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Soil fertility inputs and tillage influence on maize crop performance and soil water content in the Central Highlands of Kenya

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Abstract

Rigorous land ploughing and cropping (fertiliser treatment and mineral fertiliser combined with animal manure treatment) consistently enhanced maize crop growth and development as observed through enhanced chlorophyll content, plant height and yields. Application of soil fertility inputs significantly improved grain and stover yields except in the crop residue combined with animal manure and legume intercrop treatment (perhaps due to nutrients' competition since Lablab has an intensive rooting system). Sole organic inputs enhanced soil moisture content in both sites. Emerging from the study, however, is the lack of advantage of minimum tillage over the conventional tillage, within the period under consideration. Thus, this study highlights the possibility of improving soil water holding capacity through application of organic inputs such as crop residues, *Tithonia diversifolia* and manure, either singly or in combination. It further underpins the uniqueness of an integrated approach to soil fertility and low soil moisture content in the tropical sub-humid regions experiencing erratic rainfall in the Central Highlands of Kenya due to low and declining soil fertility, inappropriate tillage methods, soil water scarcity and prolonged dry-spells. In this study, we assessed the effects of two tillage systems and soil fertility inputs on maize crop performance and soil water content. The research was carried out in Chuka and Kandara sites in the Central Highlands of Kenya for four seasons; long rains 2016, short rains 2016, long rains 2017 and short rains 2017. The experimental design was a split plot with tillage method (minimum and conventional) as the main treatments and soil fertility inputs as the sub-treatments: Sole mineral fertiliser, mineral fertiliser combined with crop residue, mineral fertiliser combined with animal manure, *Tithonia diversifolia* combined with phosphate rock (Minjingu),

animal manure intercropped with *Dolichos Lablab* L. and a Control (conventional tillage with no inputs). Except for the control, and sole mineral fertiliser, crop residue was applied as mulch in all treatments. Based on the results, the treatments with mineral fertiliser (sole mineral fertiliser combined with mineral fertiliser treatment and mineral fertiliser combined with animal manure treatment) consistently enhanced maize crop growth and development as observed through enhanced chlorophyll content, plant height and yields. Application of soil fertility inputs significantly improved grain and stover yields except in the crop residue combined with animal manure and legume intercrop treatment (perhaps due to nutrients' competition since Lablab has an intensive rooting system). Sole organic inputs enhanced soil moisture content in both sites. Emerging from the study, however, is the lack of advantage of minimum tillage over the conventional tillage, within the period under consideration. Thus, this study highlights the possibility of improving soil water holding capacity through application of organic inputs such as crop residues, *Tithonia diversifolia* and manure, either singly or in combination. It further underpins the uniqueness of an integrated approach to soil fertility and low soil moisture content in the tropical sub-humid regions experiencing erratic rainfall.

Keywords

Rain-fed agriculture; Erratic rainfall; Organic inputs; Soil moisture content