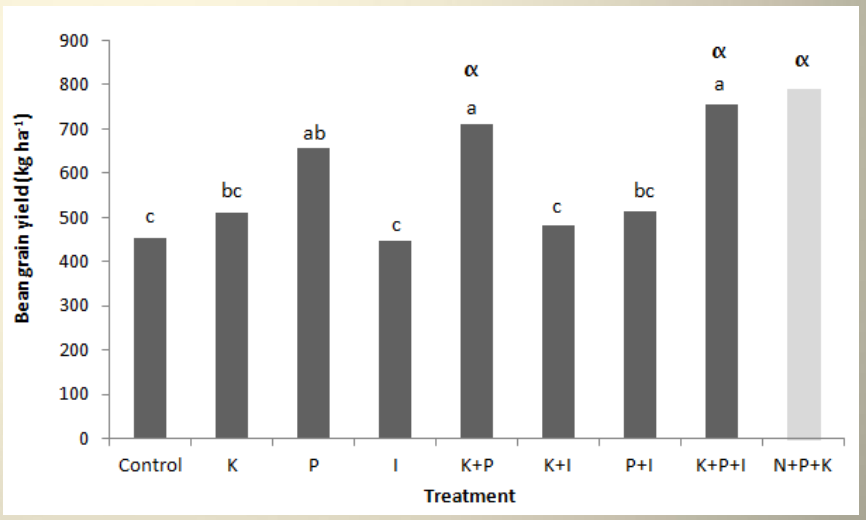
Potash fertilizer needs (cont...)

The needs of Potash fertilizer could similar trend of fertilizer requirements in Tanzania as shown in Figure



Response of crops to Potash fertilizers

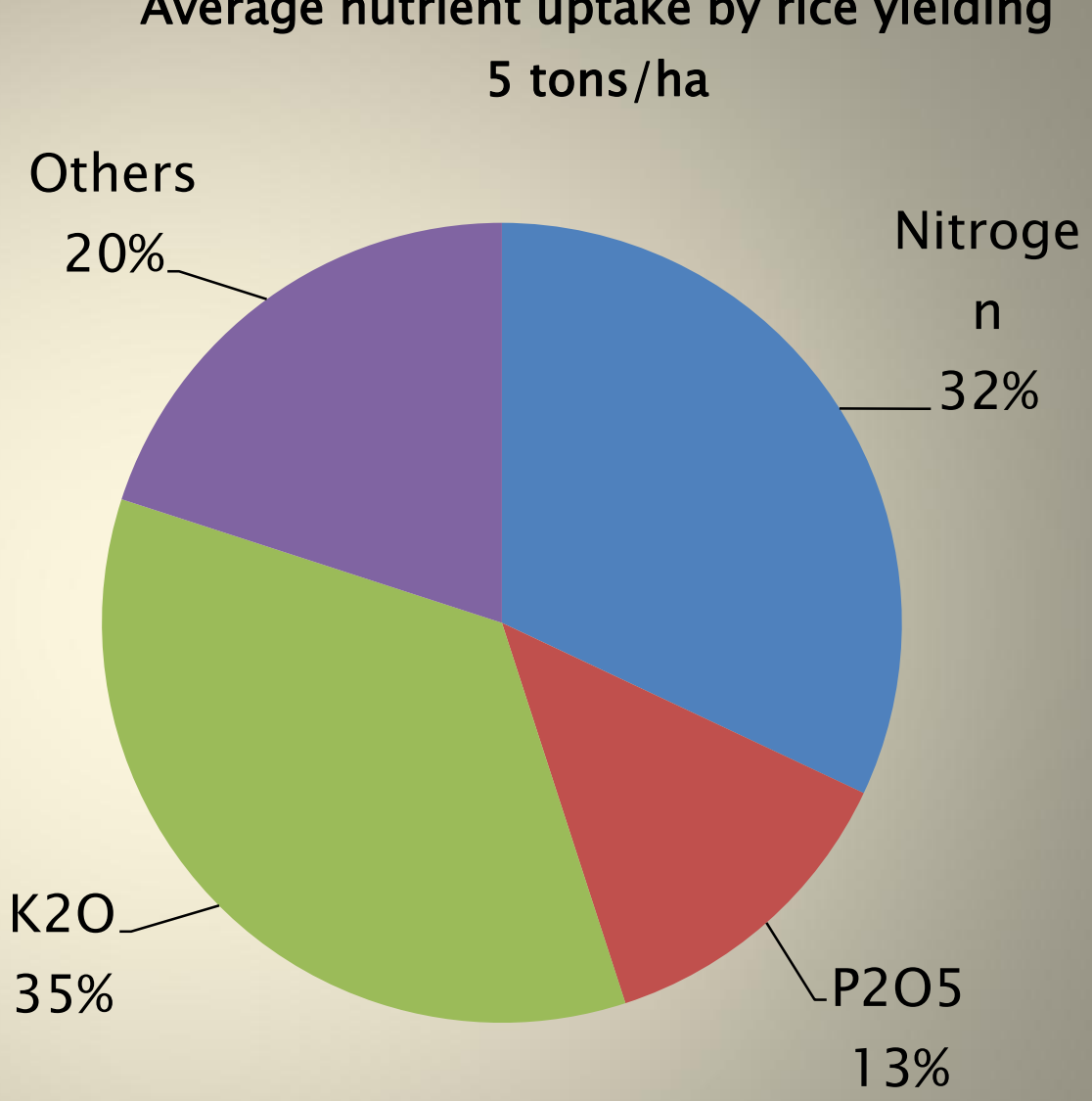
1. Maize (Wickama *et al*., 2015),
2. Phaseolus bean in the Usambara Mountains (Bressers *et al*., 2015),
3. Sisal in Tanga, Morogoro, coast and Kilimanjaro regions (Hamisi *et al.,* 2015),
4. Tobacco in Tabora, Kigoma, Mbeya and Shinyanga regions (Shenkalwa and Mapunda, 2015),
5. Other crops in southern and southern highland regions (Hella *et al*, 2015).



Role of balanced fertilization

Average rice yielding 5t ha^{-1} removes up to 110 kg N ha^{-1}, 34 kg P_2O_5 ha^{-1}, and 156 kg K_2O ha^{-1},

which is equivalent to 32 % N, 13 % P_2O_5 and 35 % K_2O.



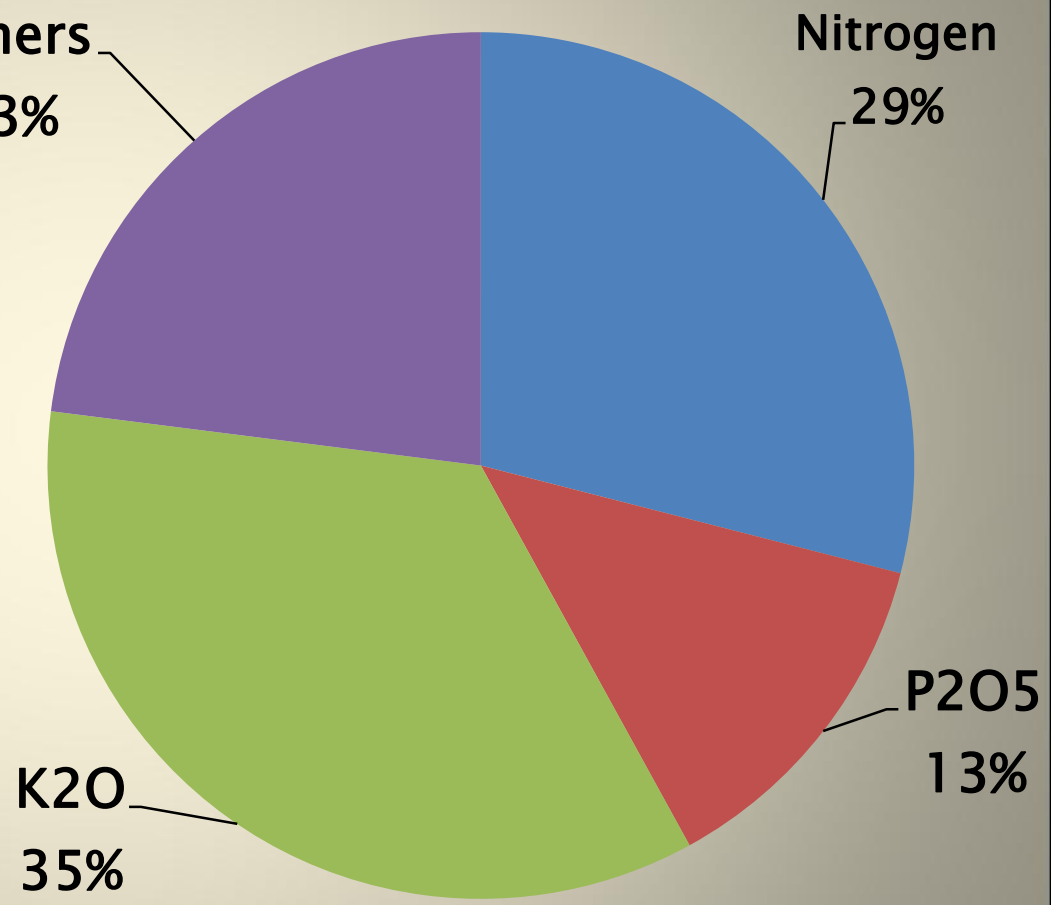
Role of balanced fertilization (cont..)

Maize, the grain yield of 9.5 t ha^{-1} removes 29 kg N ha^{-1}, 13 kg P_2O_5 ha^{-1}, and 35 kg K_2O ha^{-1},

equivalent to 29 % N, 13 % P_2O_5 and 35 % K_2O

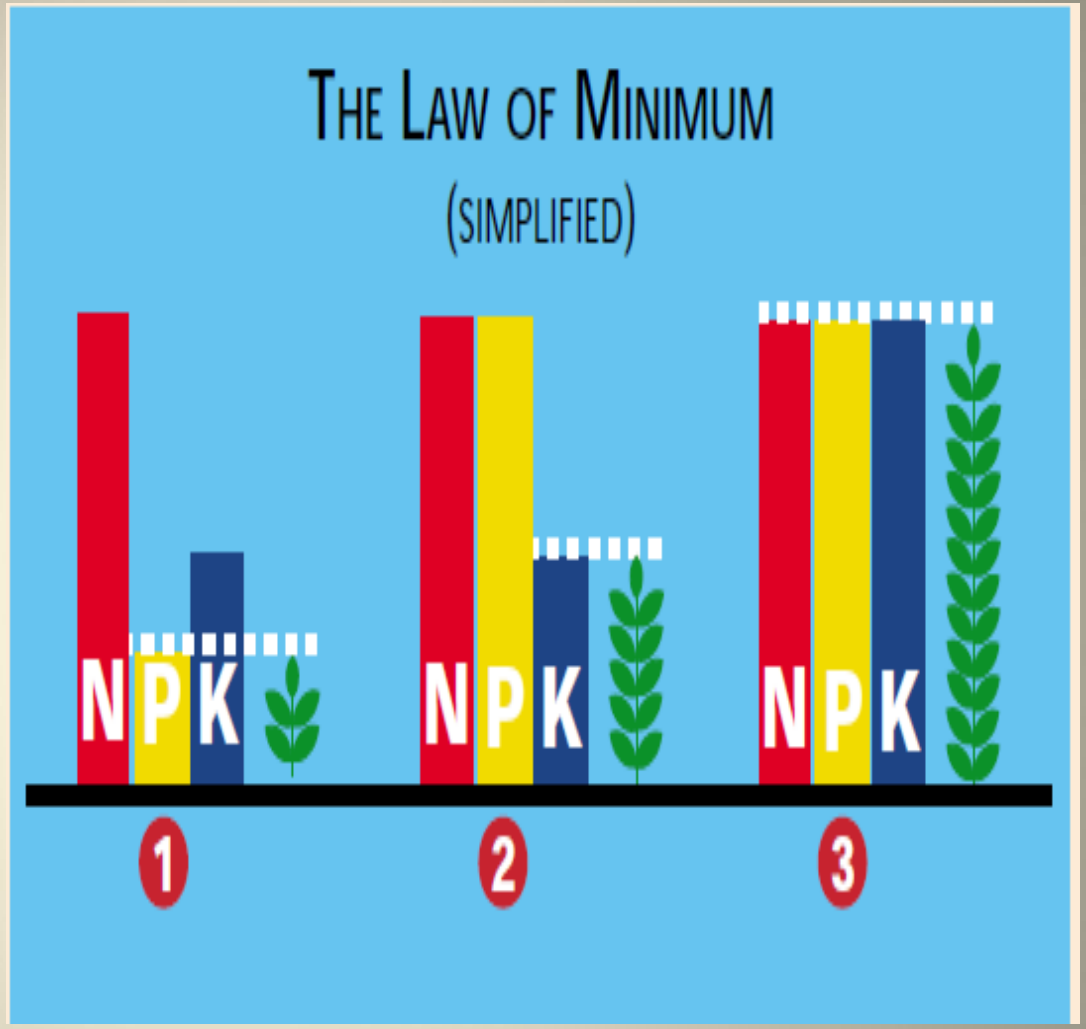
NB: Removal of large quantities of K_2O has been reported in many crops grown in Tanzania, wheat, potato, tomato, soya bean, sunflower, citrus, cotton and sugarcane.

Nutrient uptake from average maize yield of 9.5 ton/ha



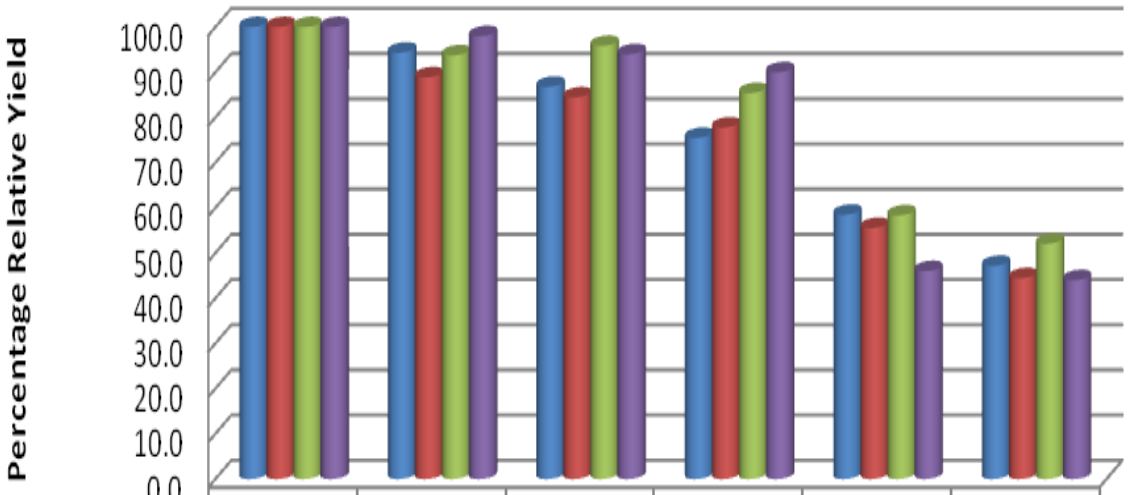
Role of balanced fertilization (Source: Hella *et al*, 2015)

1. Sufficient N and K but too little P
2. Sufficient N and P but K is too little
3. K deficiency is corrected



Role of balanced fertilization (cont..)

Percentage relative rice yields from the treatments receiving one or more nutrient relative to yield of treatment with all nutrients (NPK).



	NPK (all added nutrients)	NP (without K)	NK (without P)	N (without PK)	PK (without N)	Control (No fertilisers)
Masimba (E2)	100.0	94.3	86.8	75.5	58.5	47.2
Kwemsala (E6)	100.0	88.9	84.4	77.8	55.6	44.4
Mnyuzi (E3)	100.0	93.8	95.8	85.4	58.3	52.1
Lusanga (E3)	100.0	98.0	94.0	90.0	46.0	44.0

Role of balanced fertilization (cont..)

K removal by plants has been in place from time immemorial, it is not surprising to observe K deficiency symptoms is on the increase, and contributing to low crop yields realized.

Hence, balanced fertilizer application will ensure that:

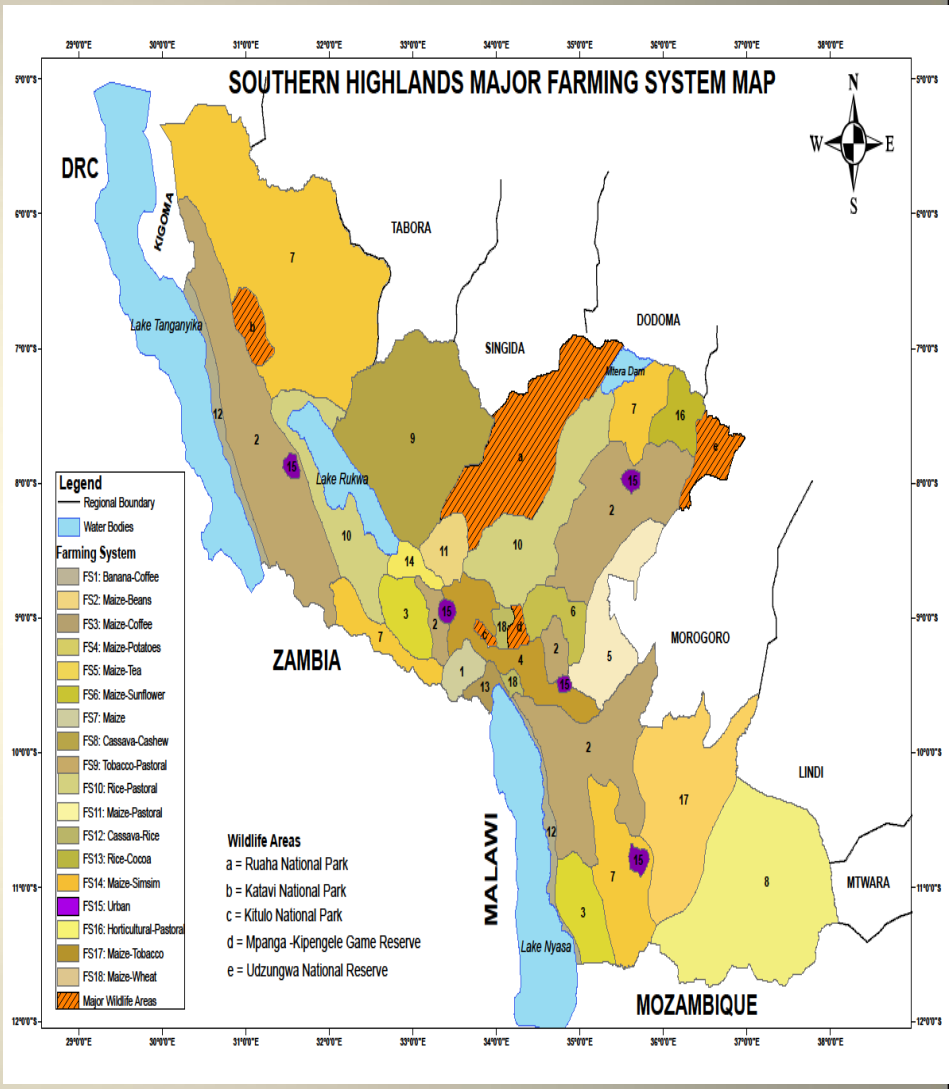
1. other inputs required achieve optimum economic yields are used efficiently
2. the plant has access to adequate amount of each nutrient which is essential to optimize yields and,

Conclusions

1. With exception of Vertisol, the other major soil types including Fluvisol, Cambisol, Ferralsol, Acrisol, and Luvisol are becoming Potash deficient.

2. In the farmer's fields, the situation of Potash status is alarmingly low. This situation requires:

- ❑Conduct diagnostic survey (including literature review) to establish current K status in soils and crops in selected areas of Tanzania
- ❑Identify research and knowledge gaps with respect to K status in Tanzania
- ❑Produce maps which show status of K-distribution and hot spots for K-deficiency in Tanzania



Conclusions (cont..)

1. The current consumption of Potash fertilizer is low compared to other nutrient element like Nitrogen and Phosphorus, but its requirements are likely to increase as the high needs for Potash fertilizers has been reported for many crops which was not needed in the past.
2. In order to adequately respond to these Potash requirements for crops, and address the role of balanced fertilization, there is urgent need to:

- ❑Review current knowledge on K fertiliser recommendations for crops in Tanzania
- ❑Identify priority crops and geographical areas for K fertilizer experiments
- ❑Conduct experiments to generate site/area specific K fertiliser recommendations, effective application methods and management options
- ❑Determine the effect of K fertiliser rates on quality of crops with respect to human and livestock health

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