VARIABILITY OF EXCHANGEABLE POTASSIUM IN SOILS OF TANZANIA:

A RARELY OBVIOUS SOIL FERTILITY CHALLENGE FOR SUSTAINABLE CROP PRODUCTION

Meliyo J.L., Masuki K F.G., Kashenge-Killenga, S., Mbogoni J.D. J., Mwango S.H., Senkoro C.J., Mkangwa Z.C., J.J. Tenga and G.J.Kajiru

BACKGROUND

Potassium (K) is an essential nutrient for plant growth (among important macronutrients), (Sparks and Huang, 1985′ Mengel and Kirkby, 1987),

K is required in the largest amount by plants next to N (Sparks, 2000).

Of the major nutrient elements, K is usually the most abundant in soils (Reitemeier, 1951).

Igneous rocks of the Earth's crust have higher K contents
than sedimentary rocks (Malavolta, 1985)

BACKGROUND…

Total K contents in soils range between 3000 and 100,000 kg ha^{-1} in the topsoils (0 to 20 cm from surface)

Of the total K content, 98% is bound in the mineral form, and only 2% is in soil solution and exchangeable phases
(Schroeder, 1979; Bertsch and Thomas, 1985).

With regards to its high total contents it is usually not considered limiting as compared to N and P
(Sommer et al., 2013)

BACKGROUND…

However, it has been established that nutrient mining over 30 years removed 660 kg N/ha, 75 kg P/ha, and **450 kg K/ha from about 200 million ha of cultivated land in Africa**(Sanchez et al., 1997)

This **underscore**, excessive K **removed** through crops, which may lead to net depletion from the soil,

In Tanzania, K deficiency has been reported in areas like Usambara Mountains (Ndakidemi, 1992).

Mowo *et al.* (2006) single K out as the most limiting in highland areas

BACKGROUND …

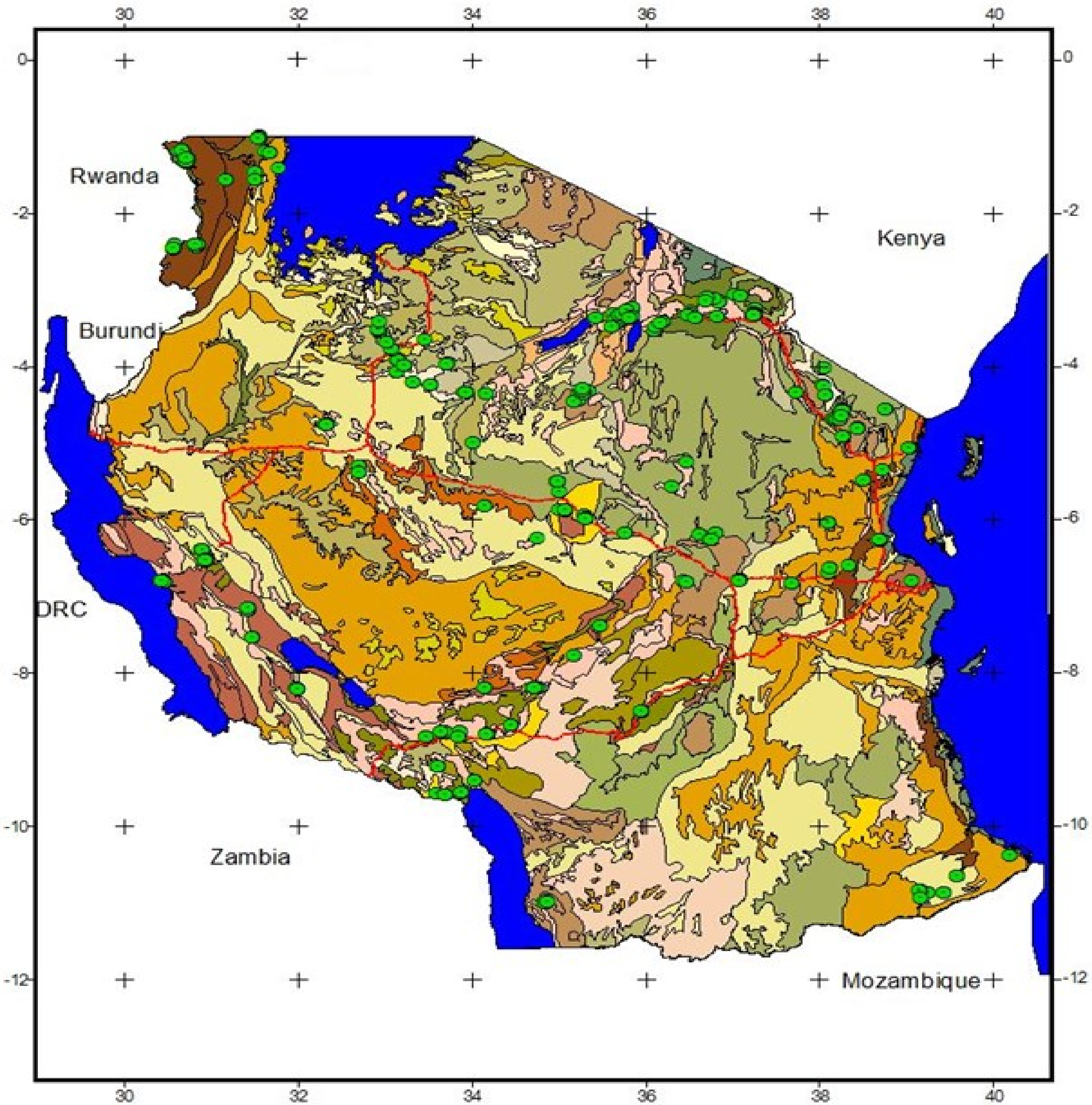
Ikerra, et al., (2006) reported potassium as an emerging potential problem in some parts of the country limiting crop productivity,

However, there is still inadequate understanding of the magnitude of the problem and its spatial distribution.

This work attempted to contribute on the exchangeable K variability in the country using a countrywide grey literature, pinpointing possible areas of excessive or deficiencies.

OBJECTIVES

To establish the variability distribution of exchangeable K and its’ deficiency in relation to locations and land use types, in order to facilitate the formulation of future strategies on integrated nutrient management research in the country.



METHODOLOGY

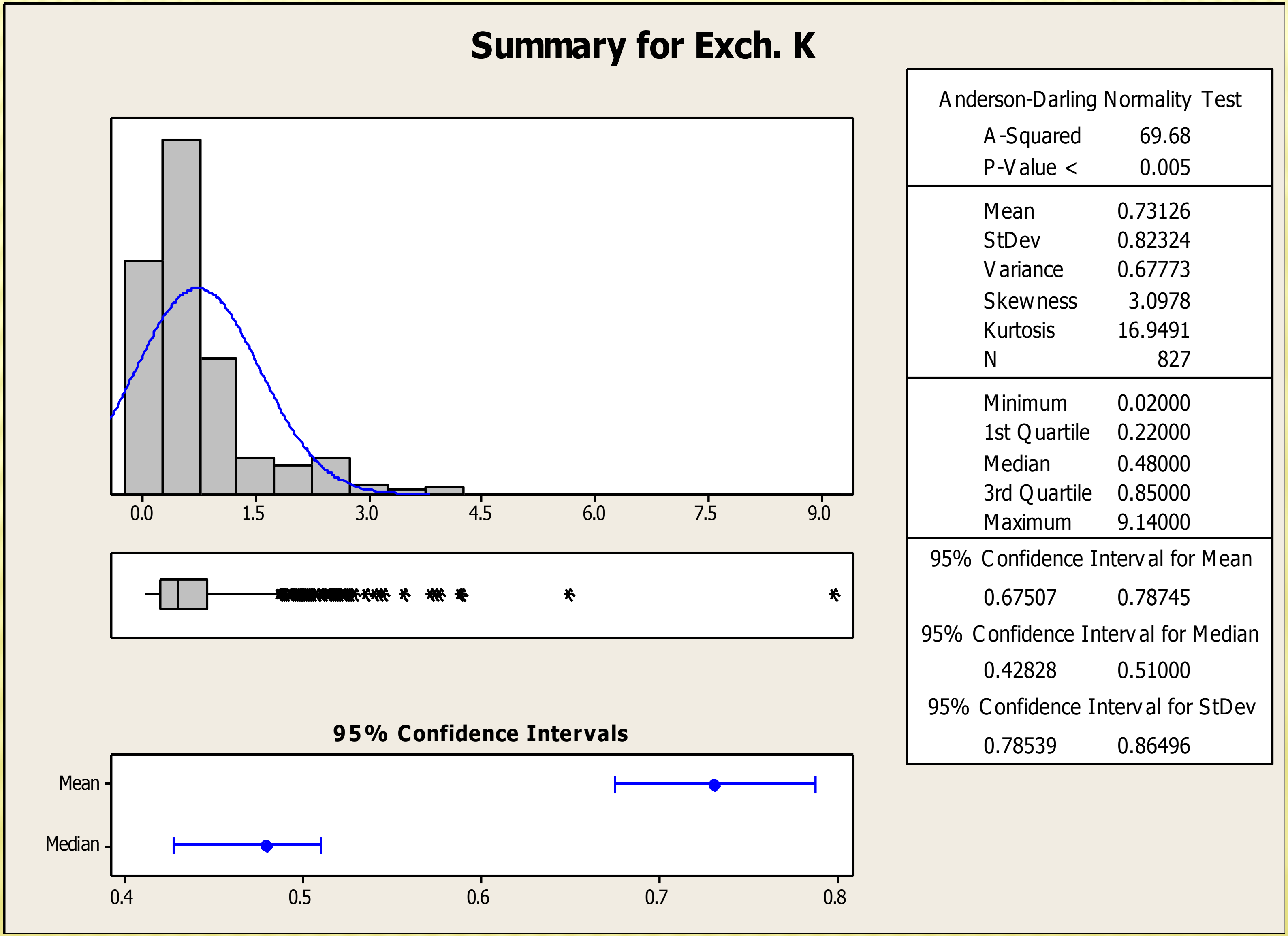
Review of soil survey memoirs from 1980s to present carried in the country

Descriptive statistics were use to analyse the topsoil 0-20 cm or 0-50 cm if not obstructed

Box plot / Whisker and histograms were used for comparisons

Figure 1: Distribution of studies reviewed to assess exchangeable K in soils of Tanzania

RESULTS AND DISCUSSION



Exch. K is variable between locations

Variations are attributed to geology, soil types and land uses

Figure 2: Summary of exchangeable soil K variation in soils of Tanzania

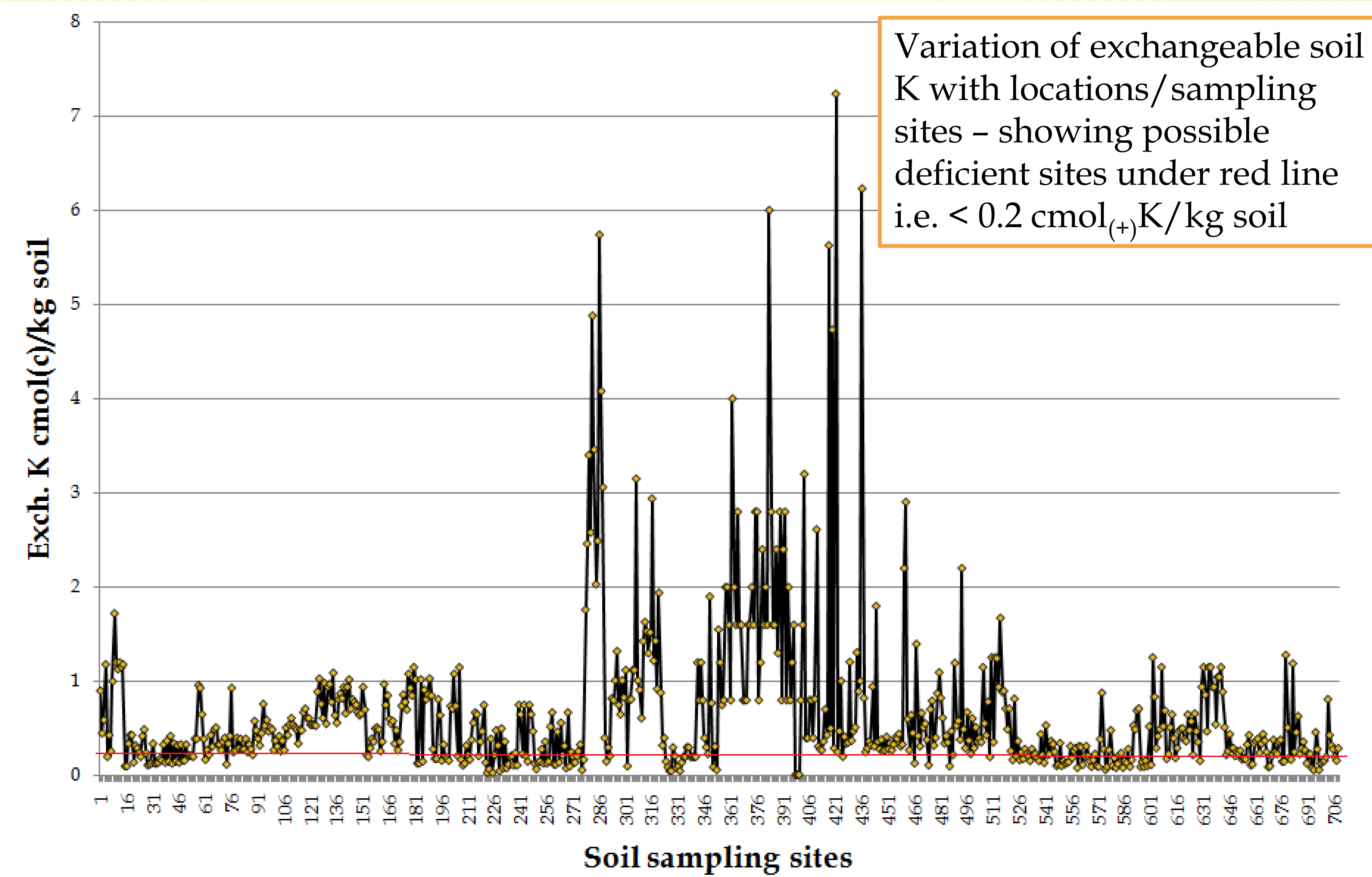
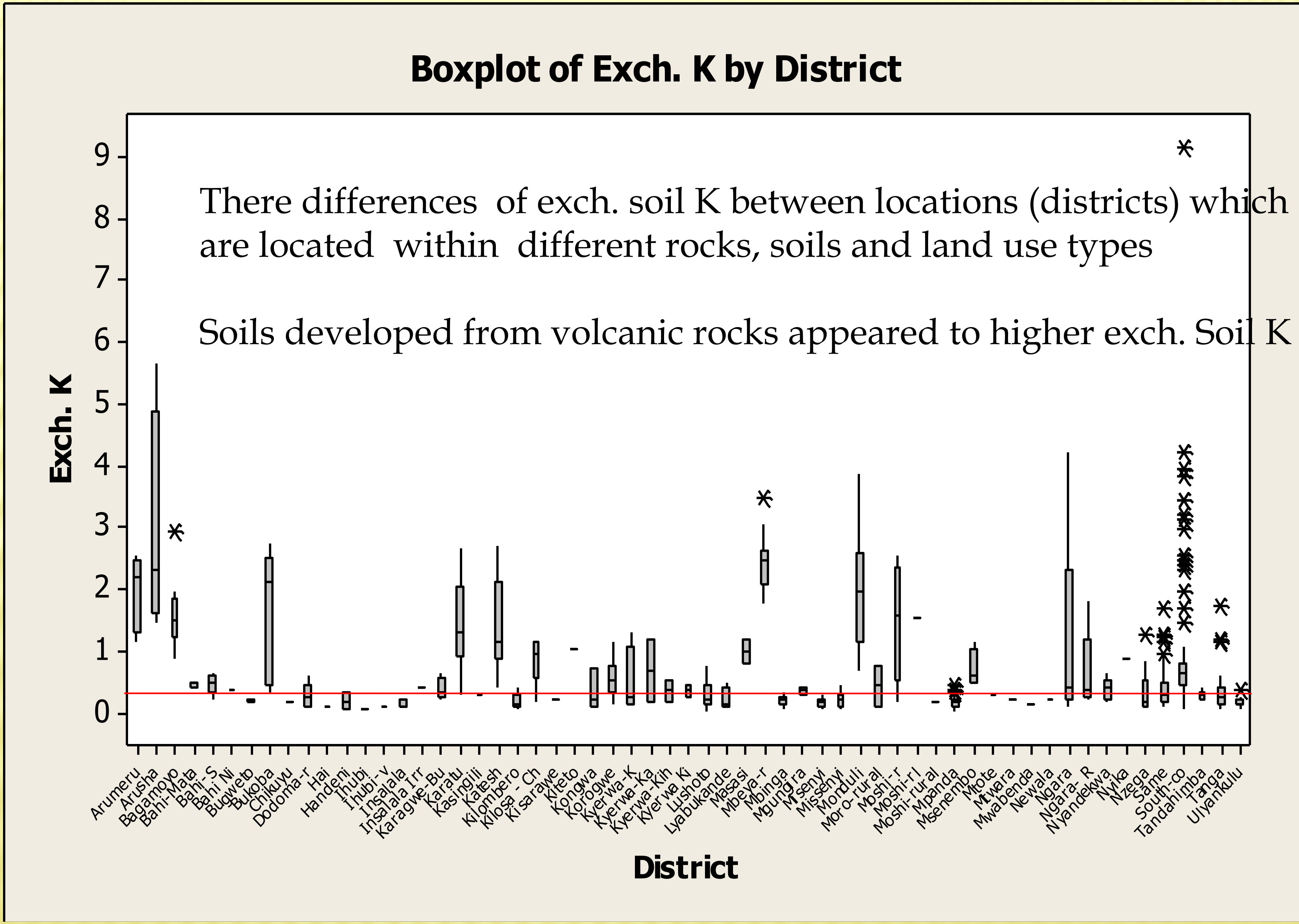


Figure 3: Variability of exchangeable soil K in soils of Tanzania

RESULTS AND DISCUSSION…



There differences of exch. soil K between locations (districts) which are located within different rocks, soils and land use types

Soils developed from volcanic rocks appeared to higher exch. Soil K

Figure 4: Variation of exchangeable soil K between locations under different parent rocks in Tanzania

RESULTS AND DISCUSSION…

Table 1: Variability of exchangeable soil K with locations

District	n	Mean	SE Mean	StDev	CV	Minimum	Median	Maximum	Range
Arumeru	8	1.973	0.207	0.585	29.67	1.13	2.18	2.56	1.43
Bagamoyo	12	1.553	0.157	0.544	35.05	0.88	1.475	2.94	2.06
Bahi-S	6	0.46	0.0629	0.154	33.48	0.22	0.475	0.65	0.43
Bukoba	7	1.624	0.4	1.059	65.17	0.32	2.13	2.74	2.42
Dodoma-r	14	0.2714	0.0485	0.1816	66.89	0.1	0.25	0.6	0.5
Hai	8	0.1125	0.0125	0.0354	31.43	0.1	0.1	0.2	0.1
Insalala	5	0.136	0.0279	0.0623	45.8	0.09	0.1	0.23	0.14
Karatu	35	1.377	0.103	0.611	44.36	0.28	1.28	2.66	2.38
Katesh	26	1.359	0.14	0.713	52.49	0.4	1.135	2.7	2.3
Kilombero	15	0.1787	0.0313	0.1213	67.89	0.05	0.15	0.4	0.35
Kilosa - Ch	8	0.852	0.127	0.36	42.22	0.16	0.94	1.15	0.99
Kongwa	8	0.35	0.105	0.298	85.03	0.1	0.2	0.7	0.6
Korogwe	159	0.54	0.0215	0.271	50.18	0.12	0.51	1.15	1.03
Lushoto	20	0.3025	0.0492	0.2201	72.77	0.03	0.22	0.75	0.72
Mbeya-r	11	2.489	0.141	0.469	18.85	1.76	2.46	3.46	1.7
Mbinga	9	0.1911	0.028	0.084	43.97	0.06	0.2	0.33	0.27
Misenyi	6	0.1633	0.03	0.0734	44.94	0.06	0.155	0.28	0.22
Missenyi	7	0.2086	0.0518	0.137	65.71	0.06	0.23	0.46	0.4
Monduli	18	1.971	0.209	0.886	44.96	0.67	1.95	3.87	3.2
Moshi-r	9	1.442	0.3	0.9	62.43	0.19	1.57	2.53	2.34
Mpanda	24	0.1733	0.0208	0.1019	58.78	0.02	0.16	0.45	0.43
Msenembo	4	0.713	0.152	0.305	42.76	0.49	0.605	1.15	0.66
Ngara	11	1.209	0.414	1.372	113.49	0.1	0.4	4.2	4.1
Ngara- R	8	0.678	0.211	0.597	88.16	0.2	0.37	1.8	1.6
Nyandekwa	7	0.3914	0.0625	0.1654	42.25	0.19	0.4	0.65	0.46
Nzega	21	0.339	0.0688	0.3152	92.97	0.08	0.17	1.25	1.17
Same	68	0.4021	0.0404	0.3332	82.86	0.08	0.285	1.67	1.59
South-co	179	0.9446	0.083	1.1109	117.61	0.04	0.62	9.14	9.1
Tandahimb	6	0.2833	0.0307	0.0753	26.57	0.2	0.3	0.4	0.2
Tanga	40	0.3555	0.0555	0.3507	98.65	0.07	0.25	1.72	1.65
Ulyankulu	13	0.1631	0.0218	0.0786	48.18	0.07	0.13	0.36	0.29

Low variation 0-15%; medium variation 15-30 %, high variation 30-50 % very high > 50

RESULTS AND DISCUSSION…

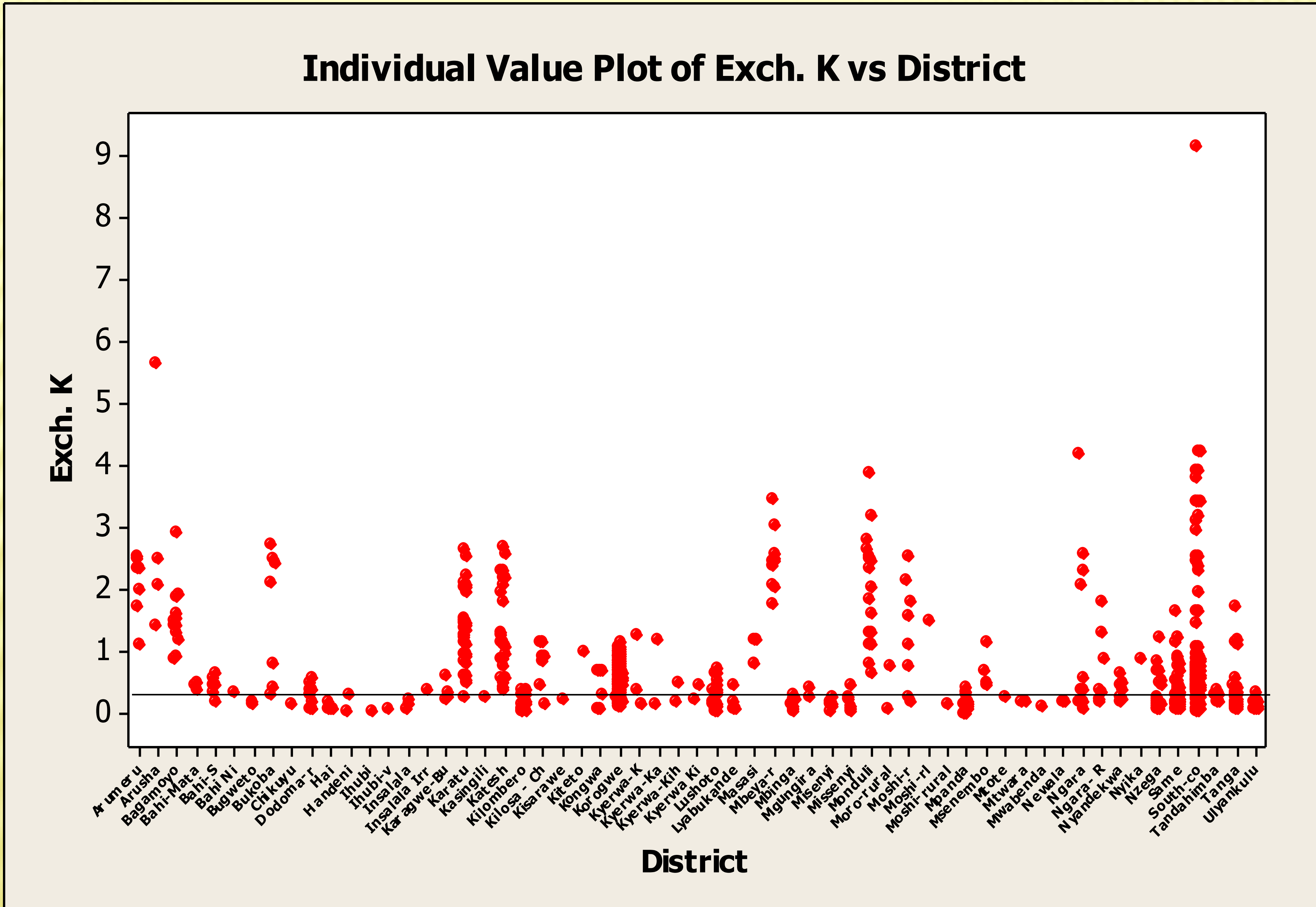


Figure 5: Variation of exch. Soil K within individual sampling sites in studied areas

RESULTS AND DISCUSSION…

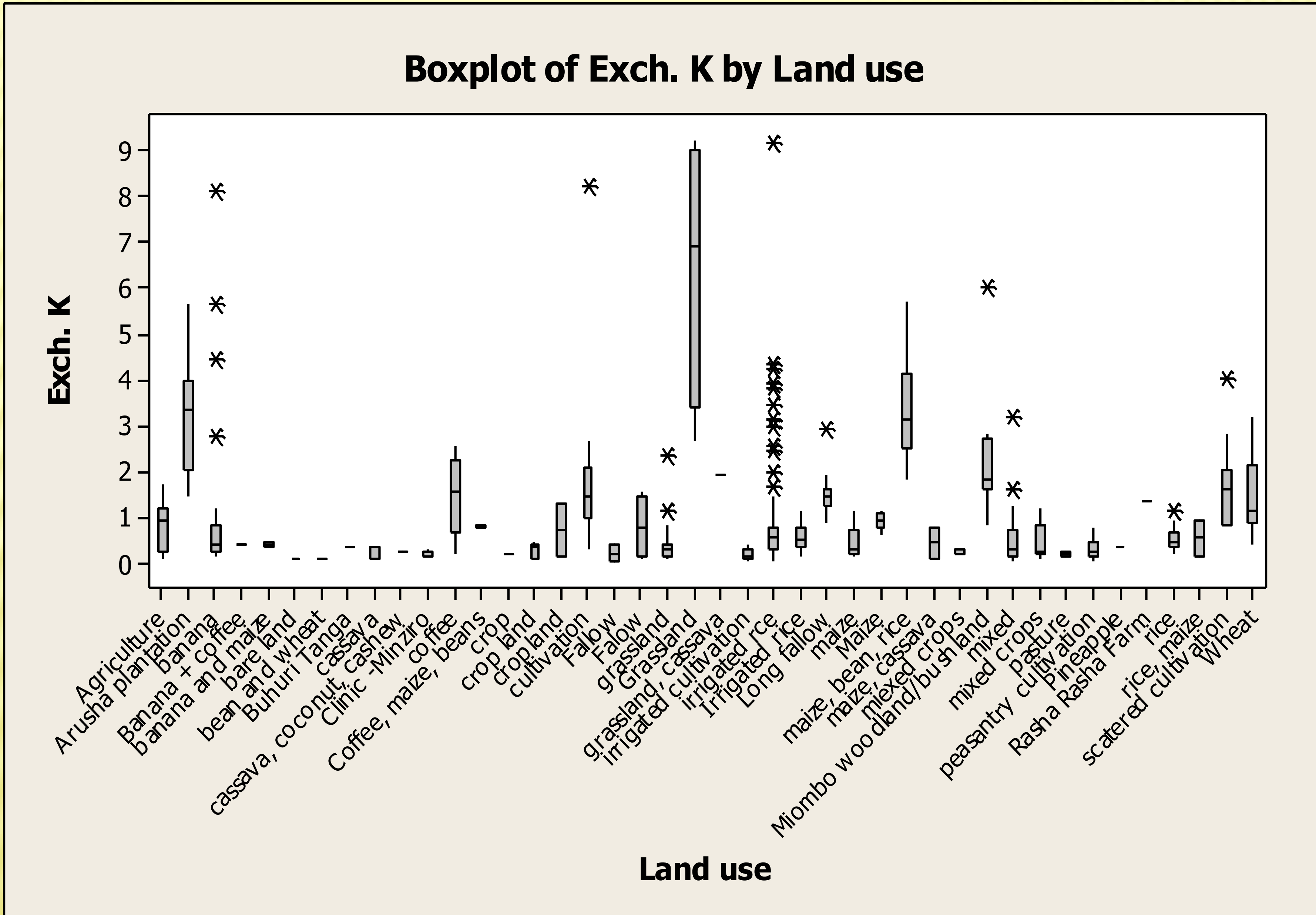


Figure 6: Variation of exchangeable soil K with land use types in the studied locations of Tanzania

SUMMARY

- This review adds understanding on the notable soil fertility variability in Tanzania as indicated by variation in exchangeable soil K.
- We further concludes that exchangeable soil K is widely variable in Tanzania, and there are areas with deficiencies which may be a limitation for sustainable crop productivity,
- Variability appears to be influenced by multiple factors included parent rocks, parent materials and land use types
- Grasslands, perennials, volcanic rocks, floody plains have had higher levels of exchangeable K than continuously cultivated areas
- We therefore recommend for verification trials in areas that have been indicated to have low soil K using various crops

Many thanks for your attention

God bless you