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Economic Assessment of Different Improved Fallow (IF) Strategies Using the Water, Nutrient and Light Capture in Agroforestry Systems (WaNuLCAS) Model

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Abstract

Scarce financial capital resources and low soil fertility are the major agricultural crop production constraints of small scale farmers in Sub Saharan Africa. These constraints have a negative effect on household income, livelihood and food security. Improved fallows (IF) are promoted as a low cost alternative to the sole use of costly chemical fertilisers to raise crop productivity. Several studies have demonstrated that IF can enhance soil fertility, carbon stocks, and biomass production suggesting that IF are a potential means to overcome the problem of low soil fertility and poor crop yields in a sustainable way. The biophysical long term effects of IF have already been quite well simulated with the Water, Nutrient and Light Capture in Agroforestry Systems (WaNuLCAS) model. However, its' socioeconomic sub-model has not yet been properly tested under different IF scenarios. The socioeconomic aspects include the sensitivity of the IF production system to household-specific production factors (e.g. labour input) and external factors such as changes in crop and fertiliser market prices, climate change, and a potential remuneration of carbon sequestration under the Clean Development Mechanism (CDM). To address this knowledge gap, the objective of this study is to assess the profitability of two IF species (*Tephrosia candida* and *Crotalaria paulina*) in promoting crop production of maize in relay cropping and rotation under different short and long term IF-crop rotation scenarios. Based on data from several project sites in Western Kenya, a cost-benefit analysis was conducted, and the WaNuLCAS socioeconomic sub-model was applied. The study highlights the strengths and limitations of the simulation capacity of the sub-model. Furthermore, the results demonstrate which IF alternatives, in both short and long terms, 1) result in a balance of the trade-offs occurring between increase in soil fertility, crop yield, and income for the small-scale farmer, and 2) maximise farmers' profits if one takes the external factors mentioned above into consideration.

Keywords: Crop modelling, Improved fallow, cost-benefit analysis, WaNuLCAS

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