Giant grass miscanthus is a bioethanol source with negative CO2 balance

April 6 2022

Bioethanol from the giant grass miscanthus, combined with carbon storage in depleted oil reservoirs, can make a significant contribution to reducing greenhouse gas emissions. Credit: University of Hohenheim / Wolfram Scheible

A significant reduction in greenhouse gas is feasible. This is the conclusion reached by researchers at the University of Hohenheim in

Stuttgart. The trick: A combination of bioethanol production from renewable resources with carbon capture and storage technologies. Depending on the calculation approach used, a reduction of more than 100 percent compared to the EU benchmark for fossil fuels is thus likely—meaning there can even be a negative CO_2 balance. The processes uses the giant grass miscanthus, which has successfully proven its suitability for this form of biofuel production within the European EU joint project GRACE.

One important measure to mitigate climate change is to emit less greenhouse gas. The transport sector in particular can make a significant contribution here, for example by replacing gasoline derived from fossil petroleum with bioethanol made from renewable raw materials.

How this already established technology can be further optimized is currently being investigated by researchers within the joint project "Growing Advanced industrial Crops on Marginal Lands for Biorefineries" (GRACE) in a new approach: "If you combine the production of bioethanol with carbon capture and storage technologies, you could help remove carbon dioxide (CO_2) from the atmosphere," stated project coordinator Dr. Andreas Kiesel from the Department of Biobased Products in the Bioeconomy at the University of Hohenheim.

Together with Croatian researchers, a novel biorefinery project is currently being developed in Croatia for this purpose: A bioethanol plant is to be integrated into an existing oil refinery owned by the oil and gas company INA in Sisak. The aim is to compress the CO_2 created during bioethanol production, inject it into the existing cavities of depleted oil reservoirs, and store it there for several hundred years.

According to Dr. Jan Lask, who is in charge of this subproject at the University of Hohenheim, the location offers two major advantages: "For one thing, the refinery is in close proximity to depleted oil

reservoirs that can be used for CO_2 storage and these reservoirs are, according to experts, stable over the long term for the next 1,000 years and beyond."

On the other hand, it is estimated that there are about 60,000 hectares of unused agricultural land in the Sisak-Moslavina County, some of which can be used to produce the biomass needed for bioethanol production. Large parts of this land were used for agriculture in the past, but were abandoned during the Yugoslav war in the 1990s.

Miscanthus—more than just an alternative to fossil raw materials

The researchers are paying special attention to Miscanthus x giganteus. Originally from Southeast Asia, this giant grass grows up to three meters high and is extremely robust. "Miscanthus can be cultivated on so-called marginal land that is not suitable for profitable cultivation of other crops. In this way, unused land can be cultivated again without competing with food and fodder crops or other products," explained Dr. Lask.

Once established as a permanent crop, miscanthus not only reduces the risk of erosion and stabilizes the soil, it also effectively suppresses the growth of weeds. This is relevant because false indigo bush (Amorpha fruticosa), an invasive plant native to North America, is currently spreading rapidly in the area in question. "Large-scale cultivation of miscanthus could be an option to reduce the spread of this species," Dr. Lask said.

Not only a promising energy crop

According to the researchers' calculations, bioethanol production from miscanthus in combination with carbon storage can contribute

significantly to reducing greenhouse gas emissions in the European transport sector: Depending on the approach for calculating biological carbon storage used, a reduction of more than 100 percent compared to the EU benchmark for fossil fuels is thus likely—meaning there can even be a negative CO_2 balance.

Despite their enthusiasm for the possibilities of bioeconomy, the partners also want to test whether there could be negative effects for people and the environment and which intensity of biomass cultivation is safe and sensible. A possible negative effect would be if more intensive cultivation of biomass were to force out other uses of the land, for example. In the best case scenario, jobs would be created, especially in areas of Croatia that have been deserted since the Balkan conflict.

In the European bioeconomy project Growing Advanced industrial Crops on Marginal Lands for Biorefineries (GRACE), the University of Hohenheim brings together 22 project partners from science, agriculture, and industry from all over Europe. These include Wageningen University and Research, AgroParisTech, and the University of Bologna, all of whom with the University of Hohenheim has joined forces in the European Bioeconomy University (EBU). Objectives: Promoting cooperation between biomass producers and processing companies in Europe, creating seamless value chains, and making biomass production more attractive with new types of crops, innovative cultivation methods, and using previously unused areas.

More information: Website of the project: www.grace-bbi.eu/

Provided by University of Hohenheim

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