

Can Alfalfa Improve Soil Carbon Storage?

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Joshua Gamble is a Research Agroecologist the USDA-ARS Plant Sciences Research Unit in St. Paul, MN. His research aims to develop and evaluate cropping systems incorporating alfalfa and other perennial crops intended to improve soil health and water quality, reduce greenhouse gas emissions, and adapt agriculture to shifts in climate. He utilizes small-plot and whole-field research combined with statistical or process modeling to evaluate the impacts of agronomic management on long-term system productivity and provisioning of ecosystem services. He works extensively on quantifying field-scale changes in soil carbon, net ecosystem carbon balances, and water quality in response to crop rotation, cover cropping, manure management, and irrigation. Recent work is also focused on quantifying uncertainty and reconciling methods for C accounting in agricultural systems. He works with established crops like alfalfa, and novel perennial systems including low-input native grassland for biomass and bioenergy, cover crops and living mulches, agroforestry systems, and perennial grains.

In January 2021, the President signed Executive Order 14008, Tackling the Climate Crisis at Home and Abroad, defining a set of strategies under the Climate Smart Agriculture and Forestry (CSAF) initiative to encourage practices that “result in additional, measurable, and verifiable carbon reductions and sequestration.” As a perennial legume, alfalfa assimilates substantial amounts of carbon dioxide, much of which is allocated to its extensive root system and, in turn, provides critical inputs for soil organic carbon (SOC). As a result, including alfalfa in rotation can improve agroecosystem C balance by 23% relative to continuous silage corn. However, more research is needed to explore how specific alfalfa management strategies impact the long-term potential for C storage under various soil and climatic conditions. This presentation will discuss findings from long-term studies in Minnesota to explore the role of alfalfa in improving SOC / agroecosystem C balance; highlight other findings from relevant SOC literature; and discuss current gaps in research.