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Influence of Biochar Application on Growth, Dry Matter Yield and Nutrition of Corn (Zea mays L.) Grown on Sandy Loam Soils of Gujarat, India

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Abstract : Sustainable agriculture in sandy loam soil generally faces large constraints due to low water holding and nutrient retention capacity, and accelerated mineralization of soil organic matter. There is need to increase soil organic carbon in the soil for higher crop productivity and soil sustainability. Recently biochar is considered as sixth element and work as a catalyst for increasing crop yield, soil fertility, soil sustainability and mitigation of climate change. Biochar was generated at the Sansoli Farm of Anand Agricultural University, Gujarat, India by pyrolysis at temperatures (250-400°C) in absence of oxygen using slow chemical process (using two kilns) from corn stover (Zea mays, L), cluster bean stover (Cyamopsis tetragonoloba) and Prosopis julifera wood. There were 16 treatments; 4 organic sources (3 biochar; corn stover biochar (MS), cluster bean stover (CB) & Prosopis julifera wood (PJ) and one farmyard manure-FYM) with two rate of application (5 & 10 metric tons/ha), so there were eight treatments of organic sources. Eight organic sources was applied with the recommended dose of fertilizers (RDF) (80-40-0 kg/ha N-P-K) while remaining eight organic sources were kept without RDF. Application of corn stover biochar @ 10 metric tons/ha along with RDF (RDF+MS) increased dry matter (DM) yield, crude protein (CP) yield, chlorophyll content and plant height (at 30 and 60 days after sowing) than CB and PJ biochar and FYM. Nutrient uptake of P, K, Ca, Mg, S and Cu were significantly increased with the application of RDF + corn stover @ 10 metric tons/ha while uptake of N and Mn were significantly increased in RDF + corn stover @ 5 metric tons/ha. It was found that soil application of corn stover biochar @ 10 metric tons/ha along with the recommended dose of chemical fertilizers (RDF+MS) exhibited the highest impact in obtaining significantly higher dry matter and crude protein yields and larger removal of nutrients from the soil and it also beneficial for built up nutrients in soil. It also showed significantly higher organic carbon content and cation exchange capacity in sandy loam soil. The lower dose of corn stover biochar @ 5 metric tons/ha (RDF+ MS) was also remained the second highest for increasing dry matter and crude protein yields of forage corn crop which ultimately resulted in larger removals of nutrients from the soil. This study highlights the importance of mixing of biochar along with recommended dose of fertilizers on its synergistic effect on sandy loam soil nutrient retention, organic carbon content and water holding capacity hence, the amendment value of biochar in sandy loam soil.

Keywords : biochar, corn yield, plant nutrient, fertility status
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