

Terrestrial Carbon Sequestration in Montana Agricultural Systems

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Summary

Montana State University has focused research on best management practices (BMPs) for terrestrial C sequestration in agricultural systems and measurement, monitoring, and verification (MMV) techniques for carbon accounting. Comparison of tilled and no-till (NT) wheat-fallow systems showed that NT effectively sequestered carbon at a rate of $0.28 \text{ Mg C ha}^{-1} \text{ yr}^{-1}$ in north central Montana. Current on-farm carbon sequestration research examines the effects of NT and continuous cropping with a legume in rotation. In 2003 six farmers began managing four 8-ha plots with and without tillage, and crop-fallow and continuous cropping treatments. Additionally, nitrous oxide (N_2O) emissions from tilled and NT systems are being quantified in plot experiments at Conrad and Bozeman, MT. Preliminary results indicate that annual N_2O emissions (0.1 – 0.5% of applied N) are not significantly offsetting annual C sequestration. MMV is critical to development of a carbon trading market in the USA. Directly measuring C change is currently cost prohibitive, therefore alternative methods using satellite remote sensing, biophysical models, and visible and near infrared – diffuse reflectance spectroscopy (VNIR-DRS) are being researched, with encouraging results. Upcoming / continuing research opportunities for farmers include a pilot carbon market lead by the National Carbon Offset Coalition (NCOC) in conjunction with MSU. Farmers in Montana will have an opportunity to enroll cropland and agree to use BMPs to sequester carbon. MSU will be conducting MMV techniques on select farms and continuing research in alternative MMV techniques including VNIR-DRS, satellite remote sensing, laser induced breakdown spectroscopy (LIBS), and carbon isotope analysis to monitor carbon cycling in the soil system.