Nations that sow food crops for biofuels may reap less than previously thought

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Global yields of most biofuels crops, including corn, rapeseed and wheat, have been overestimated by 100 to 150 percent or more, suggesting many countries need to reset their expectations of agricultural biofuels to a more realistic level.

That's according to a study led by Matt Johnston and Tracey Holloway of the University of Wisconsin-Madison Nelson Institute for Environmental Studies and Jon Foley of University of Minnesota, which drew on actual agricultural data from nearly 240 countries to calculate the potential yields of 20 different biofuels worldwide.

The analysis, publishing today (Jan. 13) in the open-access journal *Environmental Research Letters*, indicates the biofuels production potential in both developing and developed countries has often been exaggerated. Why? Because current yield estimates, most of which are based on data from the United States and Europe, don?t account for local differences in climate, soils, technology and other factors that influence agricultural outputs.

By offering an analysis of detailed, regional yield data that do encompass this variability, the scientists hope to empower wiser choices by countries about whether to invest in ethanol or biodiesel, which crops to plant, and how best to use existing farmlands. Although agricultural biofuels have been sharply criticized for their impacts on the environment and food supply, the reality is they?re here to stay, say the researchers, at least until alternatives such as cellulosic ethanol are developed. And that makes the availability of sound information critical.

"The biofuels industry has grown at an incredible rate. It?s a multibillion-dollar industry now," says Johnston, a graduate student in the Nelson Institute's Center for Sustainability and the Global Environment (SAGE). So, what we've tried to do is move beyond the back-of-the-envelope calculation -- the time for that is over. We need to look at better data sources and make more informed decisions."

"In the past," he explains, policymakers, companies and farmers have based decisions about biofuels in part on "yield tables," which make simple side-by-side comparisons of the fuel yield per unit of land for various crops; for example, the amount of ethanol a hectare of sugarcane will generate versus a hectare of corn.

The problem with these widely quoted tables, says Johnston, is the original sources of the numbers usually aren't cited, making it impossible to gauge their validity. What's more, the tables typically select a single value -- often from just one country or even a single farm -- to represent the yield of each crop regardless of where it's grown.

"Often these are very optimistic numbers and they?re chosen to promote biofuels," says Johnston. "So they usually (represent) the highest-yield, best-case scenario."

To take a more sober look, Johnston turned to a global agricultural database, developed at SAGE, which provides actual yields of 175 crops, circa the year 2000, at a resolution of roughly five miles by five miles across the entire globe. After tapping it for yields of 10 biodiesel crops, such as soybean, rapeseed and oil palm, and 10 ethanol feedstocks, including corn, rice and wheat, Johnston calculated and mapped the amount of biofuel that could be produced per hectare in every possible country by crop combination -- some 3,000 in all.

To evaluate his numbers against published yield table values, he then computed a global average yield for each of the 20 fuels, as well as the average yields of each in both developed and developing nations as a whole.

What he found were large gaps between the yield

table numbers and his own, especially for developing countries. For instance, while his calculation for the average yield of corn ethanol in developed countries matched well with current yield table estimates, the average yield of developing countries was nearly 100 percent lower.

Such disparities weren't restricted to the developing world either. Canada, for example, is one of the world?s largest producers of rapeseed. Yet, Johnston calculated its average yield of rapeseed biodiesel at just 550 liters per hectare -- nearly half the estimates in yield tables, and well below the average for other developed nations.

Researchers at SAGE and University of Minnesota plan next to compare yields of biofuels in areas with similar climates, and then study how differences in management practices, such as irrigation or fertilizer use, may be contributing to gaps in production. The idea is to help countries get the most from existing farmlands, so they?ll put less new land to the plow and can better balance investment in biofuels against other needs, such as food security. But first they just need better data.

"This is not a one-dimensional issue and just knowing the crop yields isn't going to tell you what the best solution is," says Holloway. "But if you're going to be making land use decisions related to biofuels, it's critical that you at least know what you're going to get from a plot of land."

Source: University of Wisconsin-Madison