Using corn stover for ethanol production: A look at the regional economic impacts for selected midwestern states

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Adding value to basic agricultural commodities and increasing farm income are major themes in Rural America today. Currently, the agricultural sector is in the midst of decreased farm income caused by reduced export demand and increased production levels. As incomes decline, public pressure has increased toward establishing value-added operations in rural areas. Economic development of rural areas has traditionally focused on manufacturing opportunities and has neglected agricultural value-added prospects. Rural communities either shipped raw commodities out or fed the raw agricultural commodities and shipped livestock from the region.

Recent increases in energy prices have spurred renewed interest in the use of fuel ethanol as a fuel substitute. According to a 1997 study prepared for Midwestern Governors' Conference, an increase in the demand for ethanol is estimated to boost total employment by 192,000 jobs.[1] The Economic Research Service estimated that U.S. production of ethanol could create 28,000-108,000 new jobs by 2000 for rural Midwest.[2] In addition to these economic benefits, environmental benefits such as less polluting carbon monoxide and toxic compounds and a reduction in the potential for global warming could be realized. Also, less dependency on foreign oil could increase energy and economic security.

There are three basic stages to development of ethanol from a residue biomass feedstock industry--harvesting of the residue, the transporting of the stover to the ethanol plant, and the conversion of corn stover to ethanol. The use of residues from traditional agricultural practices as feedstock for an ethanol plant would result in an agricultural by-product and would take advantage of agricultural systems currently in place. Biomass feedstock, such as corn stover, bagasse, and rice straw contain cellulose, which can be converted to sugars that are then fermented to ethanol. New technologies currently under design will convert corn stover to ethanol more efficiently. As a renewable feedstock, potential benefits from expanded market and additional economic opportunities for farmers and Rural America could be realized.

Input-output analysis using IMPLAN (Impact Analysis for Planning) was used to derive economic impacts for constructing and operating two ethanol corn stover production facilities, including farm level stover production and transportation costs. Corn stover feed rates for one production facility was 1,000 metric tons per day; for the other, 2,000 metric tons per day. The states selected were Illinois, Indiana, Iowa, Kansas, Minnesota, Missouri, Nebraska, Ohio, S. Dakota, and Wisconsin. Ethanol production process engineering design and economic information to provide input data for the IMPLAN model was obtained from the National Renewable Energy Lab (NREL). The POLYSYS (Policy Analysis System) model was used to obtain estimates on available corn stover residues. The ORIBAS (Oak Ridge Integrated Bioenergy Analysis System) model was used to obtain estimates on feedstock and transportation costs.

Four levels of impacts were analyzed representing three stages of the ethanol production process along with the construction or project investment of the ethanol facility. These impacts were quantified using estimates for direct, indirect, and induced economic impacts for the economic variables: Total Industry Output (estimated annual dollar value of the goods and services an industry produces), Employment, and Total Value Added.

Direct impacts, for this analysis, represents the estimated impacts of constructing a new ethanol facility, or the operating costs of the ethanol facility once in production, or the production of corn stover at the farm level, or the transportation of the corn stover from the farm gate to the plant gate. Indirect impacts represents the estimated impacts caused by supplying industries that occurred as a result of one of the direct impacts previously mentioned. Induced impacts represents the estimated impacts on all local industries caused by the expenditures of new household income and investment from government institutions generated as a result of the direct and indirect impacts. Total impacts is the sum of the direct, indirect, and induced impacts.

Questions asked in this research include: 1) what are the economic benefits of harvesting current available corn stover for conversion to ethanol to local communities; 2) how many plants would be economically feasible evaluated at ethanol prices of $1.15, $1.25, and $1.35 per gallon; and 3) what size ethanol plant should be constructed (1,000 or 2,000 metric tons per day)?

The 1,000 metric ton per day facilities appear to be economically feasible if the price of ethanol at the plant gate equals $1.25/gallon. Even at $1.15/gallon at the plant gate, the 1,000 metric ton per day facilities are feasible in some states. If a subsidy was available to producers using corn stover to produce ethanol so that producers were guaranteed $1.35/gallon, an estimated 136 plants would be constructed, 4,134 million gallons of ethanol would be produced, $963 million in gross income to agricultural producers would occur, and an estimated economic impact of $11 billion (see Table 1) in rural economies of the ten state region would be realized.

Table 1. Estimated Annual Impacts (Agriculture + Transportation + Operating)

	Total Industry Output ($ Millions)			
State	Direct	Indirect	Induced	Total
Illinois	1,256	674	819	2,749
Iowa	1,435	554	661	2,650
Nebraska	959	401	495	1,855
Minnesota	867	392	469	1,728
Indiana	576	256	323	1,155
Wisconsin	317	147	172	636
Ohio	272	134	135	541
Missouri	91	47	70	208
Kansas	94	50	61	205
S. Dakota	90	31	31	152
Total	5,957	2,686	3,236	**11,879**

States that can purchase a greater proportion of the input requirements for existing ethanol industries from local producers will have larger in-state economic impacts. States that required a larger area to get the initial plants supply of corn stover will have increased impacts on the transportation sector. Consequently, larger direct impacts will result compared to other areas.

List of references

[1] Evans, Michael K., “The Economic Impacts of the Demand for Ethanol”, Prepared for Midwestern Governors’ Conference, Lombard, Illinois, February, 1997.

[2] U.S. Department of Agriculture, “Ethanol Production and Employment”, Economic Research Service, ERSAIB678, July, 1993.