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"Development on the margin"

Carbon Sequestration through *Jatropha curcas* Afforestation: Preliminary Results from Burkina Faso

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Abstract

Afforestation with *Jatropha curcas* is often cited as promising option to alleviate energy scarcity through biofuel production and to fight land degradation by controlling soil erosion. *J. curcas* cultivation and processing in Burkina Faso has been actively promoted since 2007. The current study contributes to the ecological sustainability assessment of this growing sector. To this end, different scenarios of *J. curcas* production and processing in regard to their carbon and energy balances will be analyzed.

Based on a prior classification study of *J. curcas* systems in Burkina Faso, *J. curcas* systems were stratified in homogenous subgroups according to the criteria age, land management and region. Within these strata, 24 locations in four regions were selected for further analysis, comprising intercropping and monoculture systems up to an age of four years with different management intensities and living fences with an age up to thirty years. First results can be described with two foci: (1) plant-age, site and land management-dependent carbon sequestration in soil and biomass, (2) quantification of all on- farm carbon-based inputs.

By means of destructive biomass sampling, an empirical regression model predicting total aboveground biomass (B) with the stem diameter (D) could be developed, yielding $B=0.018\ D^{2.162}$ ($R^2=0.92$; a=0.018±0.006 ($p < 0.013$); b=2.162±0.119 ($p < 0.000$)). Depending on site and management properties, the aboveground biomass production varies strongly with the lowest biomass production observed on afforested marginal sites. A 2.5- year-old not managed *J. curcas* plantation on marginal land (Leptosol), characterised by shallow stony soil on a steep slope, accumulated 174.5± 132.3 kg of dry aboveground biomass ha^{-1}, providing no seed yield. In contrast, a 2.5-year-old plantation on a Lixisol managed by regular weeding and low fertilisation in the same region, produced 796.6±303.5 kg ha^{-1} with a dry seed yield of 704.4±166.2 kg ha^{-1} a^{-1} ($p < 0.005$) (both planted in a planting distance of 4×4 m). The same trends show below-ground biomass. Overall investigated systems, aboveground carbon stocks ranged from less than one Mg C ha^{-1} for young plantations to 15 Mg C ha^{-1} for mature living fences.

Keywords: Biofuel, Burkina Faso, carbon sequestration, Jatropha

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