25 January 2013 Last updated at 09:51 GMT

Sugar-rich willow can boost biofuels' green credentials

By Mark Kinver Environment reporter, BBC News

Willow is widely grown as a feedstock for biomass and biofuel industries

Scientists have identified willow trees that yield five times as much sugar as ordinary varieties, "drastically reducing" the impact of biofuels.

UK researchers found that if the trees grew at an angle, they produced a special kind of wood that resulted in the higher sugar content.

Willow, a short rotation coppice crop, is widely grown as a source for the biofuel and biomass industries.

The findings appear in the Biotechnology for Biofuels journal.

"It would drastically reduce [the environmental impact of biofuels] because you would not need such a severe pre-treatment in the conversion process, which is currently one of the highest energy consumption steps in the process of converting woody biomass to biofuels," explained co-author Michael Ray, a researcher at Imperial College London.

Energy intensive pre-treatment processes are used to soften the wood before it goes through an enzymatic stage to break down the woody matter in order to produce biofuel.

"Our feeling is that these varieties that we know yield more sugar will need a much less severe pre-treatment process," Dr Ray told BBC News.

"Ultimately, we will work towards producing varieties that actually will not need any pre-treatment at all and will be able to dissolve them in enzymes without undergoing any pre-treatment processes."

He added that the findings could also improve the environmental performance of biofuels by increasing sugar yields, making the whole process more productive and cost effective.

"What we are really working towards here is sustainability, reducing the energy inputs and improving the energy and carbon balances, and reducing the competition for land that you could use for food production," he said.

Wind in the willows

"We hopefully will be able to... generate new varieties that will be easier to break down and use the sugars to produce biofuels"

Dr Michael Ray Imperial College London
Dr Ray and his colleague Dr Nicholas Brereton said the latest work built on previous work involving a wider study on willow varieties at the national collection at Rothamsted Research, which is the longest running agricultural research station in the world.

"We found in that study that certain varieties released more sugar than others, and in that same study we discovered that it had nothing to do with the total amount of sugars that were there, so we knew that it had to be something else that was causing the differences that we were seeing," Dr Ray recalled.

"The phenomenon we are investigating is a natural phenomenon that is observed in most trees. You get a special type of wood (known as reaction wood) laid down in response to environmental stimuli, such as tipping or wind, which induces these special woods to be formed."

"We found that the trees we tipped, compared with control trees that were not tipped, the different genotypes responded differently. Some of them did not release any additional sugar, even if you tipped them. Yet in others, there were very big differences."

Reaction wood has a different cellular characteristic to normal wood and is formed when branches or stems have been disturbed and the tree attempts to return to its original position. It is also known as tension wood in deciduous trees and compression wood in conifers.

Working alongside colleagues from the University of Highlands and Islands, Scotland, the pair found the same results in the environment as well, allowing them to conclude that it was the effect of tipping that was triggering the response in the trees.

Dr Ray said that more research was needed in order to understand the underlying mechanism and identify what advantages the production of "reaction wood" offered to naturally growing tree.

"We just know that it is a natural response that we hopefully will be able to utilise that in order to generate new varieties that will be easier to break down and use the sugars to produce

biofuels," he observed.