Resource assessment, removal analysis, edge-of-field cost analysis, and supply curves for corn stover and wheat straw in the Eastern and Midwestern United States – rainfall and wind-induced soil erosion methodology

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Project Focus

The major focus of this study was to develop a methodology to estimate the amount of corn stover and spring and winter wheat straw (agricultural crop residues) that could be removed from agricultural cropland in 37 states (north-south line from North Dakota to Texas and all states east) without exceeding tolerable rainfall and wind-induced soil erosion limits. This methodology was used to produce "acreage-weighted", county-level, corn stover and wheat straw removable residue quantities and national supply estimates for 1995 to 1997. Other constraints, such as soil tilth, soil carbon, moisture retention, and nutrient value were not addressed in this analysis, although they are regarded as extremely vital to soil productivity and sustainability.

Project Methodology

The methodology developed and employed in this study was based on the Revised Universal Soil Loss Equation (RUSLE) and the Wind Erosion Equation (WEQ) which were used to predict individual county-level corn or wheat yields required at harvest to insure that the amount of soil loss would not exceed the tolerable soil loss limit. These yields were then compared to actual county-level corn or wheat yields to determine the quantity of removable residue. The approach used in this study involved a joint, voluntary effort between the U.S. Department of Agriculture's Natural Research Conservation Service (USDA-NRCS) and Agricultural Research Service (USDA-ARS), and the U.S. Department of Energy's Office of Utility Technologies.

Project Results

Results of this study indicate an average of over 47 million tons of corn stover and nearly 8.8 million tons of spring and winter wheat straw were potentially available for removal between 1995 and 1997 in these 37 states. These estimates represent an average of roughly 20% and 8% of the total corn and wheat residue, respectively, generated in the United States between these years.

The amount of residue that can be removed each year without exceeding the tolerable soil loss limit varies considerably depending on grain yields, which in turn are impacted by climate, number of acres planted and harvested, and field management practices. The amount of corn stover available for removal varied from a low of approximately 38 million tons at harvest in 1995 to a high of over 52 million tons in 1997. Similarly, the amount of spring and winter wheat residue varied from about 6.8 million tons in 1996 to over 11.5 million tons in 1997.

Over two-thirds of the corn stover that could potentially be removed was concentrated in Nebraska, Iowa, Illinois, Indiana and Michigan. The majority of residues from winter wheat production were located mainly in Ohio, Illinois, Michigan, Indiana, Kansas, and Missouri; and nearly one-half of the spring wheat residues were primarily concentrated in North Dakota. Residues produced on Western irrigated land may offer additional potential, but were not considered here.

Corn stover and wheat straw collection (baling) and edge-of-field transport costs were calculated as a function of the amount of residue removed based on data provided by Oak Ridge National Laboratory. National supply curves were developed using these costs in conjunction with county-level removable residue quantities. These supply curves indicated an average of nearly 24 million tons of corn stover and

over 4.4 million tons of wheat straw could be collected and transported to the field edge for $25 per ton or less and almost 22 and 3.8 million tons of corn stover and wheat straw, respectively, were available for between $10 and $20 per ton.

This study indicates that in some areas of the country, subject to particular tillage practices, corn stover and/or wheat straw may be available for alternative uses. This study provides a tool for farmers, agricultural scientists and technologists, and policy makers to assess whether harvesting agricultural crop residue is both economically viable and environmentally sustainable.