ScienceDaily®
Your source for the latest research news

Corn-for-ethanol's Carbon Footprint Critiqued

Date: March 11, 2009

Source: Duke University

To avoid creating greenhouse gases, it makes more sense using today's technology to leave land unfarmed in conservation reserves than to plow it up for corn to make biofuel, according to a comprehensive Duke University-led study.

"Converting set-asides to corn-ethanol production is an inefficient and expensive greenhouse gas mitigation policy that should not be encouraged until ethanol-production technologies improve," the study's authors reported in the March edition of the research journal *Ecological Applications*.

Nevertheless, farmers and producers are already receiving federal subsidies to grow more corn for ethanol under the Energy Independence and Security Act of 2007.

"One of our take-home messages is that conservation programs are currently a cheaper and more efficient greenhouse gas policy for taxpayers than corn-ethanol production," said biologist Robert Jackson, the Nicholas Professor of Global Environmental Change at Duke's Nicholas School of the Environment, who led the study.

Making ethanol from corn reduces atmospheric releases of the greenhouse gas carbon dioxide because the CO2 emitted when the ethanol burns is "canceled out" by the carbon dioxide taken in by the next crop of growing plants, which use it in photosynthesis. That means equivalent amounts of carbon dioxide are removed from the atmosphere and "fixed" into plant tissues.

But the study notes that some CO_2 not counterbalanced by plant carbon uptake gets released when corn is grown and processed for ethanol. Furthermore, ethanol contains only about 70 percent of gasoline's energy.

"So we actually reduce greenhouse gas emissions only 20 percent when we substitute one liter of ethanol for one liter of gasoline," said Gervasio Piñeiro, the study's first author, who is a Buenos Aires, Argentina-based scientist and postdoctoral research associate in Jackson's Duke laboratory.

Also, by the researchers' accounting, the carbon benefits of using ethanol only begin to show up years after corn growing begins. "Depending on prior land use" they wrote in their report, "our analysis shows that carbon releases from the soil after planting corn for ethanol may in some cases completely offset carbon gains attributed to biofuel generation for at least 50 years."

The report said that "cellulosic" species -- such as switchgrass -- are a better option for curbing emissions than corn because they don't require annual replowing and planting. In contrast, a single planting of cellulosic species will continue growing and producing for years while trapping more carbon in the soil.

"Until cellulosic ethanol production is feasible, or corn-ethanol technology improves, corn-ethanol subsidies are a poor investment economically and environmentally," Jackson added.

However, the report noted that a cost-effective technology to convert cellulosics to ethanol may be years away. So the Duke team contrasted today's production practices for corn-based ethanol with what will be possible after the year 2023 for cellulosic-based ethanol.

By analyzing 142 different soil studies, the researchers found that conventional corn farming can remove 30 to 50 percent of the carbon stored in the soil. In contrast, cellulosic ethanol production entails mowing plants as they grow -- often on land that is already in conservation reserve. That, their analysis found, can ultimately increase soil carbon levels between 30 to 50 percent instead of reducing them.

"It's like hay baling," Piñeiro said. "You plant it once and it stays there for 20 years. And it takes much less energy and carbon dioxide emissions to produce that than to produce corn."

As part of its analysis, the Duke team calculated how corn-for-ethanol and cellulosic-for-ethanol production -- both now and in the future -- would compare with agricultural set-asides. Those comparisons were expressed in economic terms

with a standard financial accounting tool called "net present value."

For now, setting aside acreage and letting it return to native vegetation was rated the best way to reduce greenhouse gas emissions, outweighing the results of corn-ethanol production over the first 48 years. However, "once commercially available, cellulosic ethanol produced in set-aside grasslands should provide the most efficient tool for greenhouse gas reduction of any scenario we examined," the report added.

The worst strategy for reducing carbon dioxide emissions is to plant corn-for-ethanol on land that was previously designated as set aside -- a practice included in current federal efforts to ramp up biofuel production, the study found. "You will lose a lot of soil carbon, which will escape into the atmosphere as CO_2," said Piñeiro.

The research was funded by the National Science Foundation, the Center for Global Change at Duke University and by the Agencia Nacional de Promoción Científica y Tecnologíca of Argentina.

Other researchers in the study included Brian Murray, the director for economic analysis at Duke's Nicholas Institute for Environmental Policy Solutions and a Nicholas School research professor; Justin Baker, a researcher with Murray and Jackson; and Esteban Jobbagy, a professor at the University of San Luis in Argentina who received his Ph.D. at Duke.

Story Source:

The above story is based on materials provided by **Duke University**. *Note: Materials may be edited for content and length.*

null

Cite This Page:

MLA APA Chicago

Duke University. (2009, March 11). Corn-for-ethanol's Carbon Footprint Critiqued. ScienceDaily. Retrieved July 28, 2014 from www.sciencedaily.com/releases/2009/03/090302183321.htm