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Fiber hemp as a feasible crop for enhancing carbon sequestration and cultivation under water scarcity in sandy agricultural soils

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Extended dry periods and increasing soil degradation compel the conventional agriculture to shift towards the sustainable practices. Hemp (*Cannabis Sativa* L.) accounts for crops that require low agricultural inputs and has a high potential to improve soil health hence fertility. The rapid hemp growth, high biomass production and remarkably expanded rooting zone have the vast potential in carbon (C) sequestration and nitrogen (N) fixation. Hemp fibers in the European Union (EU) are commonly used for pulp and paper industry and isolation materials. The study aims to (i) analyze hemp feasibility to grow and contribute to C sequestration under the water scarce conditions in initially nutrient-poor arable sandy soil with high and low canopy densities, and (ii) assess the use of hemp residues like shives and leaves as soil amendments for oat and corn crops in order to increase soil water holding capacity and serve as a long-term nutrient supply. Hemp, oat and corn crops were grown in a greenhouse experiment under LED illumination and wind ventilation for 17 h per day until the harvest. Hemp fibers were obtained through decortication. The biomass of all crops, hemp roots separated into fine and main, soil prior and after the experiment, and soil amendments were investigated for the total C and N content with an ELEMENTAR Vario Max Cube. Also, the elemental analysis for Ca, Mg, K, Zn, Cu, Fe, Al, Na was performed using HNO_3 and MP-AES analyses. Total dry root mass for oat and corn crops was measured. Additionally, the soil pH and electrical conductivity (EC) were determined. The results showed that water scarcity had hindered hemp height and biomass production. While under the water limited conditions, the low hemp canopy density had showed slightly advanced growth in comparison to the high canopy density. Furthermore, the results of oat and corn experiment indicated difference between the treatments, where the soil amendment from hemp leaves compared to hemp shives showed enhanced growth in both plant and root biomass.