

OSU 'sweet' biofuels research goes down on the farm

Oklahoma State University's sorghum-related biofuels research is taking a localized approach, with the aim of making possible the effective production of ethanol in the farmer's own field.

Sweet sorghum can be grown throughout temperate climate zones of the United States, including Oklahoma. It provides high biomass yield with low irrigation and fertilizer requirements. Corn ethanol, in contrast, requires significant amounts of water for growing and processing.

Best of all, producing ethanol from sweet sorghum is relatively easy, said Danielle Bellmer, biosystems engineer with the OSU Division of Agricultural Sciences and Natural Resources' Robert M. Kerr Food and Agricultural Products Center.

"Just press the juice from the stalk, add yeast, allow fermentation to take place and you have ethanol," Bellmer said. "Unfortunately, the simple sugars derived from sweet sorghum have to be fermented immediately."

Throw in the expense of constructing and operating a central processing facility that would only operate the four to five months of the year when sorghum would be available in Oklahoma and the challenge multiplies.

The beginnings of a possible solution presented itself when entrepreneur Lee McClune, president of Sorganol Production Co. Inc., approached FAPC scientists seeking their assistance in testing his newly designed field harvester capable of pressing and collecting juice from sweet sorghum. His proposed Sorganol process involved using the harvester, large storage bladders for fermentation and a mobile distillation unit for ethanol purification.

OSU's initial involvement in the project was to look at the feasibility of fermenting the juice in the field.

"We're examining such things as juice extraction efficiency, whether or not pH (acidity) or nutrient adjustment of the juice is needed and various environmental factors," Bellmer said.

The goal is to make production of ethanol from sweet sorghum economically viable by using an in-field processing system that minimizes transportation costs and capital investment.

Equipment such as the harvester and other technology could be owned individually or cooperatively with a number of producers sharing and possibly helping one another process ethanol from sweet sorghum.

In Oklahoma, the potential processing scenario might look like this: Plant sweet sorghum around mid-April, and then stagger plantings for two to three months. This would provide a harvest window of August through November.

"Ethanol yields in Oklahoma could range from 300 gallons to 600 gallons per acre, depending on biomass yield, sugar content and juice expression efficiency," said Chad Godsey, biofuels team member and OSU Cooperative Extension cropping systems specialist with the department of plant and soil sciences.

Godsey said the team is working to determine the maximum possible harvest window for sweet sorghum in Oklahoma.

"Obviously, the longer the harvest window, the more ethanol state farmers will be able to produce," he said.

OSU Biofuels Team researchers also are studying environmental parameters that may affect the feasibility of on-farm fermentation. A producer must be able to ferment the juice in the field during Oklahoma's harvest season for sweet sorghum, which occurs in the fall when temperature extremes are highly possible.

"Temperature can speed up, slow down or derail the fermentation process," Godsey said.

Weather data for Oklahoma indicate an average low temperature of about 44 degrees Fahrenheit and an average high temperature of approximately 98 degrees Fahrenheit during the August-through-October period over the past 10 years.

Six test plot sites are maintained at Oklahoma Agricultural Experiment Station facilities across the state, allowing OSU scientists to conduct research on sweet sorghum under local conditions.

"We would like to do with sweet sorghum what the Brazilians have done with sugar cane: In Brazil, sugar cane ethanol provides a large percentage of their fuel needs," Bellmer said.

The idea of using sweet sorghum for commercial ethanol production is not new. The reason sweet sorghum is not as popular as corn in terms of being a source of ethanol in the United States has been the need to ferment its simple sugars immediately and the high costs associated with a central processing plant that is operated only seasonally.

"By determining a process by which agricultural producers can create ethanol in the field from sweet sorghum, that barrier is removed," Bellmer said. "Producers will then have a much higher value product to sell."

Source: Oklahoma State University

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