Soil Tillage and Fertility Management Effects on Maize Yield
in Murang'a and Tharaka-Nithi Counties

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Introduction

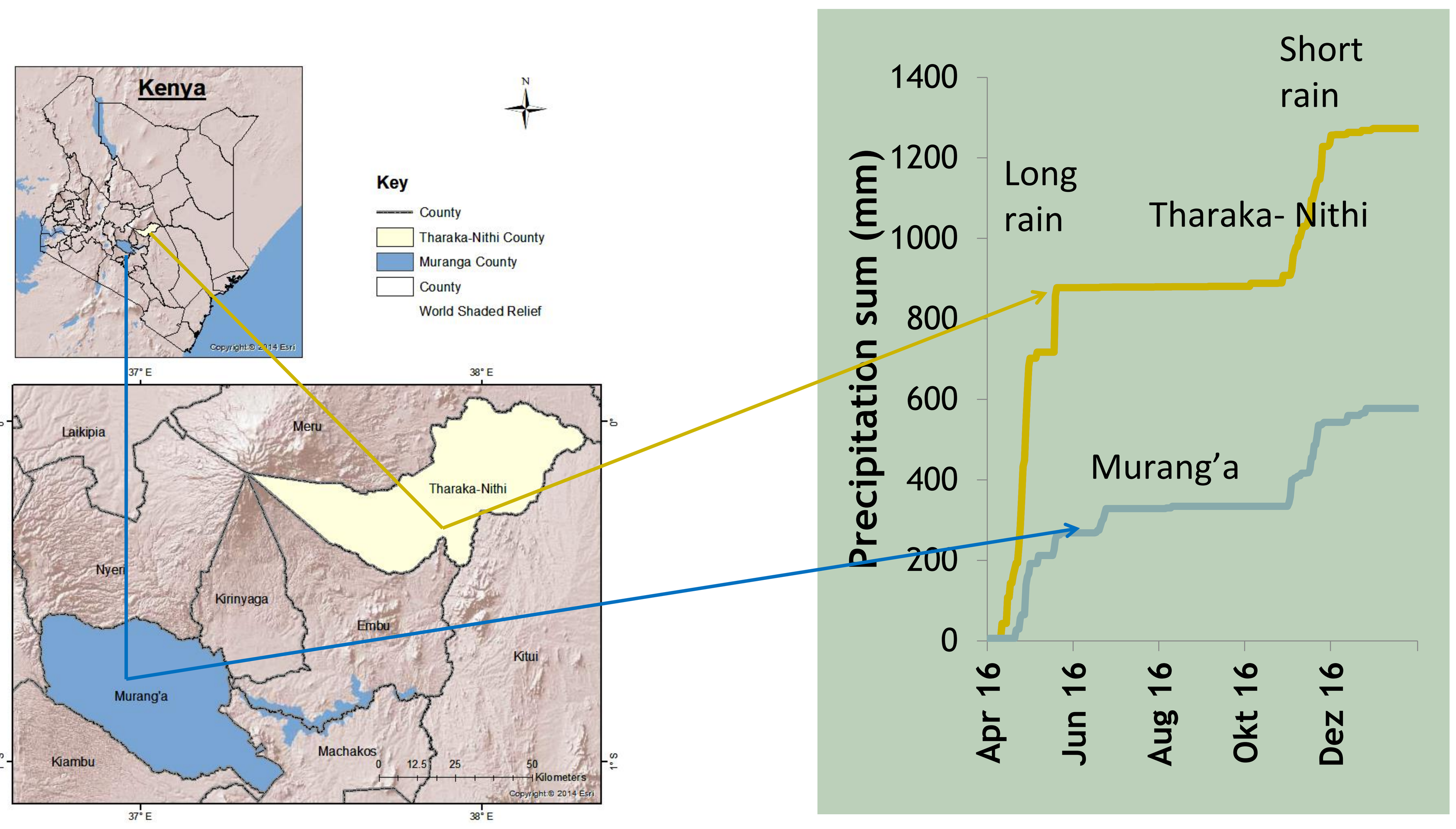
Soil fertility management is a major global constraint for food production. In sub-Saharan Africa soil nutrient decline is a result of unbalanced nutrient mining, soil erosion, lack of resources to build soil fertility and unequal soil fertility management within farms.

Although organic resources are readily available in the central highlands of Kenya, they are poorly used and soil fertility and crop yields are continuing to decline, because the soils lose their functionality. Management techniques to improve soil fertility and crop yield are urgently needed.

The objective of this study was to assess the effects of tillage (minimum and conventional tillage) and organic as well as mineral soil fertility management inputs on maize performance.

Study sites

Replicated field trials were installed in two geo-climatically different regions of Kenya, both receiving bimodal rainfall.



Experiments

The field trials were designed as split plots laid in a randomized complete block design. The test crop was maize (*Zea mays* L.). The 14 tillage and fertility input combinations were replicated four times per site. The trials were run during the long and short rainy seasons in 2016. The short rains faced a serious drought.

The treatments:

Ct: Conventional tillage; **Mt**: Minimum tillage; C: Control no input
Mf: Mineral fertilizer; **RMf**: Crop residues + mineral fertilizer
RMfM: Crop residues + mineral fertilizer + animal manure
RTiM: Crop residues + *Tithonia diversifolia* + animal manure
RTiP: Crop residues + *Tithonia diversifolia* + rock phosphate
RML: Crop residues + animal manure + legume intercrop

Tharaka-Nithi Murang'a

Laying out experimental plots

Data analysis: Data was subjected to ANOVA using Mixed Procedure Model in SAS 9.3 software, HSD at p=0.05

Swiss Programme for Research on Global Issues for Development
ORM4Soil Organic Resource Management for Soil Fertility

Initial soil characteristics

Parameter	Tharaka-Nithi	Murang'a
pH	4.85	5.49
Total N (%)	0.14	0.14
Total OC (%)	1.48	1.38
Available P (g/kg)	0.02	0.02
Exch K^{+} (me %)	0.45	1.15
Exch Ca^{+} (me %)	2.53	4.15
Exch Mg^{+} (me %)	1.17	1.38

Maize yield

Maize grain yield [$Mg\ ha^{-1}$]

Treatment	Tharaka-Nithi		Murang'a	
Tillage	**LR16**	**SR16**	**LR16**	**SR16**
Ct	2.59^{a}	0.71^{a}	3.26^{a}	0.51^{a}
Mt	2.76^{a}	0.56^{a}	3.33^{a}	0.52^{a}
p value	0.37	0.09	0.69	0.81
Soil external Input				
C	1.58^{b}	0.14^{d}	2.37^{e}	0.29^{c}
Mf	2.22^{a}	0.85^{ab}	3.82^{b}	0.77^{a}
RMf	3.05^{a}	1.16^{a}	3.70^{bc}	0.63^{a}
RMfM	3.49^{a}	1.09^{a}	4.67^{a}	0.69^{a}
RTiM	3.21^{a}	0.58^{bc}	3.09^{c}	0.68^{a}
RTiP	3.07^{a}	0.49^{c}	2.93^{d}	0.46^{b}
RML	2.11^{b}	0.12^{d}	2.46^{e}	0.11^{d}
p value	0.0001	0.0001	0.0001	0.0001
Interactions	n.s.	n.s.	n.s.	n.s.

In the first year of the trial, we didn't find any tillage effects. In the short rainy season the crops failed. Organic inputs in combination with mineral fertilization produced the highest maize grain yields during LR16. Compared to MF alone they were 57% higher in Tharaka-Nithi and 22 % in Murang'a.

Maize stover yield [$Mg\ ha^{-1}$]

Treatment	Tharaka-Nithi		Murang'a	
Tillage	**LR16**	**SR16**	**LR16**	**SR16**
Ct	5.39^{a}	0.004^{a}	5.03^{a}	0.0043^{a}
Mt	4.20^{b}	0.003^{b}	5.24^{a}	0.0044^{a}
p value	0.0001	0.003	0.72	0.79
Soil external Input				
C	2.20^{d}	0.002^{dc}	3.00^{c}	0.0041^{b}
Mf	4.70^{bc}	0.005^{a}	5.67^{a}	0.0041^{b}
RMf	5.51^{b}	0.006^{a}	7.23^{a}	0.0045^{ab}
RMfM	6.72^{a}	0.006^{a}	5.96^{a}	0.0046^{ab}
RTiM	5.39^{b}	0.003^{bc}	5.13^{abc}	0.0057^{a}
RTiP	4.91^{c}	0.004^{b}	5.52^{ab}	0.0043^{ab}
RML	4.14^{c}	0.001^{d}	3.44^{bc}	0.0034^{b}
p value	0.0001	0.0001	0.05	0.12
Interactions	0.01	n.s.	n.s.	n.s.

In Tharaka-Nithi stover yields under CT were higher than under MT and some significant interactions were found during the long rains.

Conclusion

- Soil fertility inputs significantly increased grain and stover yields at both sites even under drought conditions experienced in the short rains.
- Combinations of mineral and organic inputs resulted in higher grain and maize stover yields.

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