Enhanced energy security for smallholder farmers via integrated agroforestry systems in Tanzania

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Background

Fuelwood scarcity is a reported issue in developing countries where woodfuel (fuelwood and charcoal) consumption is one of the drivers of forest degradation and deforestation. In semiarid areas of Tanzania, firewood supply is a severe challenge. With regard to the demand side of firewood consumption, a lack of clean cooking energy sources and the use of energy-inefficient cooking devices contribute to high firewood demand at household level. However, consumption of firewood is reduced by using improved cooking stoves (**ICS**) compared to 3-stone fire stoves (**TSF**) common in rural areas. At the same time, enhancing on-farm firewood supply by agroforestry interventions can reduce households' dependency on firewood from off-farm sources.

Research aim

Our research aim was

- to determine the firewood consumption during cooking using two different types of firewood (on-farm produced *Gliricidia sepium* vs. forest-based firewood (*Mrama*) assessed by three-stone-fire stoves (Fig. 1) and improved cooking stoves (Fig. 2).
- to quantify the firewood production potential of annually pruned on-farm *G. sepium* shrubs (Fig. 3).

Materials and Methods

Three-stone-fire stove (Fig. 1)

Improved cooking stove (Fig. 2)

Gliricidia sepium wood (Fig. 3)

- We adopted the controlled cooking test methodology to assess the firewood consumption patterns of three-stone-fire stoves (N=31) and improved cooking stoves (N=14) comparing *G. sepium* firewood and the forest-based firewood species (Mrama). We used one-year old (air-dried) *G.* sepium firewood pruned prior to maize sowing to calculate wood production. We standardized the cooking task in order to make firewood consumption patterns comparable across both stove types (Fig. 4).
- The firewood production potential was assessed on a 5-year old *G. sepium* intercropping experiment at Manyusi village, Kongwa District, Tanzania. *G. sepium* was planted at 4-m x 4-m spacing within 16-m x 16-m plots in a RCBD with 3 replications. Biomass data on *G. sepium* wood was obtained from two different intercropping systems:

  System 1: Maize and *G. sepium*

  System 2: Maize, Pigeonpea and *G. sepium*

Major results

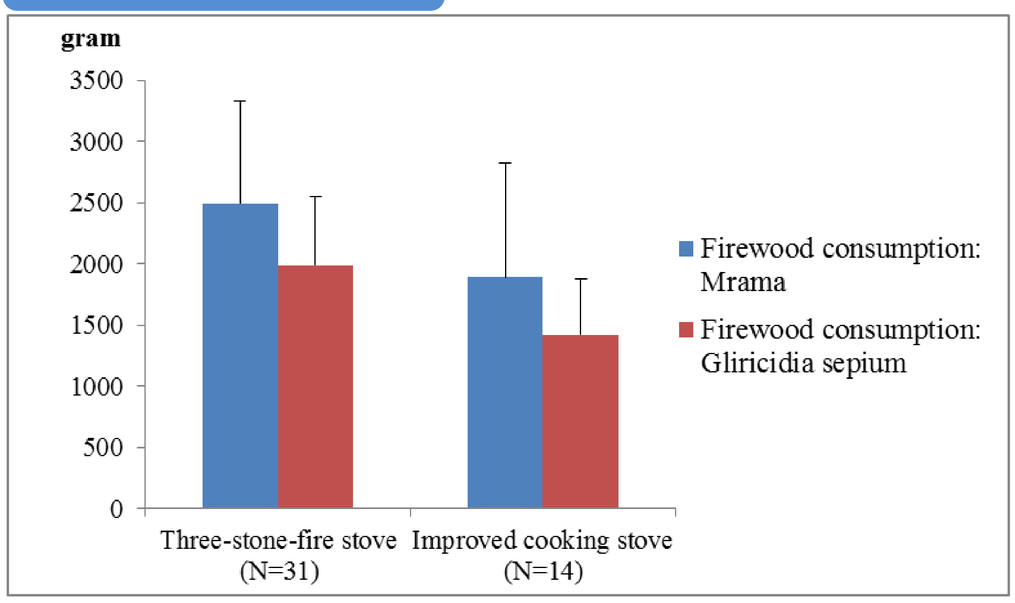

Fig. 4: Firewood consumption per meal measured with two firewood species and two cooking stove technologies (including standard deviation)

- The firewood consumption per meal using ICS compared to TSF was reduced by 24.3% with *Mrama* and by 28.5% with *G. sepium*.
- The firewood consumption with *G. sepium* was 20.2% lower compared to firewood from *Mrama* with three-stone-fire stoves; respectively 24.6% with improved cooking stoves.
- With a combined transition from three-stone-fire stoves to improved cooking stoves and from *Mrama* to *G. sepium* firewood, a substantial reduction of firewood consumption per meal of 42.9% might be realized.

- Extrapolation: Determining households' annual firewood consumption, assuming 2.5 cooking tasks per day and a household size of 5 members (Fig. 5).

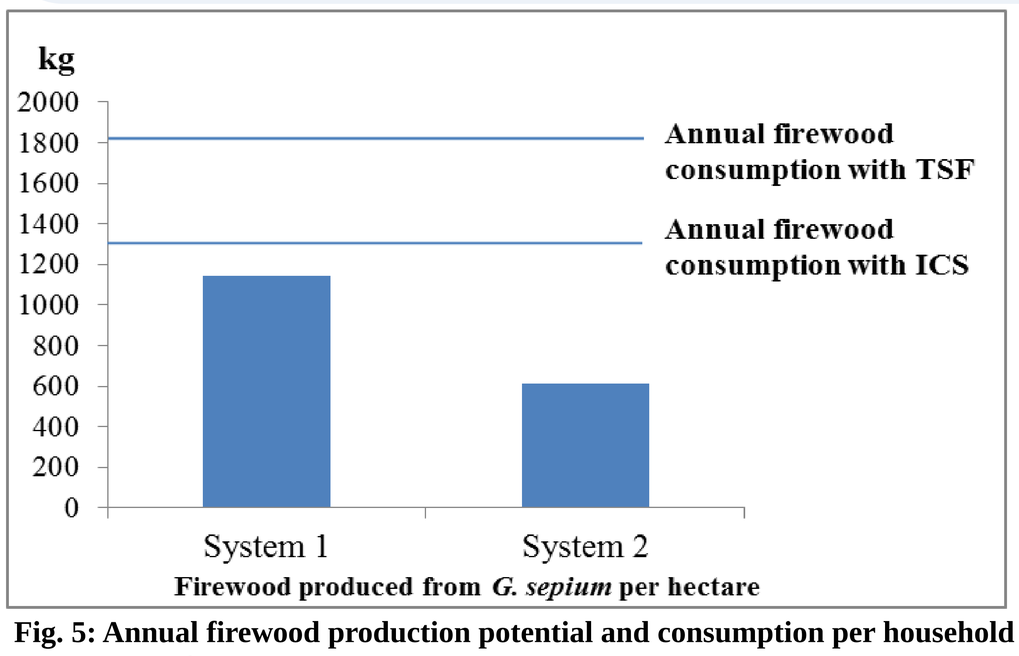

Fig. 5: Annual firewood production potential and consumption per household with *G. sepium*

Conclusion

Integrating the tested agroforestry and ICS technologies can make households independent from off-farm firewood to meet their cooking energy demand and contribute to reduce forest degradation.

Partners:

Leibniz-Zentrum für Agrarlandschaftsforschung (ZALF) e.V.

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