

Mixed Prairie Grasses Better Source of Biofuel Than Corn Ethanol and Soybean Biodiesel

December 7 2006



Mixed prairie grasses have emerged as a leader in the quest to produce biofuels.
Credit: Cedar Creek LTER Site

Diverse mixtures of native prairie plant species have emerged as a leader in the quest to identify the best source of biomass for producing sustainable, bio-based fuel to replace petroleum.

A new study led by David Tilman, an ecologist at the University of Minnesota, shows that mixtures of native perennial grasses and other flowering plants provide more usable energy per acre than corn grain ethanol or soybean biodiesel and are far better for the environment. The

research was supported by the National Science Foundation (NSF) and the University of Minnesota Initiative for Renewable Energy and the Environment.

"Biofuels made from high-diversity mixtures of prairie plants can reduce global warming by removing carbon dioxide from the atmosphere. Even when grown on infertile soils, they can provide a substantial portion of global energy needs, and leave fertile land for food production," Tilman said.

The findings are published in the Dec. 8, 2006, issue of the journal *Science*.

The study is based on 10 years of research at Minnesota's Cedar Creek Natural History Area, one of 26 NSF long-term ecological research (LTER) sites. It shows that degraded agricultural land planted with diverse mixtures of prairie grasses and other flowering plants produces 238 percent more bioenergy on average than the same land planted with various single prairie plant species, including switchgrass.

"This study highlights very clearly the additional benefits of taking a less-intensive management approach and maintaining higher biodiversity in the process," said Henry Gholz, NSF LTER program director. "It establishes a new baseline for evaluating the use of land for biofuel production."

Tilman and his colleagues estimate that fuel made from this prairie biomass would yield 51 percent more energy per acre than ethanol from corn grown on fertile land. Prairie plants require little energy to grow and all parts of the plant above ground are usable.

Fuels made from prairie biomass are "carbon negative," which means that producing and using them actually reduces the amount of carbon

dioxide (a greenhouse gas) in the atmosphere. Prairie plants store more carbon in their roots and soil than is released by the fossil fuels needed to grow and convert them into biofuels. Using prairie biomass to make fuel would lead to the long-term removal and storage of from 1.2 to 1.8 U.S. tons of carbon dioxide per acre per year. This net removal of atmospheric carbon dioxide could continue for about 100 years, the researchers estimate.

In contrast, corn ethanol and soybean biodiesel are "carbon positive," meaning they add carbon dioxide to the atmosphere, although less than fossil fuels.

Switchgrass, which is being developed as a perennial bioenergy crop, was one of 16 species in the study. When grown by itself in poor soil, it did not perform better than other single species and gave less than a third of the bioenergy of high-diversity plots.

"Switchgrass is very productive when it's grown like corn in fertile soil with lots of fertilizer, pesticide and energy inputs, but this approach doesn't yield as much energy gain as mixed species in poor soil nor does it have the same environmental benefits," said paper co-author Jason Hill, also of the University of Minnesota.

To date, all biofuels, including cutting-edge nonfood energy crops such as switchgrass, elephant grass, hybrid poplar and hybrid willow, are produced as monocultures grown primarily in fertile soils.

The researchers estimate that growing mixed prairie grasses on all of the world's degraded land could produce enough bioenergy to replace 13 percent of global petroleum consumption and 19 percent of global electricity consumption.

The practice of using degraded land to grow mixed prairie grasses for

biofuels could provide stable production of energy and have additional benefits, such as renewed soil fertility, cleaner ground and surface waters, preservation of wildlife habitats, and recreational opportunities.

Source: NSF

Citation: Mixed Prairie Grasses Better Source of Biofuel Than Corn Ethanol and Soybean Biodiesel (2006, December 7) retrieved 20 March 2024 from <https://phys.org/news/2006-12-prairie-grasses-source-biofuel-corn.html>

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