LAND STEWARDSHIP PROJECT

LSP *Myth Buster* #41

An ongoing Land Stewardship Project series on ag myths and ways of deflating them.

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➔ *Myth*: Corn Residue is a Waste Product

➔ *Fact*:

This could be the year of crop residue biofuels. Up until now, the biofuels industry has focused on using the kernel of the corn to distill ethanol. But one alternative biofuel source that has captured attention recently is stover—the stalks, shucks, etc., left in the field after corn is harvested. At first blush it appears to be the ultimate in recycling and making sustainable use of every last resource. After all, crop residue is unapologetically called "trash" by tillage experts and is considered a nuisance when putting in the following year's crop.

Using such material to produce fuel is feasible because of advances in cellulosic energy production. This relies on lignocellulose, a structural material that comprises much of the mass of plants. Popular sources of cellulosic feedstock are switchgrass, woodchips and the byproducts of lawn and tree maintenance. Residue left over after the harvest of wheat, rice and even sugar cane can also be used to produce energy. But in the Midwest, the number one potential source of cellulosic fuel production is corn stover.

For the most part, cellulosic fuel production is not being done on a large-scale commercial basis. However, several major firms are investing heavily in the technology and are saying 2014 could be a breakthrough year for producing energy from crop residues. For example, DuPont and POET-DSM are both launching major corn stover ethanol plants in Iowa, and some firms have already contracted with farmers to deliver baled stover. The firms invested in crop residue energy production are promising their ethanol process will result in 80 percent to 90 percent fewer greenhouse gas emissions when compared to conventional gasoline derived from fossil fuels.

One study by the U.S. Department of Energy and the USDA estimates that crop residues could provide one-third of ethanol's needs by the middle of this century. Fulfilling such a role would require 60 percent to 75 percent of crop residue to be recovered, says the USDA study. That will require a major tooling up of the process, and it's one reason there have been serious proposals, including in Minnesota, to provide government subsidies for harvesting crop residue for biofuels.

But crop residue such as corn stover is far from being a waste product, as far as the soil is concerned. It turns out it plays a major role in cutting erosion, building soil organic matter and helping fields store carbon.

The importance of that latter service was highlighted in a paper published this spring in the journal *Nature Climate Change*. The University of Nebraska study found that removing corn residue could result in such a carbon deficit in fields that it would produce a net *increase* in greenhouse gas emissions over five years when compared to conventionally-produced gasoline. Crop residue stores carbon dioxide, and it also creates a better environment for the soil itself to sequester greenhouse gases by building organic matter and protecting the surface.

Some scientists and biofuel industry experts fault the Nebraska study for the amount of residue removal its authors assumed would take place in a typical cornfield—they looked at removal rates as high as 75 percent or 100 percent. Companies like POET-DSM are asking farmers to harvest no more than 25 percent of what's available. But it's unclear what if any enforcement of residue removal rates or conservation tillage practices biofuel firms will impose. Anecdotal reports out of Iowa indicate well more than half of the residue in some fields is being removed.

What is clear is that removing more than 25 percent of a field's corn stover can cause significant harm to soil biology. A 2009 paper published in the *Soil Science Society of America Journal* found that removing more than a quarter of a field's stover had negative impacts on structural stability and soil fertility.

And replacing that fertility with petroleum-based nutrients like nitrogen fertilizer may help produce a bumper crop in the short term, but it won't build the kind of soil health needed to sequester carbon in the long term. Research out of the Morrow Plots in Illinois shows that nitrogen fertilizer speeds up the decomposition process in soil, resulting in a net decrease of soil organic carbon.

This sets up a vicious cycle: more nitrogen means less carbon in the soil, which reduces biological activity, requiring more nitrogen to maintain yields. And all that fertilizer requires energy to produce. So when one considers that removing residue produces more greenhouse gases directly by impoverishing our soil on the spot as well as indirectly (requiring more production of synthetic fertilizer), it's clear that stover is not something to be taken lightly. But then, many farmers already know that: a 2011 survey of Iowa producers showed only 17 percent were interested in selling stover. Environmental concerns topped the list of why they were hesitant to put "field trash" on the market.

➔ More Information

• The "Biofuels from crop residue can reduce soil carbon and increase CO2 emissions" study is on the *Nature Climate Change* website: www.nature.com/nclimate/index.html.

• A summary of the "Corn Stover Removal for Expanded Uses Reduces Fertility and Structural Stability" study is on the *Soil Science Society of America Journal* website: www.soils.org/publications/ssaj.

• The Morrow Plot "Myth of Nitrogen Fertilization for Soil Carbon Sequestration" study is on the *Journal of Environmental Quality* website: www.agronomy.org/publications/jeq.

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