Corn Stover for Bioethanol –Your New Cash Crop?

Careful and location-specific evaluation will be needed to determine what portion of stover needs to remain in the field for erosion control, moisture retention, or other purposes. In some situations, on the other hand, stover harvest might allow farmers to reduce their tillage—reaping the erosion control and soil quality benefits of minimum tillage.

Suppose someone told you that you could increase the profit from your cornfield by $20 per acre without planting anything else or changing or hurting your existing crop. And that by doing this, you would be doing great things for the environment and helping to fuel America as well as to feed it. Would it sound like snake oil or a late-night TV ad? (What if this was to develop a new business and jobs in your community, supported government programs, and followed clear guidelines on maintaining soil quality?)

Biomass ethanol technology is still developing and important questions need to be answered about corn stover removal, but prospects are excellent for you to someday be able to harvest and sell a substantial portion of your stover for fuel production—without hurting your soil or main corn grain operation.

Ethanol is already an important element of transportation fuel production. About 12% of U.S. gasoline sold contains 8% to 10% ethanol as a fuel additive to boost octane and reduce carbon monoxide and other toxic air emissions. Another 25% of U.S. gasoline now has a petroleum-derived additive that could be phased out because of water pollution concerns. Because ethanol can directly replace this additive, ethanol use could increase rapidly. Ethanol can also be used as an alternative fuel (typically in an 85% blend) to reduce our dependence on foreign oil (foreign oil currently supplies more than half of our petroleum supply). Making ethanol from the starch in corn grain already supports a $2 billion per year industry, with 55 ethanol plants providing jobs and economic stimulus to rural areas in the year 2000 and a dozen more planned for the future.

Biomass ethanol is ethanol made from non-grain plant materials known as biomass. The bulk of most plants is fibrous material consisting of cellulose, hemicellulose, and lignin. Advanced biotechnology can break down cellulose and hemicellulose into their component sugars, and then ferment those sugars to ethanol. Making ethanol from biomass as well as starch or sugar opens up the possibility of ethanol production on a larger scale, by supplementing ethanol production from corn grain. Just as making ethanol from corn grain supports corn prices, making it from stover would provide farmers with an additional revenue source. Additional technological advances are still needed before biomass ethanol can be cost-competitive with grain ethanol and gasoline, but the U.S. Department of Energy (DOE) has set a goal of having nine commercial plants in operation using local corn stover for feedstock by 2006.

Corn stover is in many ways an ideal feedstock for bioethanol production. Although bioethanol can be made from a wide range of biomass materials—from wood chips to municipal solid waste to "energy crops" of fast-growing trees or grasses—stover from existing corn production is by far the most abundant crop residue readily available today. Corn stover is, of course, also available in the same areas as corn grain, so it is easily accessible to plants that already produce ethanol from corn starch.

Harvesting stover efficiently will require overcoming several challenges. Among other things, corn stover on the ground is inherently contaminated with dirt and other foreign materials; climatic and soil conditions may not allow timely field drying of stover for safe storage; and corn stover collection may compete with other crop harvesting operations. A national effort is underway to identify the

most efficient ways of harvesting, drying, and moving stover from field to the conversion facility. With present practices and machinery, corn stover would likely be collected and baled separately, immediately after the corn grain harvest. Stover bales would then be stored and transported to ethanol plants in a manner similar to current handling of forage crops. As stover harvest becomes common, however, new equipment might allow grain and stover to be harvested simultaneously.

How much stover should be harvested is a complex question that needs to be carefully evaluated before the option for sale of stover becomes widely available. Key considerations for how much stover can be harvested responsibly include erosion control, moisture retention, winter forage practices, and soil carbon impacts. The amount of stover that should be left will also be highly specific to local conditions and topography.

The U.S. Department of Agriculture (USDA) is cooperating with the U.S. Department of Energy in performing field studies to better understand the effect of corn stover removal on soils in the Corn Belt. Scientists at the USDA, Colorado State University, the National Renewable Energy Laboratory, and Oak Ridge National Laboratory are currently engaged in a major analysis of harvesting and converting corn stover into ethanol. This analysis will help determine the overall life-cycle impact of ethanol production from stover. Already, this study has found that for the state of Iowa as a whole, 57% of stover could be removed without increasing erosion (50% for mulch-till acreage, 67% for no-till acreage). Researchers conducting that study are now focusing their attention on the impact of stover removal on soil carbon levels. As results of this study develop, they will be made available on the Biofuels Program Web site ***www.ott.doe.gov/biofuels/bioethanol.html***.

In some regions stover is now tilled under to facilitate spring soil warming. In these regions, stover harvest might make it easier to switch to minimum tillage, thus providing additional erosion control and soil-quality improvement.

Revenue potential from stover sale will also be highly specific to local situations. In general, however, the greater the volume of grain produced per acre, the greater the associated stover production and therefore sales income. The greater the distance from an ethanol plant, the higher the hauling expense would be and the less the net revenue.

Preliminary estimates suggest that fields located within about 50 miles of an ethanol plant are more likely to be profitable for stover harvest. Grower payments and other cost figures from stover collection experience for a processing plant in Harlan, Iowa, can be found at ***www.afdc.doe.gov/pdfs/5149.pdf.*** In this case, farmers received between $9 and $38 per acre net profit depending on the amount of stover collected and delivery distance.

For the present, while it may seem early to be considering stover harvest for biomass ethanol production, there are important reasons to start thinking about it now. For one thing, you probably do not take changing harvesting or tilling practices lightly. You might want to look into what your particular conditions mean for stover collection. You may also need to work with your Natural Resource Conservation Service representative to modify your farm conservation plan. You might want to experiment with stover collection on a small field. You could use the stover collected for forage or look for other interim uses. (The Harlan group mentioned above, for example, is now selling the stover they collect for production of a mulch such as that used as a growth medium for plantings along highways. For more information, contact Biomass Agri-Products 712-755-5363) DOE is eager to learn whether or not you would be interested in harvesting and selling stover when the opportunity arises. We would especially appreciate hearing about any particular reasons why you or other corn growers would not want to harvest your stover. If you have questions or comments please contact the DOE Biomass Feedstock Development Program, at bfdp@ornl.gov or 865-576-5132.

Another reason to think about stover sales now is the possibility of promoting the development of a biomass ethanol plant in your community. Because high transportation costs seriously decrease the profitability of stover collection, proximity to a biomass ethanol plant will be a major advantage for stover harvesters. The majority of grain ethanol plants are small, community-based plants, many of which are actually owned and operated by farmer cooperatives. This could quite likely be the case for stover ethanol or combination stover/grain ethanol plants, as well. Obviously, promoting and building an ethanol plant requires a lot of lead time. To explore the possibility of developing an ethanol plant in your community, please contact the DOE Regional Biomass Energy Program at ann.hegnauer@hq.doe.gov or 202-586-8014.

Most ethanol plants are small rural facilities, providing jobs and money for the local economy. Biomass ethanol plants could probably purchase corn stover, as well as kernels, from farmers within about 50 miles of the plant.

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