Biofuel production: a drink-or-drive issue?

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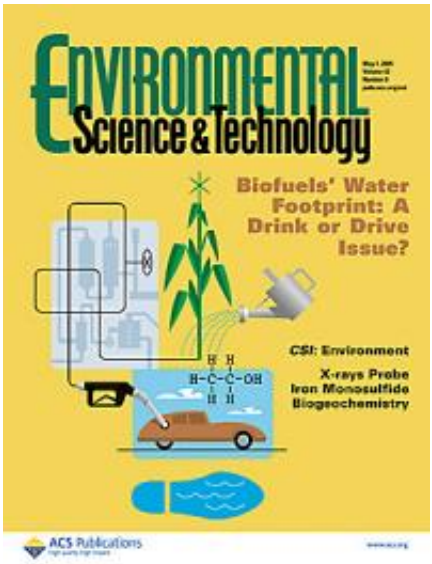

Dr. Joel Burken's article is the cover feature for the May 1, 2009, issue of the journal Environmental Science and Technology

(PhysOrg.com) -- Federal requirements to increase the production of ethanol has developed into a "drink-or-drive issue" in the Midwest as a result of biofuel production's impact on water supplies and water quality, says an environmental engineering researcher at Missouri University of Science and Technology in the latest issue of the journal *Environmental Science & Technology*.

In an analysis of the water required to produce ethanol from various crops, Dr. Joel G. Burken, a professor of environmental engineering at Missouri S&T, and colleagues from Rice University and Clarkson

University find that ethanol could become a costly proposition in terms of "gallons per mile" and other water quality issues.

They describe the Midwest's water needs and impacts as the 'water footprint' in their cover feature for the May 1, 2009, issue of Environmental Science & Technology.

The researchers report that ethanol derived from corn grown in Nebraska, for example, would require 50 gallons of water per mile driven, when all the water needed in irrigation of crops and processing into ethanol is considered. Fuel derived from irrigated sorghum grown in that state would require even more water to produce - as much as 115 gallons per mile.

Moreover, increasing production of biofuels from row crops will likely result in more water pollution due to soil erosion and the increased use of pesticides to grow enough crops to meet federal mandates for more ethanol, the researchers say. The mandated production using the current technology has driven the use of ethanol production from corn and biodiesel from soybeans as these are the currently available technologies.

In their Environmental Science & Technology article, the researchers suggest that federal regulators take a closer look at how a push for bioenergy will affect water resources.

"Developing a sustainable national biofuels program requires careful consideration of logistical concerns ... and of unintended environmental impacts," write Burken and his co-authors, Rosa Dominguez-Faus and Dr. Pedro J. Alvarez of Rice University and Dr. Susan E. Powers of Clarkson University, in their article, "The Water Footprint of Biofuels: A Drink or Drive Issue?"

To arrive at their gallons-per-mile figures, the researchers first looked at

the amount of water required to produce a single gallon of ethanol. In Nebraska, for example, it takes 800 gallons of water - from crop irrigation through final processing into ethanol - to create a single gallon of the corn-derived transportation fuel. Divide that by an average mileage of 16 miles per gallon (or two-thirds the average for gasoline-powered cars, a standard average for ethanol-powered vehicles), and the result is 50 gallons of water per mile.

While previous studies have examined biofuel production's impact on air quality, land use and net energy value, "the effect of increased biofuel production on water security has not been subjected to the same scrutiny," the researchers write. The main focus of previous studies looked at environmental trade-offs to fossil-fuel usage and not other aspects of biofuel production, according to the researchers.

"The overall water footprint associated with biofuels must recognize the impact of increased agricultural activity on water quality as well as water consumption," they write. With the federal Energy Independence and Security Act (EISA) of 2007 calling for a dramatic ramp-up in ethanol production by 2015, Burken and his colleagues foresee additional water quality problems due to "increased agricultural activity such as tilling more land for row crops and higher fertilizer and agrichemical application."

The Energy Independence and Security Act requires the United States to produce 15 billion gallons of corn-derived ethanol annually by 2015 and 16 billion gallons of fuel from cellulosic crops, such as switchgrass, by 2016. The researchers note that 44 percent of all the corn produced in the United States from 2007 would be required for ethanol production to meet the 2015 goal.

"The decision to mandate ethanol production may look great initially as we all like the concept of biofuels," Burken says, "but really our difficult

energy position and reliance on foreign oil is the result of our lack of an energy policy and investing a decade ago in biofuel technologies. Biofuel production is part of our energy future, but it needs to be considered as part of a portfolio of energy sources and technologies."

While it's unlikely the EISA will be repealed, Burken hopes lawmakers and regulators at the state and federal levels "consider a life-cycle analysis before implementing future mandates" for energy sources. Lawmakers and regulators need to consider all of the economic and environmental trade-offs - not just reducing greenhouse gas emissions, for instance. "Otherwise, we may be thinking we're addressing one environmental issue while in fact sacrificing another," Burken says.

Burken and his colleagues suggest that "drought-tolerant, high-yield plants grown on little irrigation water" would have less impact on water resources. One such crop, Burken says, is miscanthus, a fast-growing perennial grass that "grows so dense you can't walk through it and grows about 9-10 feet a year." Currently, however, no technology is available to convert the cellulosic biomass and produce it in large quantities. Once alternative biofuel production crops and processes are developed, selecting the best crop for individual settings will help to optimize biofuel production and minimize the environmental impacts of the production, Burken says.

"Developing the crops and distribution of crop production took about 100 years to get to where it was a few years ago," Burken says. "Redeveloping this production with the goal of biofuel production will take time and effort of farmers and engineers. While miscanthus may or may not be a part of our biofuels future, we at least need a little time and investment to develop the best solutions for our future."

Quoting Texas oilman T. Boone Pickens, whom Burken met on April 22 during the Missouri Energy Summit, Burken says, "The best time to

plant a tree was 20 years ago, but the next best time if you didn't is today."

Provided by Missouri University of Science and Technology (news : web)