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Socio-ecological Niches for Technologies to Improve Soil Fertility and Maize Production in Kakamega, Western Kenya

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Abstract

Farming in Kakamega is characterised by poor productivity due to limiting bio-physical factors, mainly low soil fertility and weeds infestation, together with socio-economic factors, particularly labour shortages and restricted access to capital, knowledge and markets. This situation could be improved by technologies that fit the prevailing socio-ecological conditions. A study on the socio-ecological fitness of technologies recommended to improve soil quality and consequently maize yields was undertaken with the following aims: i) to determine site and system-specific resource requirements and benefits of the proposed technologies; iii) to derive technology-specific fit indicators and; iii) to develop a decision support tool to target appropriate technology for a particular farm type. Five sites were set in three common soils and seven technical options (clean weeding, animal manure, seed priming, mineral fertiliser, zero-tillage with mineral fertiliser application, zero-tillage with cover crop (*Arachis pintoi*) and mineral fertiliser application, green manure (*Mucuna puriens*) and a control) were evaluated in the predominant soil types (Alfisols, Ultisols and Nitisols) for two growing seasons. Socio-ecological fitness of the technical options was evaluated based on socio-economic characteristics of pre-defined farm types and ecological factors. Socio-economic requirements for each technology were assessed in terms of labour, land, capital and knowledge needs. CERES-maize model was used to establish the gap between potential and actual yields. Benefits were considered in terms of labour- and land-saving, ease of implementation, effectiveness of weed control, as well as changes in maize yield and soil quality parameters. A decision support system will be developed by a multiple regression model that relates the resource requirements and benefits obtained from particular technology to the resources available in a farm type. Preliminary socio-economic results indicate that the cover crop and green manure technologies required 22 % and 20 % more labour than the control, while for animal manure and mineral fertiliser application the inputs were 10 % and 11 % higher, respectively. Most evaluated technologies required higher total capital inputs than the control: zero tillage with cover crop (32 %), green manure incorporation (26 %), mineral fertiliser (13 %) and manure application (9 %). Soil and plant samples are yet to be analysed awaiting the on-going second season.

Keywords: *Arachis pintoi*, CERES model, factors of production, *Mucuna puriens*, nutrient deficiency, weeds, zero-tillage

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