

Ethanol Crop Alternatives

Studies On Different Crops For Fuel Production Show Problems, Possible Solutions

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PORTAGEVILLE, MO. Ethanol production from sweet sorghum was discussed by Gene Stevens, Delta Center crop production specialist, at the recent Delta Center Field Day.

"In Brazil, they use sugarcane for their main source of ethanol," he began. "Sweet sorghum and sugarcane are first cousins botanically, and sweet sorghum has been grown mostly for syrup for many years in the United States."

He explained that back in World War II when sugar was rationed, many moonshiners were using sweet sorghum as a substitute for sugar. Even after that, when the price of sugar was high a lot of people used sweet sorghum for making alcohol.

"It's not a new technology, it's been used for making alcohol for a long time," Stevens added.

"My main emphasis on the research we did last year was nitrogen rates," he explained.

He used side-by-side comparisons of sorghum to corn to check nitrogen rates. For corn in 2007, the highest rate was 160 pounds of nitrogen which made a little over 200 bushels an acre; for sweet sorghum, the same amount of ethanol was produced as with the corn, but it required only 60 pounds of nitrogen.

"But there are several hurdles with sweet sorghum that we need to overcome," he said. "We don't really have a good harvesting system, although a lot of places are just using sugar cane harvesters. Those aren't available around here. Also, the juice would have to be fermented and stored, whereas the corn needs only to be harvested and put in grain bins. So the infrastructure system is better for corn."

"In the cases where we produce the same amount of ethanol with sweet sorghum and corn, it's probably still better to stay with corn," Stevens said. "What we're trying to do is come up with varieties of sweet sorghum that are earlier and more cold tolerant so we can plant earlier and get two harvests. If we can ratoon crop sorghum, we will not double the yield, we could probably increase it by 30 percent or 40 percent. That's what a lot of our work is focusing on. In the future, we hope to identify genetic markers to speed up the

process of developing cold tolerant varieties." Sweet sorghum juice is sucrose, glucose and fructose, compounds that the yeast can use readily. Once the yeast is added it starts making ethanol. With corn starch you have to add the enzyme to it. Enzymes for converting starch in corn to sugars are relatively inexpensive, so that's not really a limitation on the corn side of it.

"The enzymes for breaking down cellulose though are very expensive, in the range of \$100 a gallon," he said. "So right now the technology is not economically feasible."

"There are probably better uses for sweet sorghum bagasse than breaking the cellulose down to sugars for ethanol," he continued. "Bagasse is the part of the stalk that is left over after the sugar is extracted."

"Unless somebody comes up with an affordable enzyme, or unless there are huge govern-

ment subsidies, I don't see ethanol from cellulose being very economical right now," he added. "I'm working closely with our Biological Engineering Department on a bioenergy feedstock research project. My part of the research is the production side of bioenergy such as the crop seeding rates, fertilization, and variety selection. Dr. Leon Schumacher is working on



Dr. Gene Stevens, Delta Center Crop Production Specialist, with the University of Missouri Delta Center discussed ethanol production from sweet sorghum.

Photo by John LaRose, Jr.

harvesting equipment for biofuels, and Dr. Bill Jacoby is working on the process of gasification. So it's a three-stage research project and my part is the agronomics of biofuel production."

Stevens said the advantage with sweet sorghum is that it can be grown on soils that do not produce high corn yields. A lot of research on sweet sorghum is underway in Oklahoma and Texas where there is less rainfall than Missouri.

"We have the biomass yields from the sweet sorghum in 2008 but have not tested the sugar content in the stalk samples that are currently in our lab freezer," he continued. "In 2008, the corn yields in our plots were around 175 bushels per acre on our silt loam site, but barely above 100 bushels on the heavy clay gumbo location. The sorghum produced over 40 tons fresh weight per acre on the clay soil which is great. This indicates to me that maybe we are better off planting corn for food and feed on our most productive silt loam soils and growing sweet sorghum for ethanol in fields with marginal soils."

He identified the best sweet sorghum varieties as M181E and the Topper 76. "If you look at the Dale sweet sorghum plots, you will notice that most fell over from the high winds that we had recently," he said. "Lodging is something that we need to work on too."



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