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RELATIONSHIP BETWEEN SPACE ACTIVITIES AND CLIMATE SMART AGRICULTURE: THE SOIL BIOCHAR INFLUENCE ON ROOT ANATOMY AND NODULATION OF COMMON BEAN GENOTYPES

Abstract

Space-activities and Climate Smart Agriculture (CSA) are in tandem. The environmental-impact of the space-industry directly or indirectly affects climate-science negatively or positively. More-so, there is a report that global-warming effects are felt by satellites and space-debris. It is therefore timely to continue to mitigate and adapt to climate-change through: space-sector's systematic reduction of space-activities that contribute to climate-change; the use of space-technology to mitigate and cause adaptation to climate-change; and the decline of activities that contribute to climate-change. To mitigate and adapt to climate-change: firstly, does space-industry conform to Restriction of Hazardous Substances (RoHS) and Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) regulation? As chemical exclusions are vital components for the space-hardware. Secondly, the use of space-technology (e.g. satellites) facilitates raising of awareness of changes and evolution about climate-change. Thirdly, one of the activities that contribute to climate-action to assist the outer-space activities is CSA. Greenhouse-gases (GHG) contribute to greenhouse-effect, absorbing infrared-radiation. Of all GHG, carbon-dioxide is major (above 40%) as climate-change is caused primarily by carbon-emissions. When carbon-dioxide levels rise at the space-edge, this apparently reduces the pull that the Earth's atmosphere has on satellites and space-debris. So, reducing the carbon-dioxide levels through human-activities is very helpful. The decline of other activities contributing to climate-change is important for satellites to remain in-orbit, not crashing back to Earth. Effective climate-action requires international-cooperation, and national and local-initiatives. Agriculture is estimated to contribute 40% to climate-change, hence reducing climate-change impacts intentionally is key. The impact assessment can be done via soil-cultivation, crops-production, or animals-breeding. As animals rearing (cows) contribute to global-warming through

methane release and deforestation; and making soil more-competent through factors influencing soil organic carbon-sequestration and carbon-dioxide emissions partaking in CSA e.g. adding biochar and microbial-biomass to soil sequesters carbon to soil, making soil more competent, reduces to minimum carbon escape to atmosphere; and still makes crops have nutritional-benefits, improving food-security. This is because plants account for the majority of human food that needs these benefits. Therefore, contributing to CSA and adoption of this practice and policy by agriculture policy-makers is crucial. In this study, the benefits of improved root-nodulation effects (nodule-number, nodules-fresh-weight, nodule-size) of biochar on plant genotype after addition to soil of common-beans *Awash melka* and *Chercher* were determined; via structural-analysis using Scanning Electron Microscopy (SEM). Done because of importance of nodulation to legumes, as common-beans have edible-seeds consumed worldwide; and their overall-benefit to space climate-action.