HOUSEHOLD BIOCHAR PRODUCTION AND USE BY SMALLHOLDER FARMERS IN KENYA

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About 40% of the world population lack access to clean cooking fuels. In rural sub-Saharan Africa the majority of people prepare their meals with firewood on open three stone fires. Biochar-producing microgasification cookstoves provide an opportunity to reduce fuel consumption and reduce the indoor air pollution in the cooking area, while use of biochar in soils sequesters carbon and increases agricultural yields, thereby improving livelihoods, especially for women. This paper presents findings from transdisciplinary research that started with long-term biochar field trials established in 2006. During recent years this research has involved 150 farming households at 3 locations in Kenya that produce biochar in locally manufactured GASTOV Top-lit Updraft (TLUD) gasifier cookstoves and use the biochar in their own fields. Fuel use, indoor concentrations of CO, CO_2 and $PM_{2.5}$ in cooking areas, and biochar production potential was measured in 75 households during cooking of a common Kenyan meal. The produced biochar was used in field trials with maize (*Zea mays*) and kale (*Brassica oleracea*) comparing biochar to normal farming practices, at biochar doses of 1-10 t ha^{-1}. Findings from one of the sites, in Kwale County, show that for cooking a meal, on average 18 % of fuel was saved compared to the three stone open fire. In addition, 200 g biochar were produced which corresponded to 16.5% of the biomass used. Concentrations of CO and $PM_{2.5}$ were reduced by 57 and 79 %, respectively. Fuel use was dominated by the wood types neem (*Azadirachta indica*) and casuarina *(Casuarina equisetifolia)*, but a large variety of wood types were used by the households. Yield increases of maize in Kwale correlated positively with biochar dose. For the 20 farmers that finalized the trials in the first season, yields increased from 0.9 Mg ha^{-1} in the control plot to 4.4 Mg ha^{-1} in average in the biochar-amended plots. In addition to presentation of data on biochar production, we present data on biochar quality and use from all three sites. Implications and prerequisites for long-term success and upscaling will be discussed. This research contributes to knowledge on adoption of improved cookstoves by investigating how biochar production can be an additional incentive for cookstove uptake. Furthermore, it contributes to the understanding of biochar production potential in African rural areas. This case study shows that biochar systems in rural Africa can contribute to climate change mitigation. Biochar technology can at the same time help to solve the problems with energy and food security that farmers are facing, and thereby contribute to sustainable development.