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An *in-situ* Technique for Producing Low-Cost Agricultural Biochar

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ABSTRACT

Application of biochar to agricultural soils is effective to sequester atmospheric carbon and improve soil quality, but current pyrolysis and transportation costs are so high that biochar is too costly to be used at field scale. This study developed a new *in-situ* technique, "burn and soil cover" (B-SC), which can be used by farmers for production of biochar with crop residue. In this study, the air-dried feedstock, elephant grass and corn residue, were burnt *in situ* for black carbon production in the field. After approximately 90% of the leaves were combusted, the burning process was dramatically slowed down by covering the feedstock with soil. The biochar yield averaged 18.0 ± 1.3 (n = 15) and 13.7 ± 1.3 (n = 10) kg per 100 kg of feedstock for the elephant grass and for the corn residue, respectively. The biochar properties were suitable for soil improvement. The inputs for the B-SC biochar production only included labor force, open field, crop residue and simple tools. The operational time for processing 10 kg of the corn residue by the individual farmer was 24.4 ± 4.1 minutes (n=10). As compared with the conventional field burning process, the B-SC process drastically shortened the time for biomass burning, and generated a significantly lower emission of smoke and thermal energy. This simple technique can be particularly practical and effective for farmers to improve the soils of poor quality in China.

Key words: biochar; burn and soil cover; crop residue; field burning; soil quality.

INTRODUCTION

The application of biochar to agricultural soils improves soil quality and productivity, sequesters atmospheric carbon (C) in the soil, and mitigates climate change (Glaser *et al.*, 2002; Marris, 2006; Woods *et al.*, 2006; Lehmann, 2007; Laird, 2008; Lee *et al.*, 2010; Woolf *et al.*, 2010; Haefele *et al.*, 2011; Taghizadeh-Toosi *et al.*, 2012; Manyà , 2012; Sohi, 2012; Joseph *et al.*, 2013; Solaiman and Anawar, 2015). The estimated worldwide maximum capacity for storing biochar C into the 1411 million ha of agricultural soils is approximately 428 gigatonnes of C (Lee *et al.*, 2010). There is a great need for large quantities of biochar to store the atmospheric C in agricultural soils. Currently, the commercial biochar production cost can range from US$300 to US$7000 per tonne in developed countries (Joseph *et al.*, 2013). Moreover, the transportation of biochar from the production site to the application sites further increases the cost. These high costs tend to prohibit field-scale biochar applications. In developing countries, biochar applications in agricultural soils are more seriously limited due to the limited production and transportation facilities. Therefore, there is a great need of a low-cost biochar

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