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To Harvest Stover or Not: Part 2

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June 22, 2016

***farmdoc daily* (6):118**

Recommended citation format: Paulson, N., and M. Khanna. "To Harvest Stover or Not: Part 2." *farmdoc daily* (6):118, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, June 22, 2016.

Permalink: http://farmdocdaily.illinois.edu/2016/06/to-harvest-stover-or-not-part-2.html

Mandates for second-generation biofuels in the US create potential markets for farmers to collect and market their corn stover biomass. Removing stover from the field has the potential to reduce organic matter and nutrients available in the soil, while increasing the potential for soil erosion. Furthermore, there are concerns that the potential to sell stover might impact farmers' crop rotations and tillage practices, potentially leading farmers to switch from corn-soybean to continuous corn rotations. Since continuous corn production may lead to lower per acre yields and require more nitrogen application per acre than corn grown in rotation with soybeans, this change in production practices has the potential to increase nitrate run-off.

Although the sustainable rate of corn stover harvest relative to residue produced is an ongoing area of research, many studies indicate that a larger percentage of corn stover can be harvested if no-till practices are used as compared to conventional tillage. A price for corn stover may therefore create incentives to switch to no-till practices.

In the *farmdoc daily* article posted on February 18, 2016, we discussed the economics of harvesting corn stover, providing some specific examples for Illinois from the Biomass Crop Budget Tool for Corn Stover (available for download as part of the farmdoc *FAST* suite here). Today's article provides maps illustrating breakeven stover price estimates for rainfed US counties (east of the 100th meridian) included in the budget tool, and further discusses how breakeven corn stover prices differ with crop rotation and tillage practices.

The breakeven stover prices illustrated in the maps below represent the corn stover price that would need to be received by the farmer to cover the costs associated with harvest/collection, storage, as well as the additional costs needed for nutrient replacement. These farmgate breakeven prices do not include any change in profits from corn production due to stover harvest or change in corn production practices.

We find, in general, that breakeven stover prices tend to be lower in areas with greater corn yield potential since the amount of stover biomass produced is assumed to be proportional to grain yield. Removing more stover per acre reduces breakeven prices by spreading the fixed costs associated with harvest, and storage over a greater number of tons of biomass.

Harvesting stover reduces organic matter and nutrient levels, and can lead to greater potential for soil erosion caused by water and wind. The proportion of available stover which can be removed from the field (the stover removal rate) which leads to minimal negative impacts varies with tillage practice. Specifically, we assume that 30% of the available stover can be removed under conventional tillage practices while 50% can be removed if no till practices are being used (Scarlat, Martinov, and Dallemand 2010). Crop rotation is also assumed to impact stover yields and breakeven prices via grain yields. In a continuous corn rotation, a corn yield drag will lead to higher breakeven stover prices compared with a corn-soybean rotation.

Figure 1 maps estimated breakeven stover prices for counties with available data in the eastern half of the US. Harvesting stover is estimated to become economical in a price range of $50 to $65 per ton for main Corn Belt areas of Iowa, Illinois, Indiana, and Ohio. Other areas with relatively low breakeven stover prices include the southern parts of Minnesota and Wisconsin, the eastern portion of South Dakota, and in Nebraska where irrigated corn production provides high productivity and stover potential. Breakeven stover prices exceed $65 per ton in regions on the fringe of the corn belt, with breakeven stover prices increasing above $80 per ton as you move further out from the main corn producing areas of the country. This pattern in breakeven stover prices is associated with corn grain yields which, again, are proportional to corn stover availability.

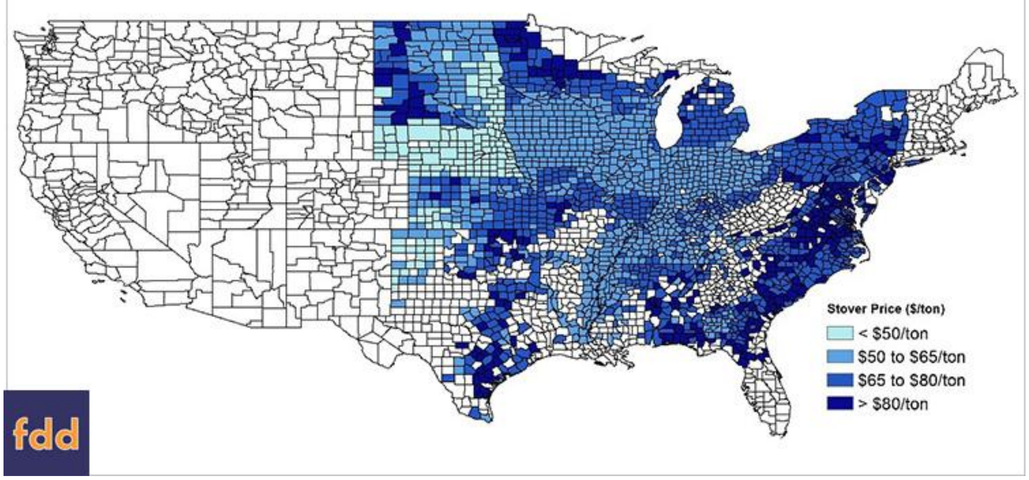


Figure 1. Breakeven Corn Stover Prices, Corn-Soybean Rotation with Conventional Tillage

Figure 2 maps county-level breakeven stover prices for a corn-soybean rotation using no-till tillage practices. Due to the higher stover removal rate assumed under no-till, breakeven stover prices are lower across all regions. Compared with conventional tillage, no-till practices result in a $15/ton lower breakeven stover price on average across all counties included in the analysis.

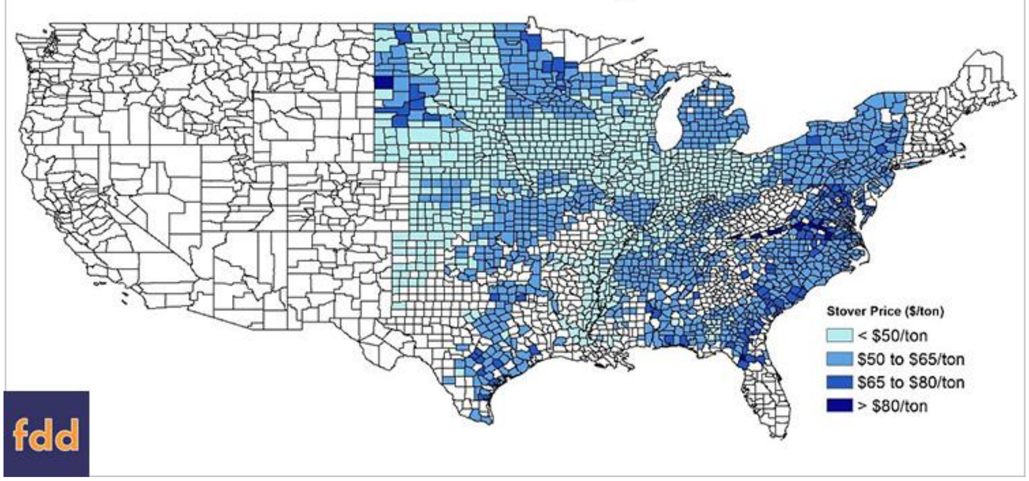


Figure 2. Breakeven Corn Stover Prices, Corn-Soybean Rotation with No-Till Tillage

Figure 3 maps breakeven stover prices for a continuous corn rotation under conventional tillage practices. Compared with a corn-soybean rotation (figure 1), breakeven stover prices are higher for the continuous corn rotation due to the assumed yield drag. Breakeven stover prices are, on average, $6/ton higher for continuous corn when conventional tillage practices are used.

Figure 3. Breakeven Corn Stover Prices, Continuous Corn Rotation with Conventional Tillage

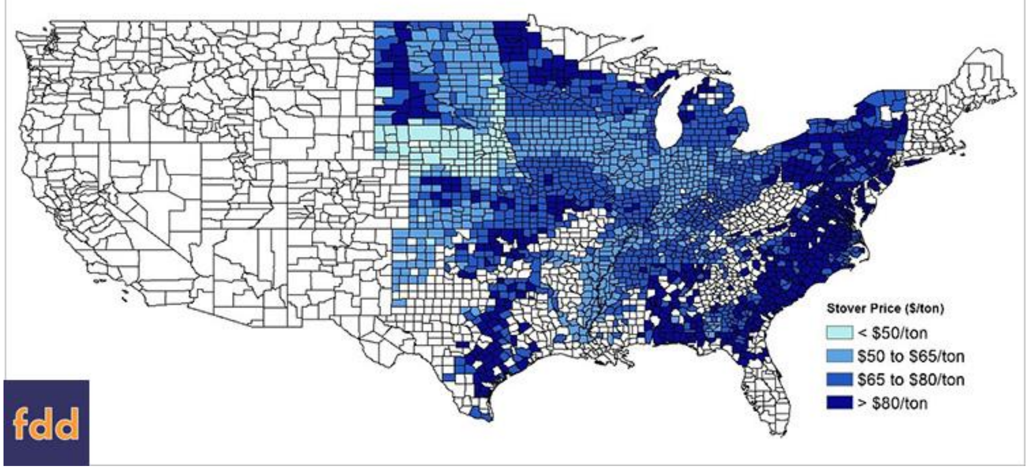
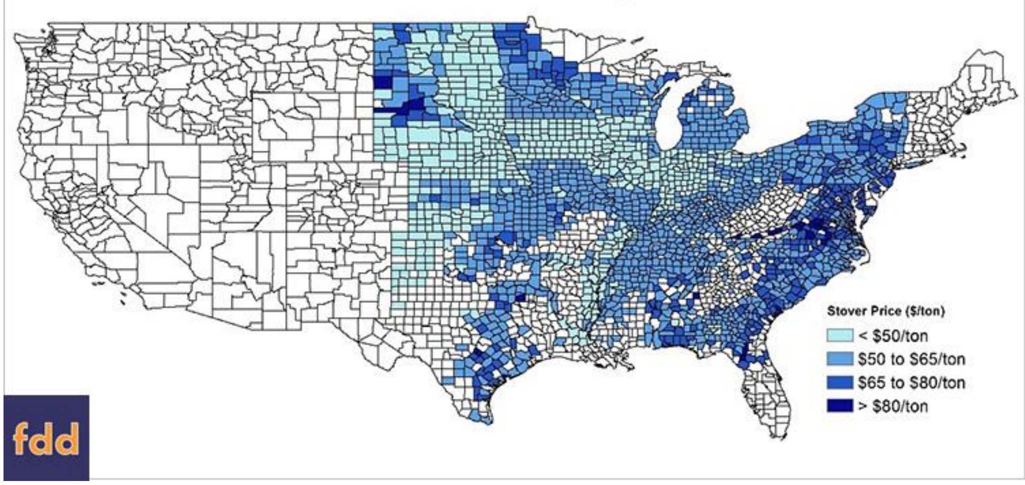


Figure 4 maps breakeven stover prices for continuous corn under no-till practices. Similar to the corn-soybean rotation, breakeven stover prices are lower under no-till tillage practices. The average decline in breakeven price from conventional to no-till is slightly higher for the continuous corn rotation at $17 per ton, compared with an average reduction of $15 per ton for the corn-soybean rotation. Comparing costs under continuous corn and the corn-soybean rotation under no-till practices (figure 2 vs. figure 4), moving from a corn-soybean to a continuous corn rotation leads to an average increase of $3 per ton for the breakeven stover price.

Figure 4. Breakeven Corn Stover Prices, Continuous Corn Rotation with No-Till Tillage



Implications

Estimates from the Biomass Crop Budget Tool for Corn Stover suggest that with a given price of biomass, farmers producing corn stover with corn grown in rotation with soybeans using no-till practices may find it more profitable than farmers using other rotation/tillage combinations. As compared to harvesting stover with continuous corn production and under more intensive conventional tillage practices, the advantages for no-till practices are relatively large, reducing breakeven stover prices by $15 to $17 per ton on average, while the advantage for the corn-soybean rotation is relatively small at $3 to $6 per ton. Other than accounting for nutrient loss replacement costs, these estimates do not incorporate any effects of removal of corn stover on future crop yields. Further research is needed to examine the extent to which stover removal, particularly with continuous corn production, may impact yields on the field in future crop years.

References

FAST Tools: Biomass Crop Budget Tool – Corn Stover. farmdoc, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign. http://farmdoc.illinois.edu/pubs/FASTtool_special_cornstover.asp

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