Sustainable biomass removal rates

A. What is this research project?

Complementary approaches are being used to identify sustainable biomass for bioenergy systems: harvest rates for corn-soybean rotations, use of cover crops, inclusion of perennial crops in rotations, and alternative bioenergy production systems such as grass-based systems.

- Several rates of corn stover harvested from no tillage and from chisel plow plots in a no-tillage corn-soybean system.
- Cover crops planted to replace some of the biomass and provide additional erosion protection, also plots that incorporate perennials into the rotation in a no tillage system.
- Evaluating alternatives to strict C-S rotation, including perennial grasses, annual grass hybrid, living mulch, and cover crop. Soil quality, grain yield and biomass production are being monitored over time.
- Several of these systems are also being monitored through on-farm collaborative trials.

B. What problem does it address?

Harvesting biomass (crop straw or perennial crops) for bioenergy feedstock can accelerate erosion and reduce soil organic matter, thereby negatively impacting soil quality and productivity, and causing environmental degradation. This work strives to minimize potential negative impacts of biomass harvest, while maximizing biomass and economic return.

C. How does it enhance other projects?

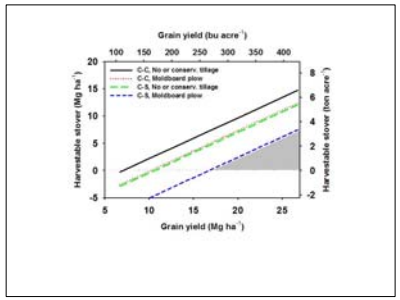
These projects are directly linked to the national ARS cross-location project: Renewable Energy Assessment Project (REAP). The goal of REAP is to ensure that the soil resource indefinitely meets the demand for food, feed, fiber and fuel. Providing cropping systems strategies appropriate in the Northern Corn Belt, with its high quality soils, but short growing season. This research is integrated into three complimentary projects: Soil and crop management systems to sustain agricultural production and environmental quality in the northern Great Plains; Soil Carbon Cycling, Trace Gas Emission, Tillage and Crop Residue Management; and Multi-scale evaluations of land use management systems in the upper Midwest.

D. What are the potential benefits of partnering with ARS on this research?

ARS has the scientific network of soil scientists, agricultural economists, plant physiologists and modelers that are able to integrate information for independent locations to provide local and national guidelines, strategies, and decision support tools.

E. Who are the potential customers?

Producers, energy industries, conservationists, regulatory agencies, other scientists, and policy-makers.



Estimated amount of harvestable corn stover needed to maintain soil organic carbon, these estimates assume all soybean straw remains on field. (Johnson et al., 2006)

Clockwise from top left: Corn stover harvest in corn/soybean rotation; winter rye cover crop in corn stubble; switchgrass plot; hairy vetch cover crop after wheat straw harvest.

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Stage of Development

Field plots and on-farm trials have been established, corn-soybean study in 2005 with two harvest years; alternative biomass production systems established in 2007. Initial estimate on harvest rates and integrated biomass systems was published based on existing information.

Moving Forward

Empirical data, modeling efforts, on-farm trials and integration of economic and environmental risks and benefits need to be assessed; whereby, local, regional and national biomass management and harvest rates can be based on solid science and transferred through a variety of media (e.g. technical bulletins, decision aids, publication).

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