

**Construction of biochar production system and the effects of  
biochar application on the growth of paddy (*Oryza sativa* L.)  
under compact and loose soil conditions**

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## ABSTRACT

Major soil type of Batticaloa district is sandy regosol. This soil type has some drawbacks for agricultural activities such as low retention of water, leaching loss of nutrient specially nitrogen and low CEC. Leaching loss of nutrients leads to ground water pollution and other environmental issues. An environment friendly technique is needed to overcome the negative features of sandy regosol in order to uplift the agriculture sector of this region. In this context, experiment was conducted to identify the effects of biochar application on the growth of paddy (*Oryza sativa* L.).

In this regard, first experiment was conducted to construct a low cost Biochar Production system to produce coconut shell biochar through pyrolysis process. Second experiment was conducted with the following treatments: T<sub>1</sub> - Biochar (BC) at the rate of 10 ton/ha, T<sub>2</sub>- BC 20 ton/ha, T<sub>3</sub>- BC 30 ton/ha, T<sub>4</sub>- BC 40 ton/ha, T<sub>5</sub>- control. The pots were filled with biochar treated soil as per treatment structure. Urea (0.5%) in liquid form was added to all treatments uniformly. Leachate from each treatment was collected separately after 7 days and analyzed for its nitrogen content. Application of biochar at the rates of 30 and 40 ton/ha significantly ( $p < 0.05$ ) reduced the nitrate concentration of leachate in comparison to control (T<sub>5</sub>).

The third experiment was arranged based on the findings of the second experiment. A pot experiment was conducted to find out the effects of biochar application at two different soil compaction levels (Bulk density of 1.3 (Loose -C0) and 1.5gcm<sup>-3</sup> (Compact - C1)) and three rates of biochar application (0 (T0), 10 (T1) and 30 (T2) ton/ha) were arranged factorially with the treatment combination of C0T0, C0T1, C0T2, C1T0, C1T1 and C1T2. All the agronomic practices were followed uniformly,

as per the recommendation of Department of Agriculture. Measurements were taken at 2 weeks interval from second weeks after sowing (WAS) to eight WAS. The addition of biochar with  $1.3 \text{ g cm}^{-3}$  and  $1.5 \text{ g cm}^{-3}$  bulk density had significant ( $p < 0.05$ ) effects on tested parameters of rice over the control. The application of biochar at the rate of 30 ton/ha on both density of soil, mentioned above, significantly increased the plant height (1.42% and 4.5%), leaf number (14.58% and 14.13%), leaf area (31.20% and 44.38%), shoot dry weight (59.54% and 25.58%), root dry weight (65.74% and 37.7%), number of tillers (3.48% and 15.29%), Number of axils root (16.65% and 21.85%) and axils root length (25.81% and 15.05%) respectively. And there was interaction effect between biochar application rate and soil compaction level on tested parameters such as shoot dry weight, root dry weight, leaf area, and number of axils roots of rice while there were no interactions recorded on plant height, leaf number and number of tillers of rice plants.

Therefore, finding of this study concluded that the application of biochar favors rice plant growth and showed better performance with increasing rate of biochar. In addition biochar reduces the environmental pollution and retain the chemical nutrients with minimum leaching along with downward movement of water. ;

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