

NP 202 FY 2003 Annual Report

Development of tools for assessing the sustainability of management practices.

Soil quality assessments typically involve measuring a suite of appropriate soil properties, but interpretation of these properties is often difficult. ARS scientists from Ames, Iowa and Lincoln, Nebraska have provided leadership in the development and implementation of tools for assessing sustainability of soil resource management practices. Recently, scientists from Ames have developed an indexing tool, the Soil Management Assessment Framework (SMAF), that can be used to quantify a suite of soil properties that affect soil functions related to agronomic productivity and environmental quality. The SMAF can help prioritize management goals, identify critical soil functions, and help select indicators that provide useful information about how a specific soil is functioning. The SMAF should help land managers sustain soil resources in the United States and abroad.

Knowing when to deep till compacted soils. Compacted layers beneath the soil surface can restrict root growth, thereby reducing use of water and nutrients from subsurface layers. Deep tillage temporarily alleviates this high soil strength condition, but can be costly. Field studies at Florence, South Carolina demonstrated that each 10-atmosphere increase in compaction (soil strength) could reduce corn yields by 20-50 bushels per acre depending on soil moisture. Knowing how increased soil strength reduces corn yield, allows producers to decide when deep plowing is cost-effective.

Soil and crop management practices to improve soil condition. Soil and crop management practices cannot be optimized to improve soil function without basic knowledge of the relationship between agricultural practices and biological processes. Scientists at Columbia, Missouri evaluated soil respiration, metabolic and genetic profiles of the microbial community, and enzyme activities in soils under various management practices at field sites in the claypan region of Missouri. Respiration, enzyme activities and microbial communities were generally higher when soil organic matter levels were improved using management practices that included organic amendment additions, crop residue retention and minimum tillage. This research demonstrates that producers and their advisors can sustain the quality and productivity of the soil resource by using relatively simple and inexpensive management tactics.