Soil Resources Management Projects (NP 202) at USDA-ARS, Sidney, MT

Contact Scientists

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Applied Research

Research on Irrigated Management

1. Measurement of soil quality indicators in grassland and transitional cropland under irrigation and non irrigation.
2. Irrigation type and tillage effects on crop residue and soil carbon and nitrogen pools.

Objectives

1. Examine the effects of land transition from grassland to cropland with tilled vs. non-tilled, irrigated vs. non-irrigated, and continuous vs. rotated crops on soil C and N pools, aggregation, and microbial communities and crop yields.
2. Examine the effects of irrigation (mid-elevation sprinkler application and low energy precision application) and tillage (strip-till and conventional till) on crop residue and soil C and N pools under sugar beet and barley.

Measurement of parameters for dryland and irrigated projects

Soil: Organic C, total N, particulate organic C and N, microbial biomass C and N, potential C and N mineralization, NH_4-N, NO_3-N, K, Ca, Mg, and Na concentrations, electrical conductivity, pH, aggregation, bulk density, soil aggregating basidiomycetes and bacteria, and microbial communities. Detection of inoculum of fungal pathogens responsible for net blotch and head blight in soil.

Crop: Crop yield, biomass production, residue cover and amount, and C and N contents.

Applied Research

Research on Dryland Management

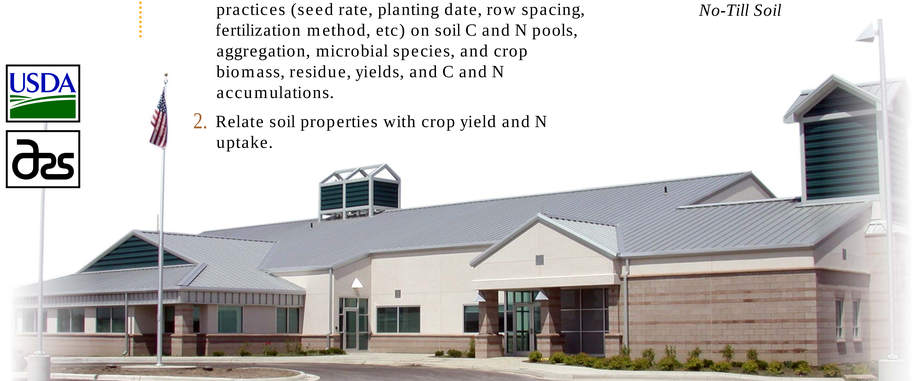
1. Tillage, crop rotation, and cultural practices influence on soil quality and crop yields.
2. Cover crop and nitrogen fertilization effects on soil properties and no-till spring wheat yield.
3. Long-term effects of tillage frequency and cropping intensity on crop residue and soil properties.

Conventional Till Soil

No-Till Soil

Objectives

1. Determine the influence of tillage (no-till, conventional till, and tillage frequency), crop rotations (one-, two-, three-, and four-year rotations and standard vs. stacked rotation), cover crops (legume, nonlegume, and mixture of legumes and nonlegumes) and cultural practices (seed rate, planting date, row spacing, fertilization method, etc) on soil C and N pools, aggregation, microbial species, and crop biomass, residue, yields, and C and N accumulations.
2. Relate soil properties with crop yield and N uptake.



Basic Research

1. Comparison of wet and dry sieving methods on soil aggregates and associated carbon and nitrogen pools.

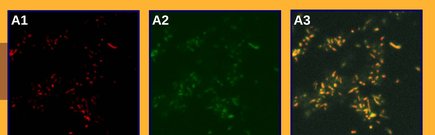
   Determination of soil and solution extraction ratio for inorganic nitrogen in soils amended with crop residue.

Objectives

1. Determine aggregate separation methods that measure aggregate-size distribution, C and N pools, and microbial communities in dryland and irrigated soils.
2. Determine soil and solution ratio for extraction of NH_4-N and NO_3-N concentrations in soils amended with fresh crop residue.

Measurement of parameters: Aggregate-size distribution, organic C, total N, particulate organic C and N, microbial biomass C and N, potential C and N mineralization, NH_4-N, NO_3-N, soil aggregating basidiomycetes.

Soil Microbiology



Confocal laser scanning microscopy showing the spatial arrangement of components comprising 2 day-old soil aggregating isolate BR2C2 (A) and 2 day-old non-soil aggregating isolate BR1B3 (B) growing in single cell layer. Magnification = 4000X.

A1: Soil aggregating bacteria in microaggregates stained red with propidium iodine at 635 nm excitation.
A2: Mucilage was reacted with fluorescein-labeled wheat germ agglutinin (FITC-WGA) (Sanford et al. 1995). The mucilage matrix material fluoresced green at 488 nm excitation.
A3: A dual color image showing the cells (red to yellow) surrounded by a layer of mucilage. All three images showed the same field.

1. Identification and characterization of soil aggregating bacteria in microaggregates (0.250-0.050 mm).
2. Development of a molecular DNA protocol (using specific primers and real-time PCR) to quantify the amount of the most efficient bacterial aggregators in soil microaggregates (bacteria/mg soil).

Objectives

1. Advance scientific understanding of the function of specific bacterial species inhabiting the microaggregates in soil aggregation.
2. Help to know if management practices (in dryland and under irrigation) can enhance bacterial communities that favor stabilization of microaggregates.
3. Use the technique as a biological indicator of soil quality.