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Impact of Tillage and Crop Rotation Systems on Carbon Sequestration

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Introduction

Carbon sequestration is an issue worth exploring for its potential impacts on, and benefits for, agriculture and climate change. Agriculture, can be part of a potential solution to the problem of global warming. When soil conservation and plant residue management are implemented, the concept of carbon sequestration is highly linked to soil management practices, soil conservation practices, and crop rotation. The benefits of soil carbon sequestration as a result of soil conservation practices to the soil system are enormous, such as the improvement of soil aggregate stability, water holding capacity, nutrient availability, microbial activities, etc. The need for evaluating different tillage and crop rotation systems is essential for understanding soil potential for carbon sequestration. The objectives of this research are to evaluate the effects of different crop rotations, tillage practices, and residue qualities on soil carbon sequestration.

Materials and Methods

This study is part of a statewide project started in September 2000. This study is conducted on several research farms in Iowa. The experiment at this location consists of three different crop rotations, a cool season pasture, a warm season pasture, and a corn, soybean-corn-meadow-meadow-meadow rotation (CSCMMM). The design of the study is a completely randomized design. Both cool and warm season pastures have four replications and were placed in existing experiments. The cool season pasture consists of bromegrass, and the warm season pasture is switchgrass. The CSCMMM crop rotation consists of four replications. The site for the CSCMMM rotation was planted to alfalfa. The alfalfa stand will be killed this fall, and the site will be split into two equal halves and planted with corn and soybean for next year.

Soil samples were collected for 0-5, 5-10, 10-15, 15-30, and 30-60 cm depths. The samples will be analyzed for total nitrogen, total carbon, organic carbon, and inorganic carbon and pH. Soil bulk density will be estimated for the same depths. Plant residue samples were collected to determine the amount of plant residue left on the field after harvest and to estimate total carbon and total nitrogen. Grain yields and dry matter will also be determined where applicable.

Results and Discussion

At this time the results from laboratory analyses are not complete. The results will be available in a follow-up report at the end of next season. This study will provide additional information that can help answer some of the questions about carbon sequestration as related to tillage and crop rotation systems.

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