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Strategies to Sequester Carbon and Improve Soil Productivity in Nebraska: Biochar and Cover Crops

Abstract.

Biochar and cover crops (CCs) are innovative strategies, but their potential to sequester C, reduce greenhouse gas emissions and N leaching, and improve water retention and crop yields have not been much studied in Nebraska. We will conduct two separate projects to address this gap:

Project 1 will assess the biochar effects on C sequestration, gas fluxes (CO_2, N_2O, and CH_4), microbial activity, water and nutrient retention, physical properties, and crop yields using **field and greenhouse studies**. For the **field study**, we will use a biochar experiment established on a low C soil in 2018 at UNL High Plains Ag Lab near Sidney, NE Biochar rates include 0, 3.125, 6.25, 12.5, and 25 Mg ha-1 with three N levels applied at 0, 84, and 168 kg ha-1 as urea in a split-plot design. In the **greenhouse** under tomato, we will study corn and wood biochars at five biochar rates (0, 2.5, 5, 10, and 20 g kg-1) with three N levels (0, 84, 168 kg ha-1 fertilizer) in different "problem" soils (low C, saline, and acidic).

Project 2 will investigate how CCs with and without N fertilization (0, 50, or 100 kg N ha-1) and no, non-harvested, and harvested CC biomass affect root biomass C input, C sequestration, gas fluxes, water and nutrient retention, and crop yields. We will use two existing no-till CC field experiments near Clay Center and Sidney, NE. Crop rotations are corn-rye CC-soybean-rye CC at Clay Center and field pea-sorghum-sudangrass CC-corn at Sidney.

We will disseminate results and seek external funding to expand this project. This project will demonstrate the value of biochar and CCs and provide much needed data to make practical recommendations. This project can lead to the creation of C credit markets, increase profitability, and aide policy decision development.