

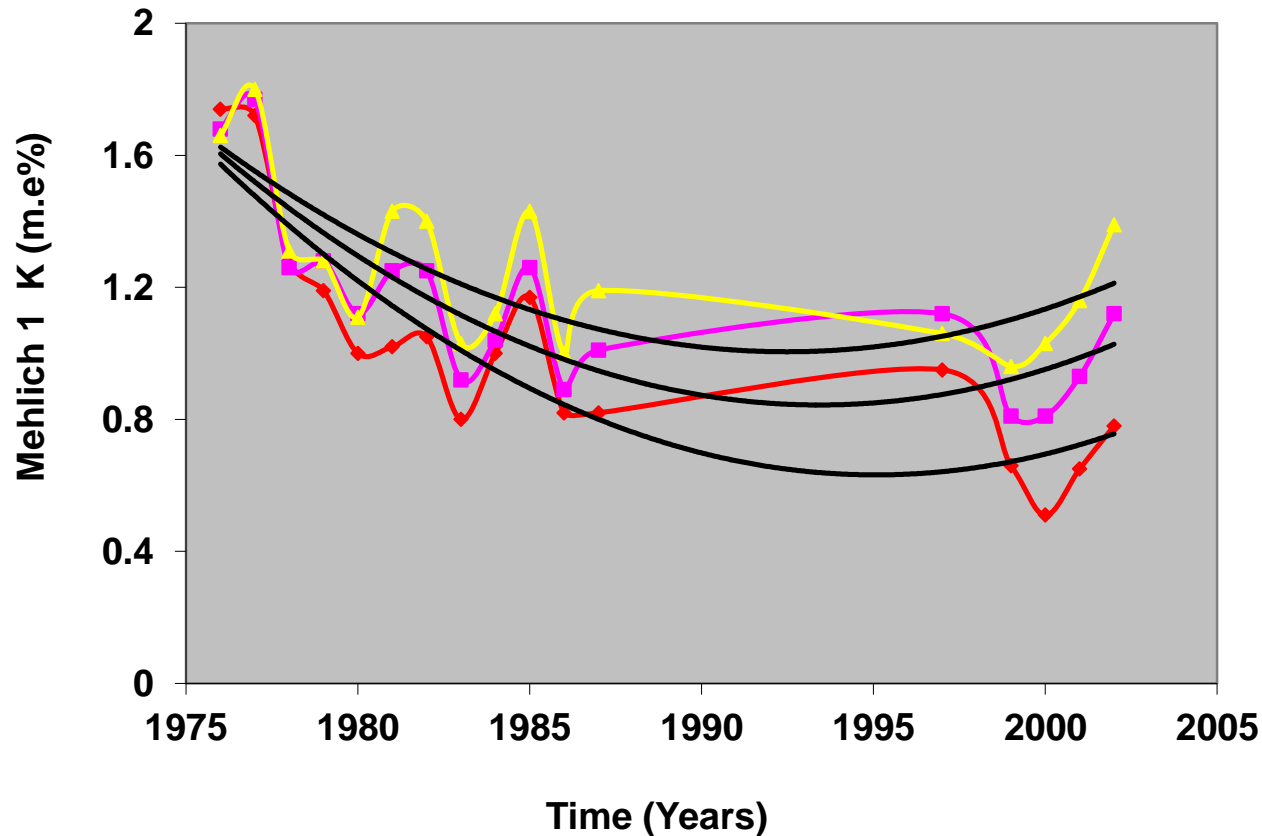
# Responses of Five Major Food Crops to Potassium Fertilisation and Establishment of Soil Critical Potassium Levels in Kenya

**Esther Gikonyo<sup>1</sup>,  
Stephen Kimani<sup>1</sup>,  
Bernard Waruru<sup>1</sup>, Lilian  
Mbuthia<sup>2</sup>, Catherine  
Kibunja<sup>1</sup>, Anthony  
Esilaba<sup>1</sup>, Maurice  
Radiro<sup>1</sup>, Michael Okoti<sup>1</sup>**

# Introduction

- **Misconception: Potassium is believed to be sufficient in Kenya Soils**
- **High K depletion reported**
  - **In SSA about 29 Kg ha<sup>-1</sup> yr<sup>-1</sup> (Stoorvogel and Smaling, 1990)**
  - **In Kisii about 70 Kg ha<sup>-1</sup> yr<sup>-1</sup> (Smaling et al., 1993)**

# Decline in Soil K over 30 years of continuous cropping under different manure rates

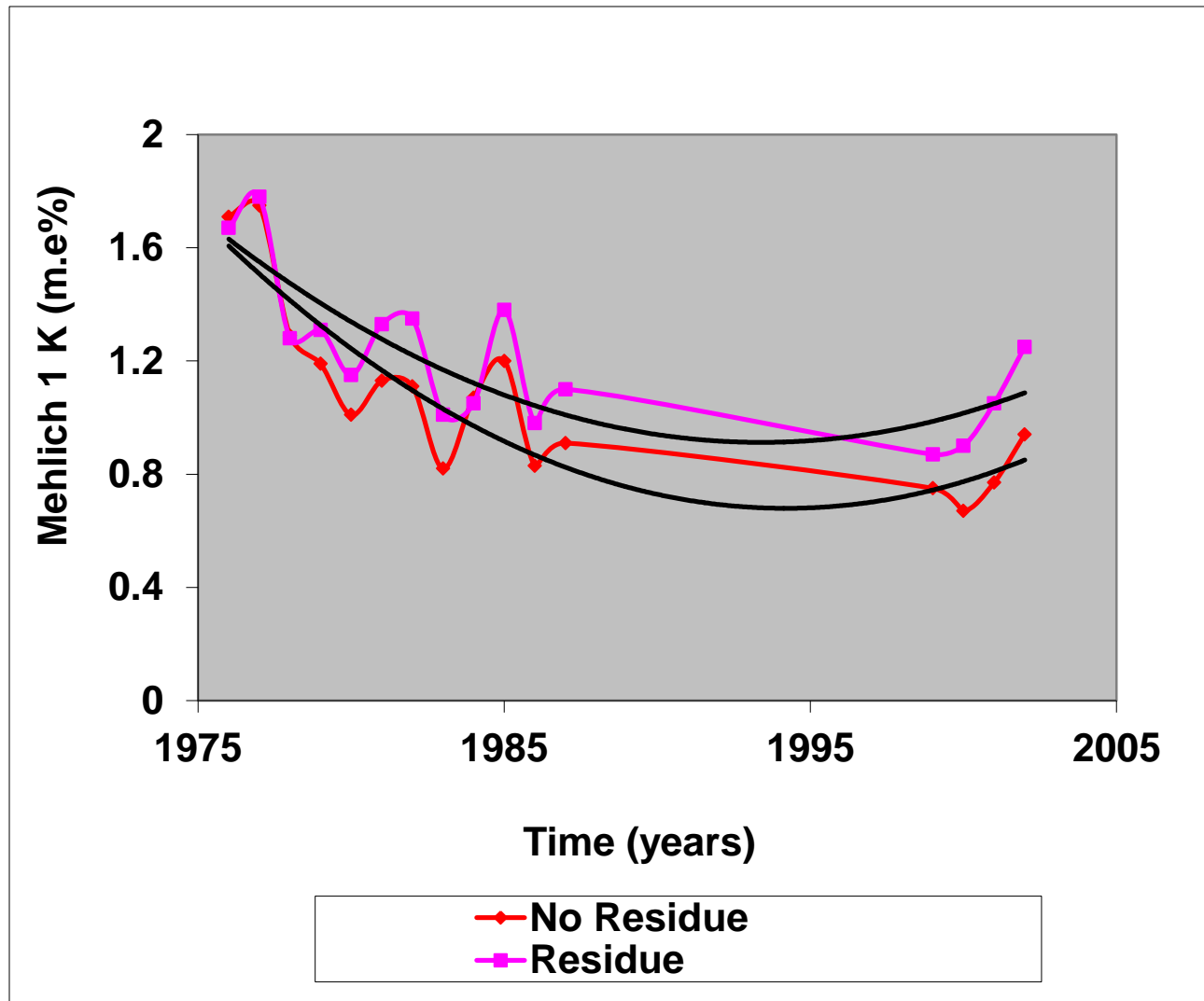


—◆— Nil

—■— Manure (5ton/ha)

—★— Manure (10 t/ha)

# Decline in soil K over 30 years of continuous cropping under maize residue incorporation



# Estimated average annual consumption of main fertilizers (1998-2002) in Kenya

Fertilizer name	Amount (MT)	% Share
DAP	90,963	28.2
MAP	19,465	6.0
25:5:5+5S	64,747	20.0
NPK(23:23:0)	17,536	5.4
CAN	46,816	14.5
Urea	25,369	7.9
Speciality	13,918	4.3
Others	44,187	13.7
<b>All fertilizers</b>	<b>322,532</b>	<b>100</b>

# Introduction...

- **Depletion resulting from continuous cropping leading to K mining to deficiency levels**
- **K deficiency observed in Western Kenya and parts of Central Kenya highlands**
- **Emerging importance of studies in crop responses to K and Soil Critical Potassium levels (SCKLs)**

# Objectives

- **To evaluate the effects of K fertilizer application on five major food-crops in Kenya**
- **To establish crop specific SCKLs for the five food-crops.**

# Materials and Methods

- **Source of data - Fertilizer Use Recommendation Project (FURP)**
  - **70 site in 31 districts**
  - **Soil characteristics**
    - **Soil pH – 4.0 – 7.7 but 21/30 with pH equal or less than 5.5**
    - **Modified Olsen K - 9/30 sites with K equal to or less than 0.2**
    - **Organic carbon – 23/30 with O. C equal to or less than 2.0%**



# FURP Experiments

**Crops grown in 3 modules:**

- **Module 1- Maize monocrop in all sites**
- **Module 2 – Maize /Legume intercrop**
- **module 3 – area specific crops e.g Potato, Sorghum cabbages etc.**

**■ 2 Experiments carried out :**

**Expt. 1 – N x P factorial at 4 levels**

**Expt.2 – N and P plus some site specific treatments such as **K, lime, manure etc.****

# Materials and Methods...

- 5 crops studied were: **Maize(36), Beans(28), Cabbage (15), Potato (17), Sorghum (10)**
- SCKLs were determined by **the Cate-Nelson scatter plot method**. Relative yield was determined by **maximum yields at zero-K /Maximum yields at plus K**

# Materials and Methods...

- **SCKLs were determined by superimposing a vertical and horizontal line on a scatter diagram so as to maximize the number of points in the positive quadrants (Lower left and upper right).**

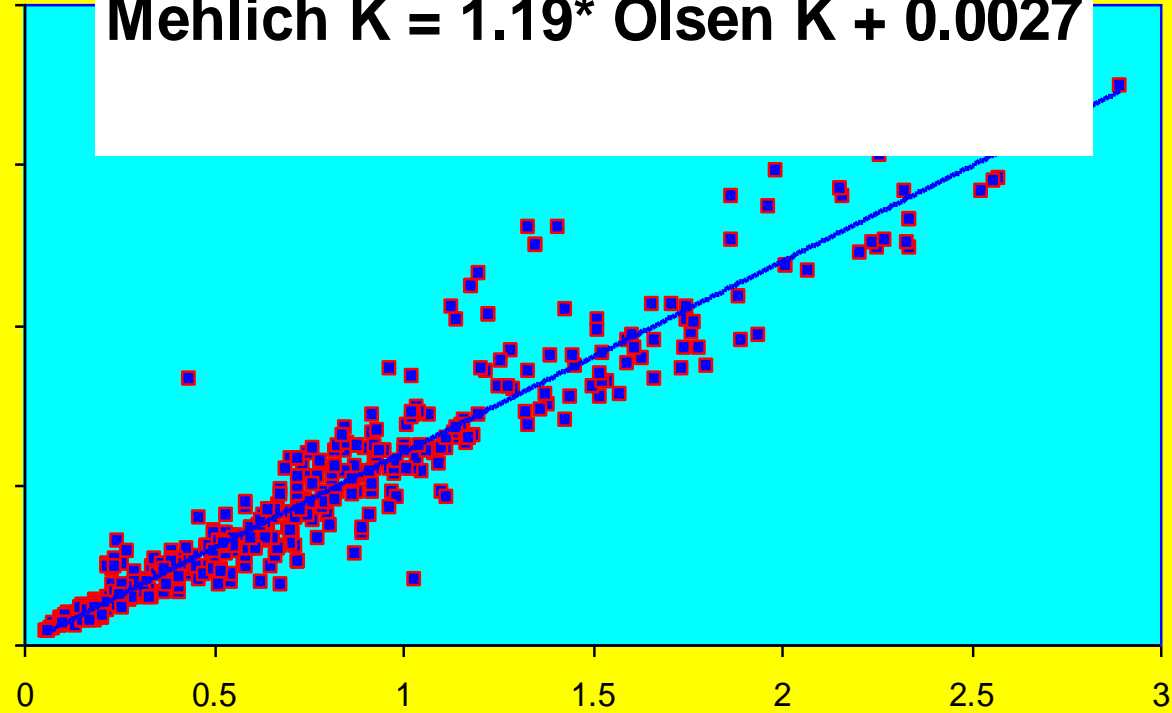
# Results and Discussion

# Summary of Crops, total no. of sites and K-responsive sites and yield increment

<b>Crop</b>	No. of sites in crop	No. sites with sig. K response (pos./neg.)	Yield increment (ha <sup>-1</sup> )
<b>Maize</b>	36	4 / 4	-1.02 – 1.13
<b>Beans</b>	28	2 / 2	-0.07 – 0.29
<b>Potatoes</b>	17	0 / 0	–
<b>Cabbage</b>	15	1 / 1	-2.7 – 3.9
<b>Sorghum</b>	10	1 / 1	-0.25 – 0.45

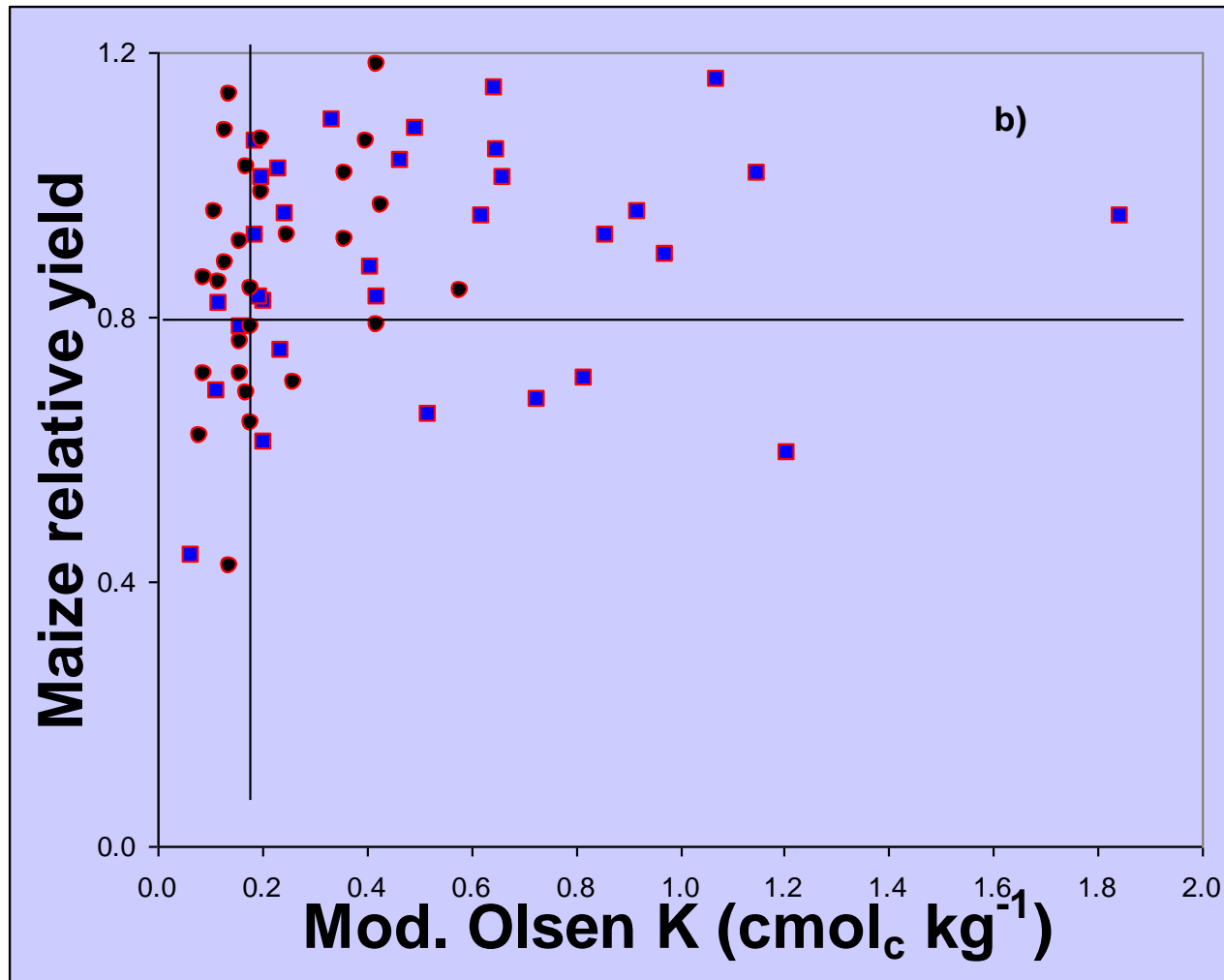
Mehlich 1 K (cmol<sub>c</sub> kg<sup>-1</sup>)

Mehlich K = 1.19\* Olsen K + 0.0027

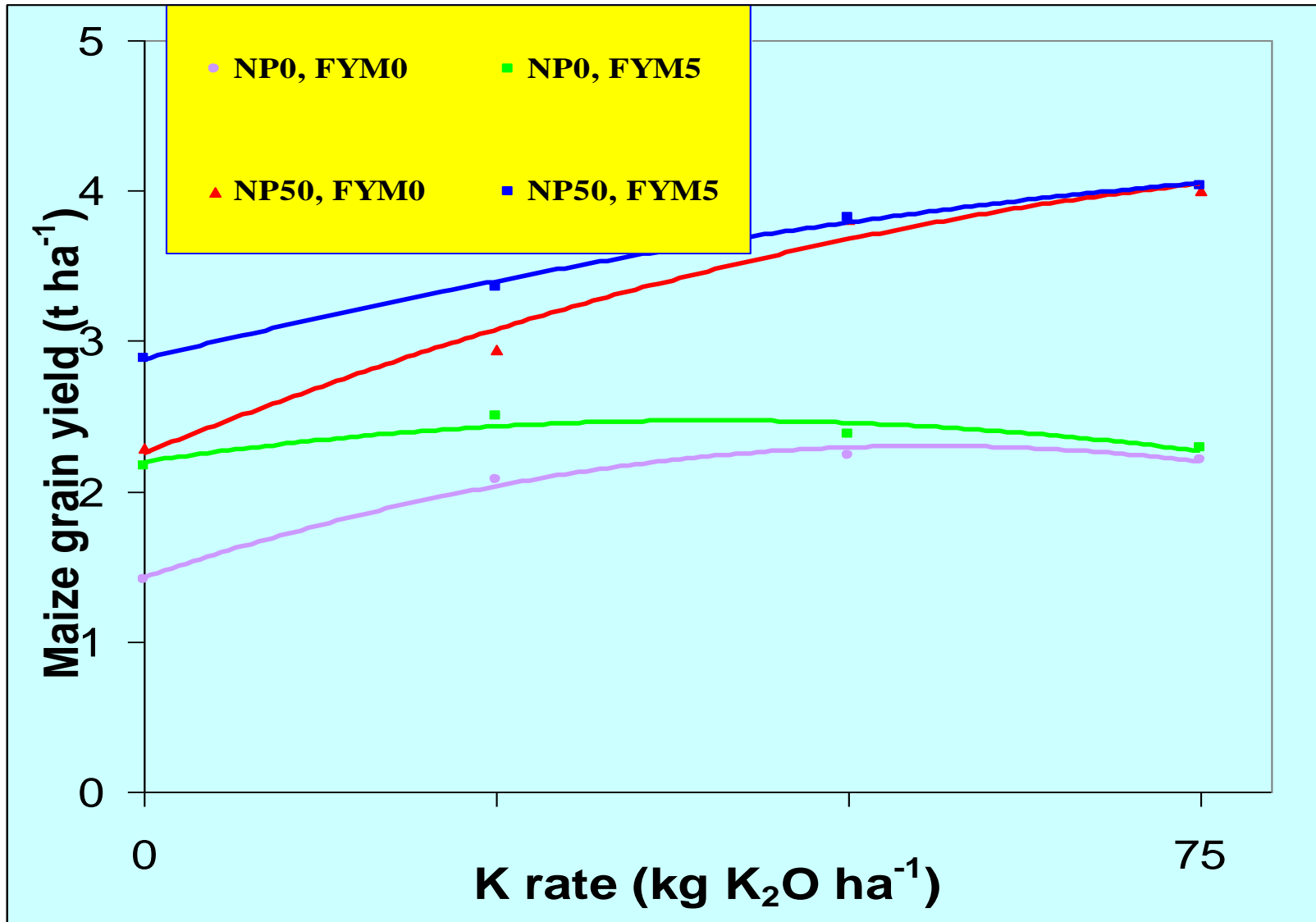


Mod. Olsen K (cmol<sub>c</sub> kg<sup>-1</sup>)

# Maize SCKL

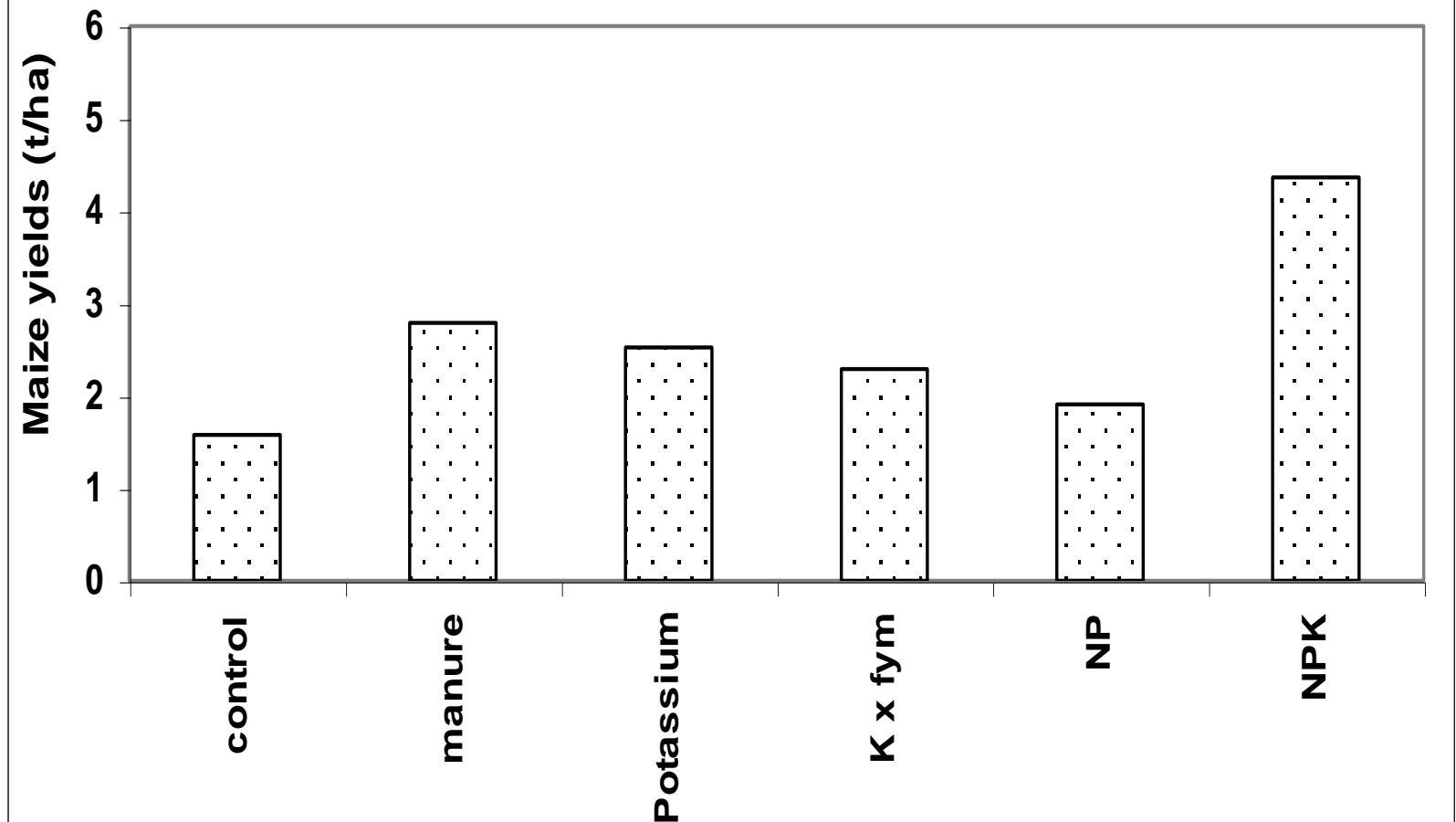


# Maize response to K at Kerugoya

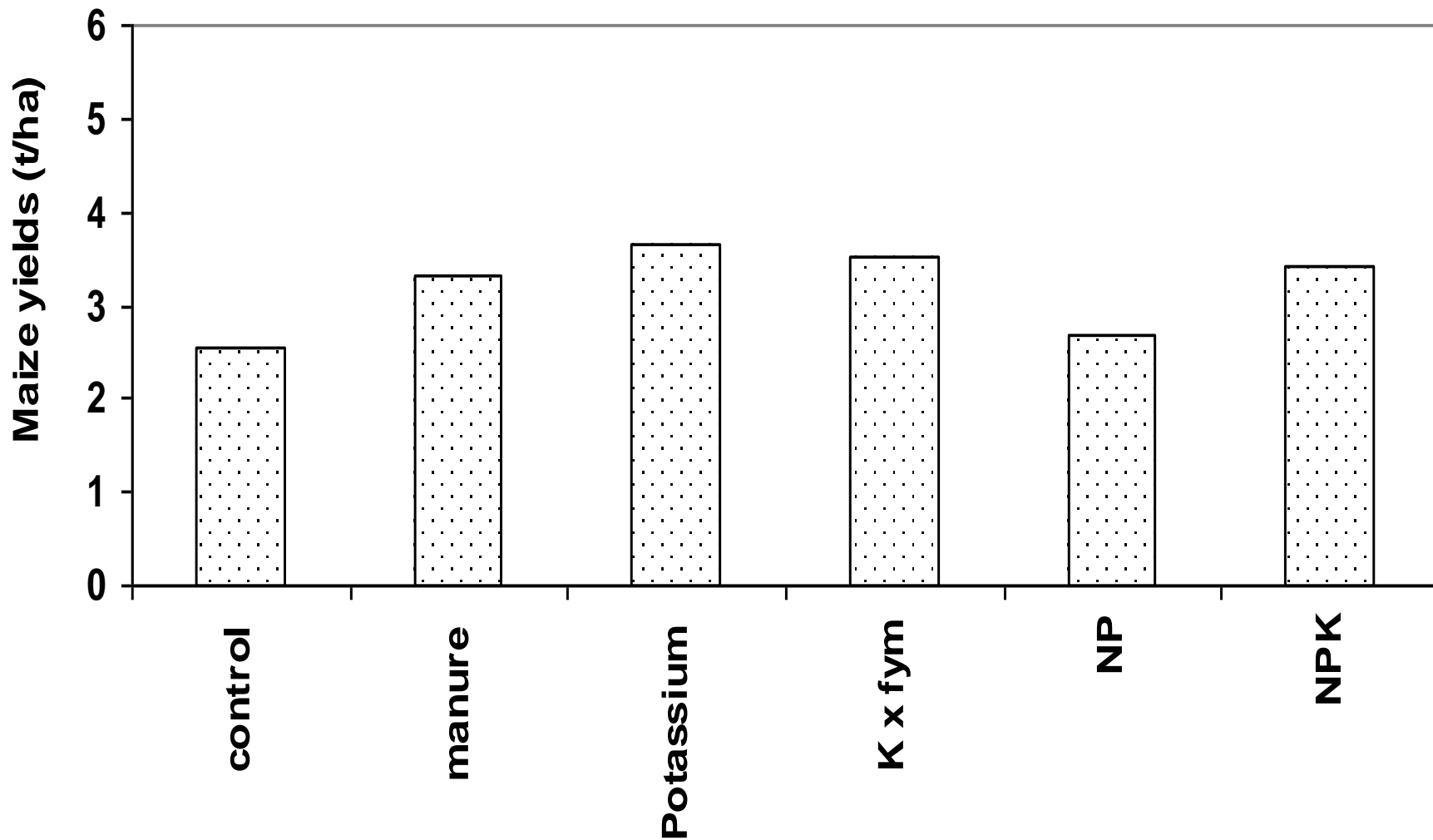




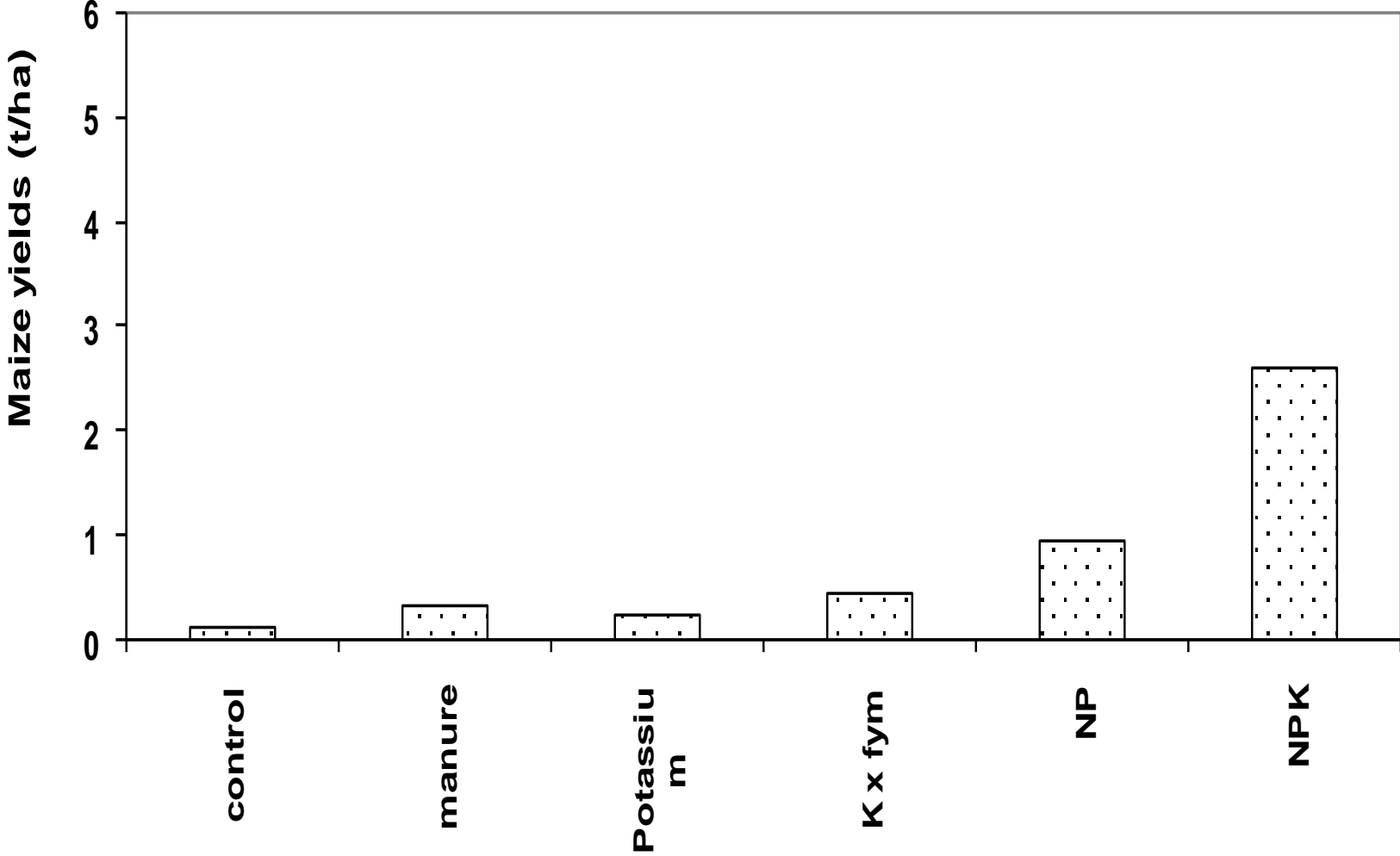
a) Maize response to various treatments at Kerugoya

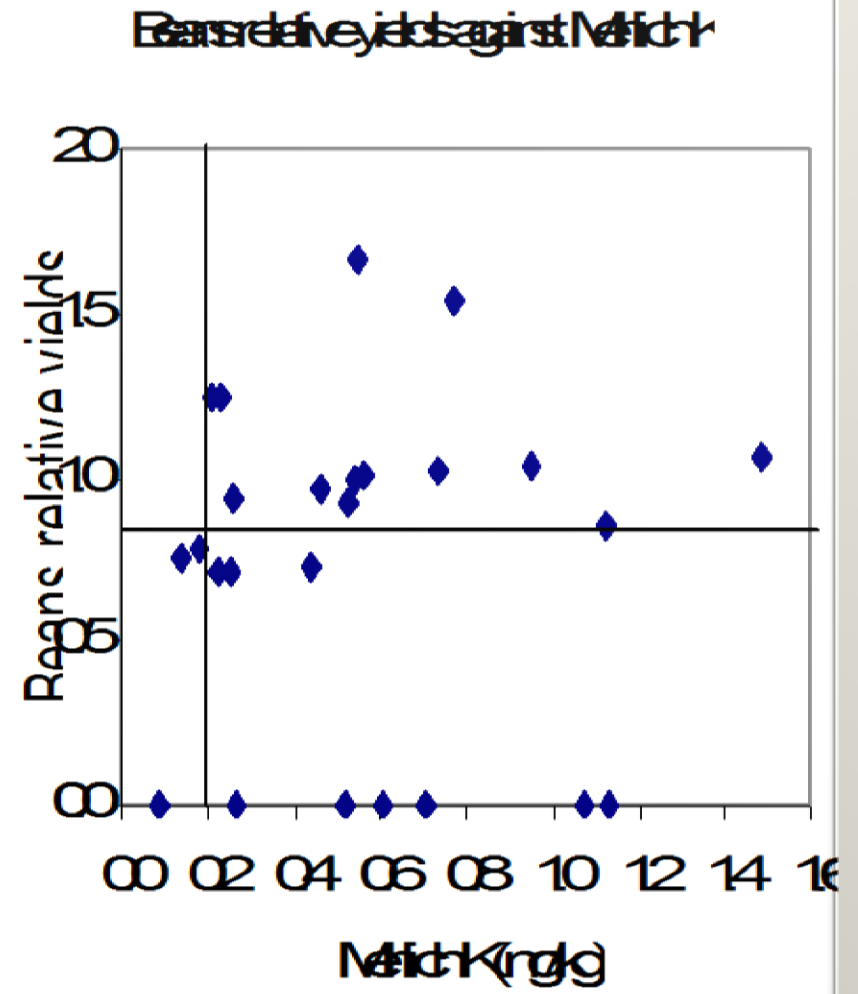
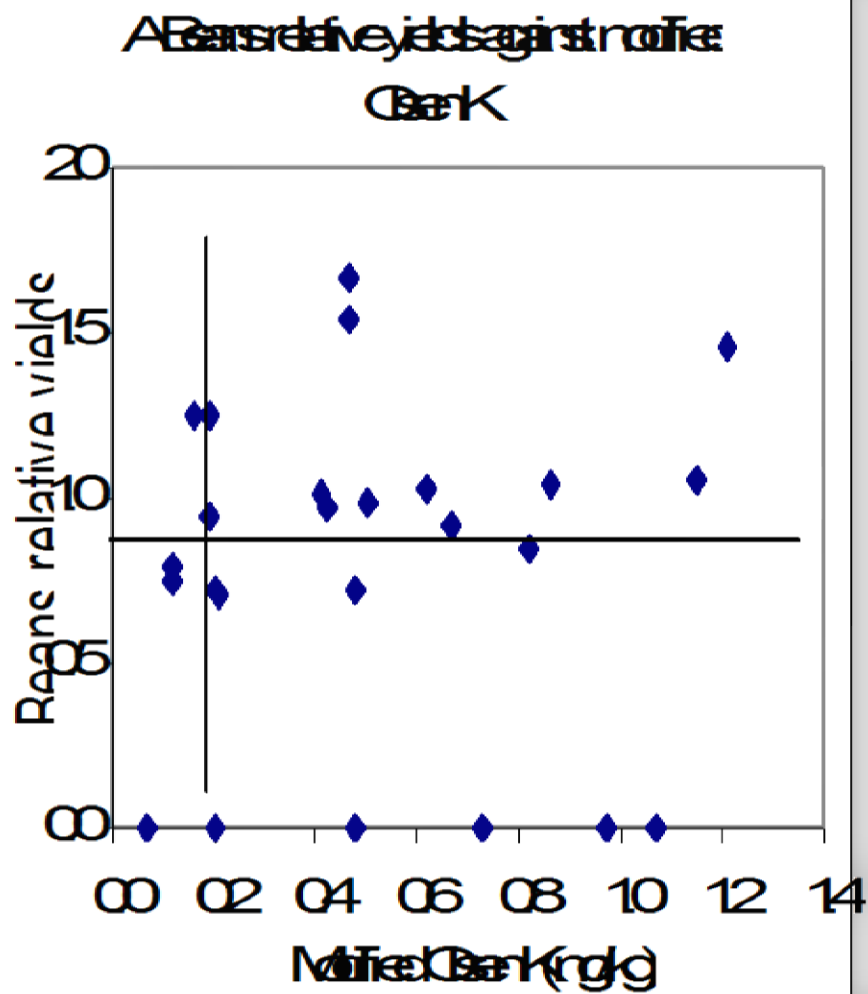


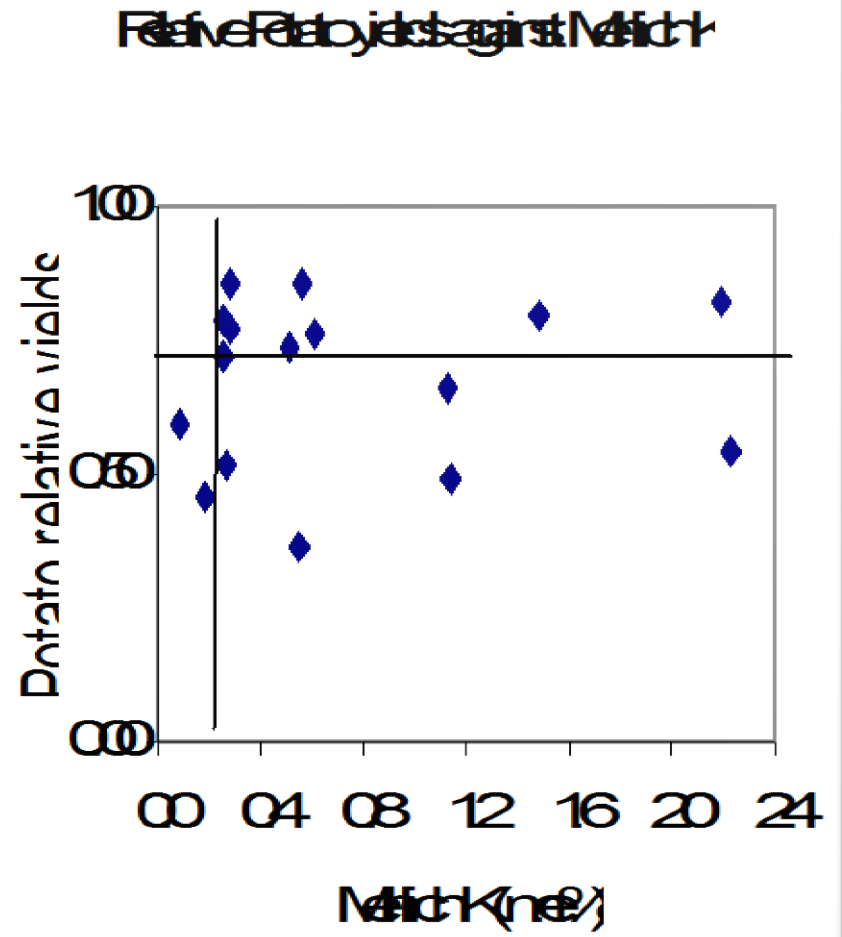
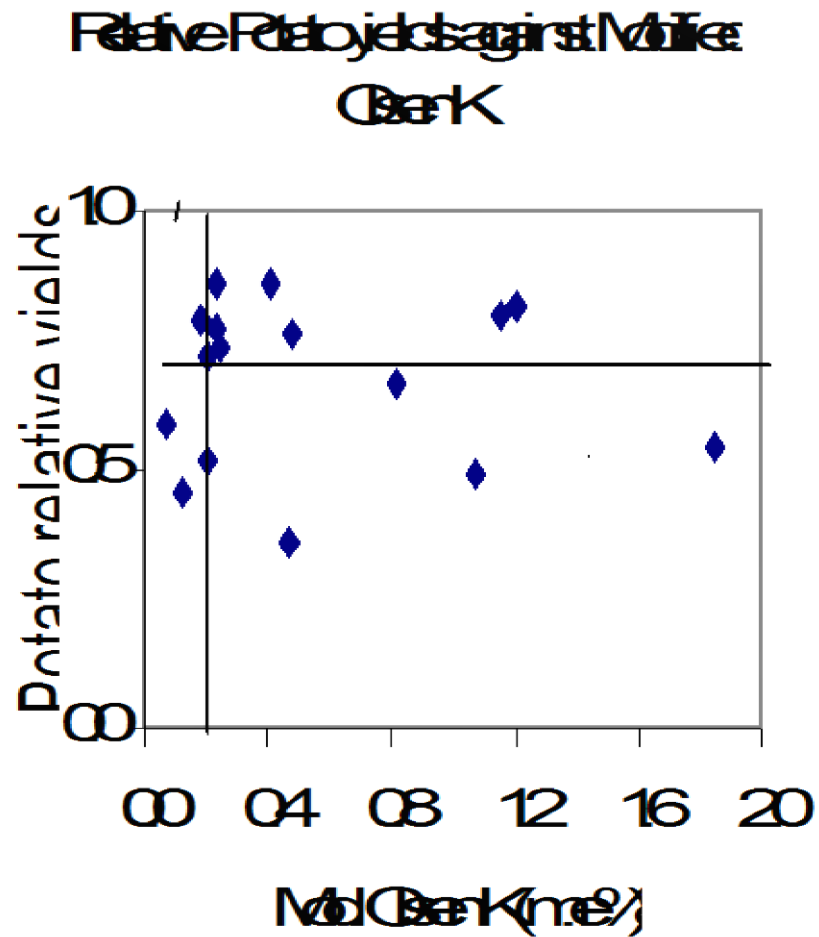
**b) Maize response to various treatments at Tulaga**



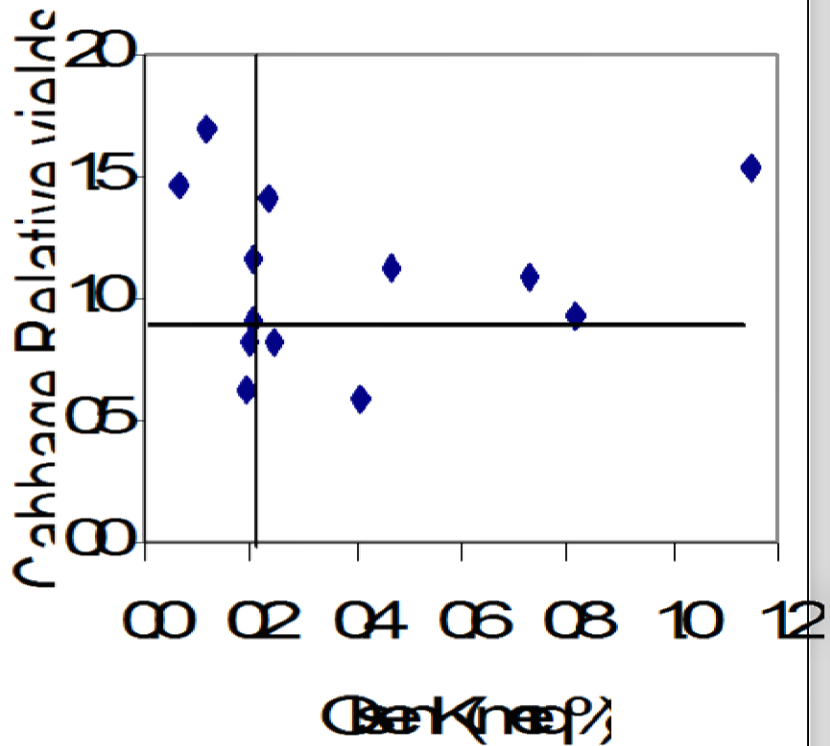
c) Maize response to various treatments at Kavutiri



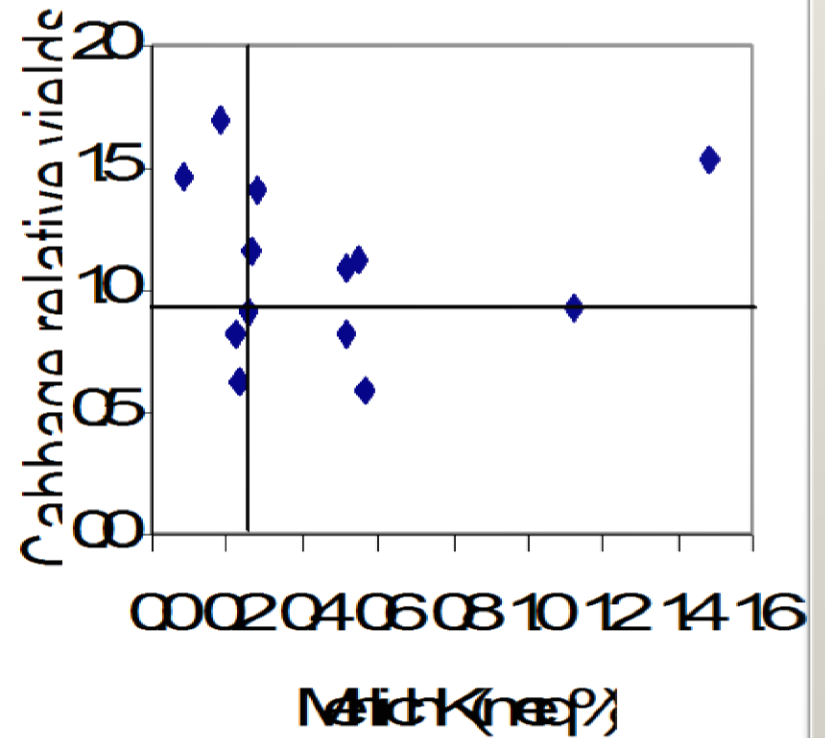


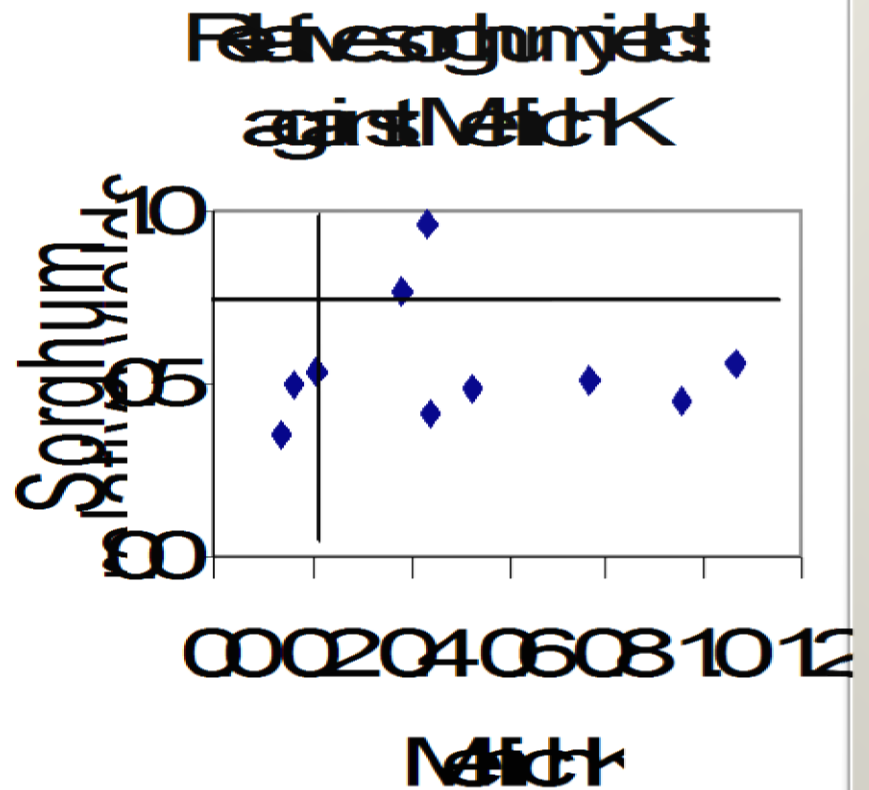
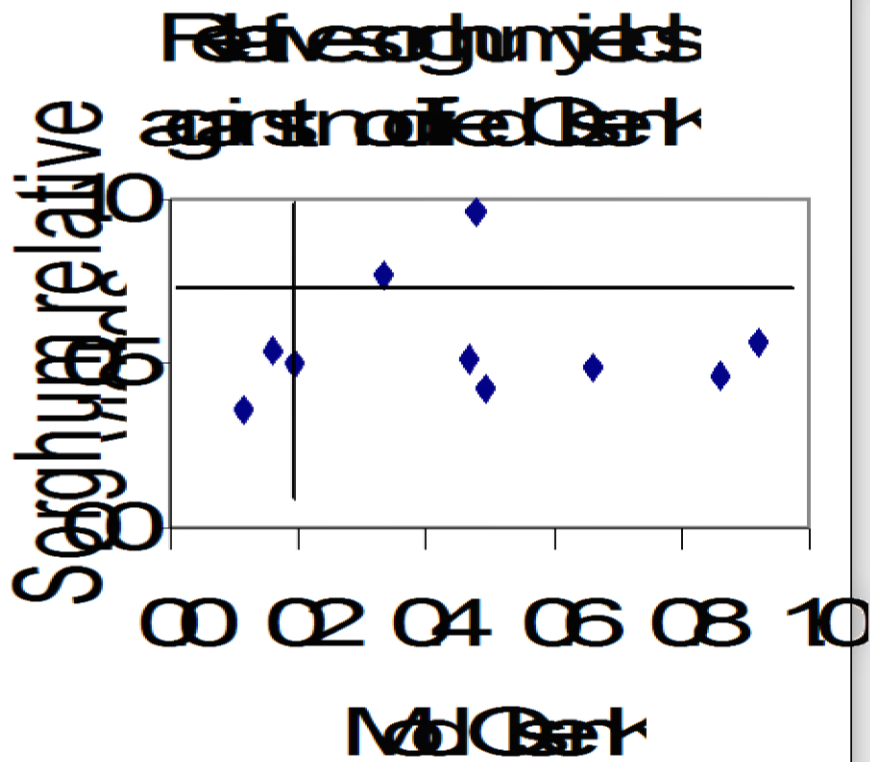


Melegestrela



Melegestrela





# Conclusions

## Extraction Method      Crop Specific Soil Critical K Level ( $\text{cmol kg}^{-1}$ ) levels

	Maize	Sorghum	Cabbage	Potato	Beans
<b>Modified Olsen</b>	<b>0.18</b>	<b>0.20</b>		<b>0.20</b>	<b>0.18</b>
<b>Mehlich 1</b>	<b>0.22</b>	<b>0.23</b>		<b>0.24</b>	<b>0.20</b>



# Conclusions

- ◎ Mehlich K = 1.19 Olsen K + 0.003
- ◎ Responses to K were **positive in some sites and negative in others**
- ◎ SCKLs established in this work requires **refinement** by using more K-deficient soils

# Acknowledgements

- IPI
- GTZ
- GOK
- Director KARLO
- FURP Staff
- Farmers