

A quick way to grade grasses for ethanol yields

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U.S. Department of Agriculture (USDA) researchers have developed an inexpensive way to grade the ethanol potential of perennial grasses at the biorefinery's loading dock.

That future has been made possible by a team of Agricultural Research Service (ARS) scientists, including Ken Vogel, Rob Mitchell, and Steve Masterson at Lincoln, Neb.; Hans Jung at St. Paul, Minn.; Bruce Dien at Peoria, Ill.; and Michael Casler at Madison, Wis. ARS is USDA's chief intramural scientific research agency, and this research supports the USDA priority of developing new sources of bioenergy.

The researchers developed the first use of near-infrared sensing (NIRS) to measure 20 components in switchgrass biomass that determine its potential value to biorefiners. These components include cell wall sugars, soluble sugars and lignin. With this information, 13 traits can be determined, including the efficiency of the conversion from sugars to ethanol.

This is the first use of NIRS to predict maximum and actual ethanol yields of grasses from a basic conversion process. This capability already exists for [corn grain](#) using NIRS.

Predictions of actual ethanol yields were based on hexoses, or six-carbon sugars, in the plant cell wall and as soluble sugars. Since additional ethanol could be produced from pentose or five-carbon sugars as conversion technology improves, the NIRS method can be used to

estimate what the total potential yield of ethanol or other biofuels would be if all sugars in the plant were converted.

The scientists tested switchgrass varieties and experimental lines adapted to the Midwest with the NIRS analyses and found significant differences for actual and potential ethanol yield per ton and per acre.

The study shows it is feasible to use NIRS to estimate ethanol yields of switchgrass at about \$5 a sample, instead of \$300 to \$2,000 per sample using conventional analytical methods.

The calibrations developed in this study-and improved future versions-can be used in all aspects of plant research, including basic genetics and harvest and storage research for a variety of perennial grasses. The NIRS equations are already being used for developing new cultivars in ARS breeding programs in Nebraska and Wisconsin.

This method also can be used to find ways to grow grasses for the highest ethanol yields.

ARS and the Near Infrared Spectroscopy Consortium (NIRSC) of Hillsboro, Wis., recently established a cooperative agreement for the purpose of transferring the NIRS calibrations for switchgrass composition to other public and private laboratories that conduct research on developing switchgrass into a biomass energy crop, and to industries who are using or will use switchgrass for biomass energy. NIRSC is an association of commercial laboratories, universities, government groups, plant research companies and instrument companies, and its members collaborate together to unify knowledge, accuracy and application of NIRS technology.

Vogel and his colleagues published findings from this research in the journal *BioEnergy Research*.

More information: Read more about this research in the August 2011 issue of Agricultural Research magazine:

[www.ars.usda.gov/is/AR/archive ... /switchgrass0811.htm](http://www.ars.usda.gov/is/AR/archive.../switchgrass0811.htm)

Provided by United States Department of Agriculture

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