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Grass biofuels 'cut CO2 by 94%'

Biofuels: Quick guide

Producing biofuels from a fast-growing grass delivers vast savings of carbon dioxide emissions compared with petrol, a large-scale study has suggested.

A team of US researchers also found that switchgrass-derived ethanol produced 540% more energy than was required to manufacture the fuel.

One acre (0.4 hectares) of the grassland could, on average, deliver 320 barrels of bioethanol, they added.

Their paper appears in the Proceedings of the National Academy of Sciences.

The five-year study, involving 10 farms ranging in size from three to nine hectares, was described as the largest study of its kind by the paper's authors.

Co-author Ken Vogel of the US Department of Agriculture's (USDA) Agriculture Research Service, based at the University of Nebraska, Lincoln, said that all previous energy analyses had been based on data from research plots and estimated inputs.

Last year, a team of scientists had also examined the energy gains from ethanol produced from switchgrass, but their model suggested that the net gain was in the region of 343%, which was considerably less that the USDA team's findings.

Biofuels: Next generation

"A lot of their information was based on small plot data and also estimates of what would be needed in the agronomic production of

biofuels," Dr Vogel explained.

"We had on-farm trials, so we had all the data from the farmers on all the inputs needed to produce the crops.

"We were able to take this information and put it into this model and able to come up with a very real-world estimate."

The energy inputs required to produce the crops included nitrogen fertiliser, herbicides, diesel and seed production.

However, he added that as there were no large-scale biorefineries in operation, the team did have to estimate how much bioethanol such a plant would be able to produce in order to calculate the net energy gain.

"Right now, the Department of Energy is co-funding the construction of six biorefineries in the US. These plants will be completed around 2010, and will be above the pilot plant scale."

Although the process to produce ethanol from switchgrass was more complex than using food crops such as wheat or corn, the so-called "second generation" biofuel could produce much higher energy yields per tonne because it utilised the whole plant rather than just the seeds.

Carbon cuts

The team also calculated that the production and consumption of switchgrass-derived ethanol cut CO2 emissions by about 94% when compared with an equivalent volume of petrol.

SWITCHGRASS FACTS

Scientific name: *Panicum virgatum L*
Species is a perennial grass
Distribution: North and South America, parts of Africa
Grows to heights of 0.5-2.5m
Produces an average of 320 barrels of bioethanol per hectare
(Source: USDA; Cardiff School of Biosciences)

Burning biofuels releases carbon dioxide, but growing the plants absorbs

a comparable amount of the gas from the atmosphere.

However, the energy inputs used during the growing and processing of the crops means the fuel is rarely "carbon neutral".

"Greenhouse gas (GHG) emissions of ethanol from switchgrass, using only the displacement method, showed 88% less GHG emissions than conventional ethanol," the researchers wrote.

"The use of... biomass residue for energy at a... biorefinery is the main reason why switchgrass and human-made prairies have theoretically lower GHG emissions than biofuels from annual (food) crops, where processing is currently derived from fossil fuels."

A number of organisations, including the UN, have expressed concern that biofuels could do more harm than good.

The criticisms of the technology include taking large areas of arable land out of food production, inflating crop prices and limited carbon emission savings.

'Low faith in biofuels

"In contrast to most European countries, the US has quite a bit of land that is being held outside of (food) production at the moment," Dr Vogel told BBC News.

"We are looking at the use of switchgrass on marginal cropland The intent is to have energy crops being grown on marginal cropland, so it would not be in competition with food crops on our best land.

He also added that there were other factors within the process of producing the biofuel that limited its financial and environmental feasibility.

"Because there is going to be a lot of tonnage of material shipped to the biorefinery, there is going to be some economics involved."

In order to maximise the carbon reductions, he said: "A biorefinery will have a feedstock supply radius of about 25 to 50 miles, so the feedstock of any biorefinery needs to be localised."

As the switchgrass had to be sourced within the local area, Dr Vogel said

it was important that the land delivered a high yield of grass in order to meet the refinery's demands.

Annual rainfall was a key factor affecting the delivery of the necessary yields.