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Doubling Returns to Land and Labour? The Potential of Improved Tree Fallow in the Humid Highlands of Southwestern Uganda

David Siriri[1], Thomas Raussen[2]

[1] *International Centre for Research in Agroforestry (ICRAF), Uganda*
[2] *Consultant, Germany*

Abstract

Decreasing per capita food production and insufficient wood availability affect the livelihood of smallholder farmers in highlands of Southwestern Uganda. Fields on bench terraces are under intensive continuous cultivation without any soil amendment leading to nitrogen deficiency and a degraded soil structure. The study explored the potential of tree improved fallows in overcoming wood deficits and soil limitations.

The potential of indigenous (*Sesbania sesban*, *Acanthus pubescens*) and exotic (*Calliandra calothyrsus*, *Alnus acuminata*, *Tephrosia vogelii*) tree species as improved fallow on previously degraded land was compared to natural fallow and continuous cropping in a randomized block design with 3 replications. After a fallow phase of two years, trees were harvested, wood removed while leaves and twigs were incorporated before crops were grown. Performance of *Triticum aestivum* and *Zea mays* was assessed for four seasons. The effect of fallows on water conductivity and weed biomass and its composition was assessed.

Soils sampled showed significant ($p < 0.05$) differences between treatments in their nitrogen (NH_4^+ and NO_3^-) levels, especially on the less fertile upper parts of the terrace with highest levels for *Sesbania* followed by *Calliandra*. In both the fallow and cropping phases, weed biomass was lowest in the plots with leguminous tree fallows.

Sesbania, *Calliandra* and *Alnus* produced over 24 tones ha^{-1} of sun-dried firewood, respectively. Farmers preferred *Alnus* and *Calliandra* for their firewood qualities and higher farm gate prices. Green manure production from tree fallows ranged from 5.4 to 1.8 t ha^{-1}.

Crop performance after the fallow phase followed the trends in mineral nitrogen levels. *Sesbania* and *Calliandra* plots had significantly higher wheat and maize yield across all the four seasons. The levels of mineral nitrogen explain only 42 % of the yield differences while differences in soil physical properties are thought to be reason for much of the remaining differences as evidenced by doubled water conductivity in the fallow plots.

The yield advantage due to fallows declined over time as nutrients continue to be removed through crop harvest and soil structure deteriorated with continued cropping.

The system shows potential to double returns to land and labour and is currently under wide on-farm testing.

Keywords: Agroforestry, improved fallows, Uganda

Contact Address: Thomas Raussen, Consultant, Wilhelmshäuserstraße 15, 37217 Witzenhausen, Germany, e-mail: tgraussen@aol.com