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Participative Development of a Top-lit-up-draft Reactor for Simultaneous Cooking and Biochar Making

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Abstract

Biochar in many countries is being used as a valuable soil amendment improving the soil structure and nutrient holding and exchange capacity on a long-term base. Up to date many different technical devices with different capacities and technical qualities have been developed to produce the required biochar. The material used to feed these devices ranges from forest products to agricultural residues like maize cobs.

The present study describes the participative and gradual adaptation of an existing 200 litre Top-Lit-Up-Draft (TLUD) reactor (Pyrolyser) in Tanzania that as a first version was solely used for biochar production. After reflective stakeholder-scientist consultations it was sought to find a solution sufficing local demands of adding a cooking component to the biochar making by synchronising both. This device should be economically and technically feasible at minimal costs in Tanzania. A new reactor was designed to meet the requirements. Iteratively, modifications and test trials of the existing TLUD reactor design were done, and then the new reactor and its operating protocol were obtained and tested. The results showed that the new reactor, on average boiled 4.5 litres of water at 93 degree Celsius within 44 minutes. Also, it produced 0.30 kg of biochar per kg of cobs fed, totalling 6.0 kg per reactor minimal filling. The reactor average operating temperature was 159 degree Celsius. The initial cost (€ 68) of acquiring the new reactor may not be affordable for single households in rural area but for stakeholder groups using it together. Household's saving which may be gained from commercialising the new reactor is assumed to amount (€ 37)/month. Apart from these promising parameters of the new reactor, more researches are needed to unleash full potential of its applicability in the rural areas.

Keywords: Biochar, cobs, Cooking, energy, fertiliser, firewood, household, Reactor, TLUD, top-Lit-Up-Draft