Food vs. fuel: Scientists say growing grain for food is more energy efficient

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Using productive farmland to grow crops for food instead of fuel is more energy efficient, Michigan State University scientists concluded, after analyzing 17 years' worth of data to help settle the food versus fuel debate.

"It's 36 percent more efficient to grow grain for food than for fuel," said Ilya Gelfand, an MSU postdoctoral researcher and lead author of the study. "The ideal is to grow corn for food, then leave half the leftover stalks and leaves on the field for soil conservation and produce cellulosic ethanol with the other half."

Other studies have looked at energy efficiencies for crops over shorter time periods, but this MSU study is the first to consider energy balances of an entire cropping system over many years. The results are published in the April 19 online issue of the journal Environmental Science & *Technology*.

"It comes down to what's the most efficient use of the land," said Phil Robertson, University Distinguished Professor of crop and soil sciences and one of the paper's authors. "Given finite land resources, will it be more efficient to use productive farmland for food or fuel? One compromise would be to use productive farmland for both -- to use the grain for food and the other parts of the plant for fuel where possible. Another would be to reserve productive farmland for food and to grow biofuel grasses -- cellulosic biomass -- on less productive land."

He, Gelfand and Sieglinde Snapp, another co-author and an MSU associate professor of crop and soil sciences, analyzed data collected from 1989 to 2007 at the W.K. Kellogg Long Term Ecological Research site. That National Science Foundation-funded project studies ecology and environmental biology to provide a better understanding of both natural and managed systems. It is the only agricultural program in the 26-site NSF national LTER network.

The scientists compared the energy inputs and outputs of producing corn, soybeans and wheat grown using four systems: conventional tillage, no-till, low chemical input and organic, and then using all harvested plant material for either food or biofuel production. They also looked at energy balances for growing alfalfa, an important forage plant that can be used either for biofuel or for beef cattle feed.

The analysis showed that using no-till production to grow grain for food was the most energy-efficient system for food or fuel production. Avoiding plowing with no-till management reduces tractor fuel use during production.

Producing a kilogram of corn for human food provides more energy than converting the corn to either ethanol by processing or to meat by feeding it to animals. Growing alfalfa for biofuel is 60 percent more efficient than using it as cattle feed, according to the study.

Robertson and Gelfand also are members of the Great Lakes Bioenergy Research Center, a partnership between Michigan State and the University of Wisconsin-Madison funded by the U.S. Department of Energy to conduct basic research aimed at solving some of the most complex problems in converting natural materials to energy.

The U.S. Energy Independence and Security Act of 2007 calls for biofuels to comprise 22 percent of the nation's transportation fuels by

2022.

"This research is aimed at policymakers who have to decide how and where biofuels should be grown and the best way to encourage farmers to follow those suggestions," Robertson said.

Research by MSU agricultural economics professor Scott Swinton earlier found that the most profitable cellulosic biofuel crop right now is corn stalks and leaves.

"Our research suggests that this is an energy-efficient strategy as well, so long as the grain is used for food," Robertson said. "But there are not enough corn stalks to meet expected energy needs and federal policy also may decide to offer incentives to grow crops that offer more environmental benefits than corn, including incentives to grow grasses on less productive land.

"The promise of biofuels made from biomass is huge, from both climate mitigation and economic perspectives," he continued. "But the promise could come up short if we don't pay attention to details such as the land on which they are grown."

Provided by Michigan State University