Drilling Into the Details of Corn Stover Biomass

Adam Wirt of Poet writes about corn stover, the biomass feedstock of Project Liberty. Poet-DSM is currently producing ethanol at its commercial-scale facility.

By Adam Wirt  |  September 23, 2014

Biomass is one of the most abundant natural resources. It comes in many varieties, including virgin woods, energy crops, agricultural residues, food waste and even municipal and industrial wastes. Though not all biomass is created equal, it is almost always organic, and under the right conditions, it’s a sustainable source of energy that produces significantly fewer carbon emissions than fossil resources.

When it comes to turning biomass into biofuels, the key is to convert energy stored in the biomass from the sun through photosynthesis into a more readily usable form. In the case of Project Liberty, that’s ethanol. Because the goal usually is to maximize yields in this conversion, the best choice of biomass may be different, depending on the proximity of the biorefinery to its biomass source. Proximity is important, because transportation can push the per-unit cost of biomass beyond the profitability point.

At Project Liberty in Emmetsburg, Iowa, we chose corn stover—a mix of cobs, stalks, husks and leaves—because it is readily available and it is a byproduct of the corn harvesting process. It requires no farming inputs, such as extra tillage, planting or fertilizing, so it has minimal to no effect on agronomic soil sustainability when it is removed responsibly from the field.

In addition, synergies between the cellulosic and grain-ethanol refineries, in terms of the excess energy created in the cellulosic process can be shared with Poet Biorefining’s Emmetsburg corn-ethanol facility to reduce greenhouse gas emissions significantly. Our plan in choosing Emmetsburg was to give our first project using the cellulosic conversion process its best chance of success.

Although corn stover is a byproduct of corn and is harvested from fields that are ideal for farming, many biomass feedstocks, such as miscanthus, switchgrass and other energy grasses, can be cultivated from more marginal farmlands in arid locations, which require fewer inputs and attention. Many also can produce two crops per year, which can be attractive for harvesting and storage.

Because Poet has been a pioneer in biomass harvesting and soil agronomics research since 2006, the company had amassed a significant knowledge base. This experience helped all involved understand not only the agronomic details of harvesting corn stover, but also the “soft” elements, which include relationship building and working with and educating farmers about sustainably removing this important element in soil conservation from their fields. As farmers (called growers in the Poet-DSM system) understood the financial and farm-related benefits of stover harvesting, more than 300 area growers have now readily committed to providing their biomass to help in feeding the Liberty biorefinery’s annual needs.

One of the changes that would be required of the growers was in harvesting the stover. When looking for sustainable harvest methods, we researched several different collection methods to find the one that best met our main criteria: minimal nutrient removal, leaving enough residue for erosion control, and maintaining current soil organic matter and carbon levels.
The most ideal method, due to lower dirt contamination levels, fewer passes over the field and smaller nutrient impact, was second pass baling. These bales contain less contamination because the material isn’t being raked or chopped. Since raking is avoided, at least one additional pass across the field is eliminated, compared to traditional stover baling. By using this method, only 20 to 25 percent of the above-ground corn residue is collected.

When it comes to handling and storage, biomass is bulky and requires significant space, especially since corn stover is harvested once annually. Because of the desired composition as a feedstock and to maximize the sustainability of stover harvesting, Project Liberty utilizes EZ Bales, a 1-ton bale comprising roughly 33 percent cobs, 43 percent husks and leaves, 16 percent stalks and 8 percent ash. The EZ Bale process typically results in less nutrient replacement per ton of removed biomass than traditional stover collection processes. Although Project Liberty has a 22-acre stackyard for buffering biomass, the majority of the EZ bales are decentrally stored in grower fields, both to reduce the risk of loss due to fire and limit dedicated acreage at the biorefinery.

As of press time, our Poet-DSM team has already begun producing ethanol using Project Liberty’s cellulosic process. We look forward to working with other industry producers in expanding the number of cellulosic ethanol biorefineries in the U.S. and abroad.

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