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T E N N E S S E E

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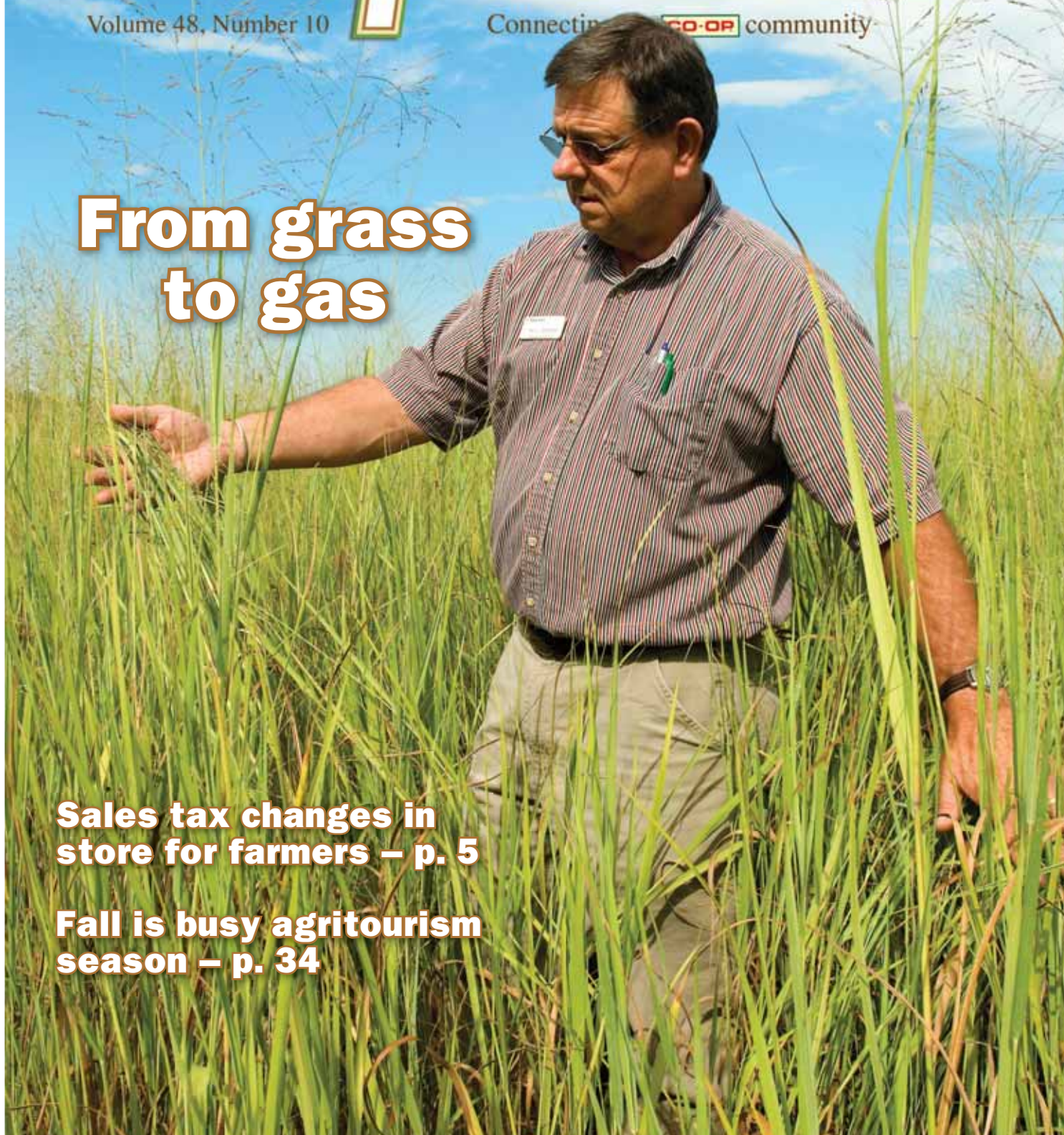
Volume 48, Number 10

Connecting **CO-OP** community

From grass to gas

**Sales tax changes in
store for farmers – p. 5**

**Fall is busy agritourism
season – p. 34**



From GRASS to GAS



This 3-year-old field of switchgrass in Henry County is providing a valuable learning experience for University of Tennessee Extension agent Ken Goddard, who has been working with five producers in a U.S. Department of Energy-funded study in which bales of switchgrass are being substituted for coal at an electricity-generating plant. Now that UT will be turning switchgrass into ethanol at a new pilot plant in East Tennessee, many recommendations for future growers are based on what the West Tennessee farmers have found.

Producing alternative fuels is the driving force behind much of Tennessee's new agricultural research

Story and photos by Allison Morgan

If a new pilot ethanol plant being built in Monroe County proves successful, Tennessee researchers and farmers could be the first in the nation to turn blades of grass into tankfuls of gas.

The \$40.7-million research-scale biorefinery is being constructed at an industrial park in Vonore by the University of Tennessee, recipient of a generous \$70 million from the state to aggressively pursue biofuel production. UT announced in September that it will partner with Mascoma Corporation, a pioneer in biofuel production, to build and operate the plant.

The principal product of the East Tennessee facility will be cellulosic ethanol, which is derived from plant material rather than the more traditional corn-based ethanol. UT expects the primary feedstock for the refinery to be switchgrass, a hardy, perennial, warm-season forage crop that grows in large volume, requires few inputs, and has a high cellulosic content. One acre of switchgrass can produce 500 gallons of ethanol.

Because it does not compete with food or feed uses, using dedicated energy crops like switchgrass to produce cellulosic biofuels may be the answer to producing affordable, domestic, renewable fuel without raising food or feed costs, said Kelly

Tiller, director of operations for UT's bio-energy programs, speaking to some 150 farmers and community members who turned out for a public forum on biofuels in late August at Walters State Community College in Morristown.

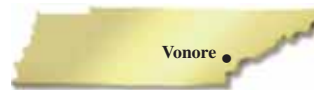
"We really feel that cellulosic-based fuels are the next wave of the future and have long-term sustainable potential," said Tiller. "We think that within a 20-year period, we could be producing and consuming about 1 billion gallons of cellulosic biofuels in the state of Tennessee. That would displace our current use of gasoline by about 30 percent."

Once considered a weed by farmers and a wildlife habitat by conservationists, switchgrass may now become not only a source of renewable energy but also a source of added income for Tennessee producers. An \$8 million farmer incentive program is under development by UT to encourage local production of this new energy crop. This incentive will include payments to help with establishment plus money to help offset other costs of producing and harvesting the crop. That's in addition to the price, which has not yet been determined, that producers would receive for the end product.

UT plans to contract 800 to 1,000 acres of switchgrass for 2008 and will eventually have around 8,000

acres to supply the ethanol facility. By early November, producers will be able to submit applications for a five-year contract to produce switchgrass for the research project, said Clark Garland, UT professor of ag economics. He said the first fields will be planted this spring, and production will be spread among as many farmers as possible, with plot sizes ranging from small to substantial. For logistical reasons, mainly the cost of transportation, the switchgrass plots will be limited to a 50-mile radius of the Vonore facility.

"Right now, we're having open discussion with farmers to find out what these contracts need to look like in order to give them a reasonable return," said Garland. "Because this is a demonstration refinery, there are risks involved. That's the reason the incentives are there — to help offset some of that risk for our producers."



Construction of the pilot ethanol plant is expected to begin by the end of 2007 and be completed by 2009. The first gallon of "grassoline," UT's patented term for this type of ethanol, should be produced by 2010. When operating at full capacity, the facility will require 170 tons per day

of switchgrass and other cellulosic material and will produce about 5 million gallons of ethanol per year, which is about one-tenth the production of a commercial facility. Tiller said this will allow researchers to fine-tune the process in order to create a system that can be expanded to larger plants across the state in coming years.

"We think we can have as many as 10 of these commercial biorefineries throughout the state," she said. "Each will have significant impact on the local economies and will be largely rural-based because of the need to locate them very close to where the feedstock crops are being produced."

The rural setting that's close to UT and its research partner, Oak Ridge National Laboratory, made Monroe County "a good fit" for the pilot plant, Tiller said.

"There were several factors that led to the selection, but mainly it is close enough to Knoxville and Oak Ridge to allow easy movement by researchers and students to and from the plant," said Tiller. "Plus, we have good transportation infrastructure there, and it is in a very fertile farmland region where the agricultural community has shown interest in the biofuels effort."

The East Tennessee farmers who will soon start supplying switchgrass

to the Vonore plant can take their cue from four growers in Henry County and one in Benton County who have been producing the crop as part of a separate Department of Energy-funded research project for the past three years. A little more than 90 acres are growing there for use in a study in which switchgrass is being substituted for coal to provide power at an electricity-generating plant in Gadsden, Ala.



Henry County Extension agent Ken Goddard has been working closely with these growers to learn as much as he can from the production and harvesting process, and many of UT's current recommended practices for switchgrass have been developed from their experiences.

"I didn't know much about switchgrass before we started this study, but I was certainly interested and excited about the potential," said Goddard. "We've been working out the budgets and the prices farmers would have to receive for the crop in order to consider growing it. We've asked our farmers to report back to us with their problems so we'll know what kind of learning curve there is for this new crop."

High yields, low inputs

He said they've found that because switchgrass adapts to a wide variety of climatic and weather conditions and can be grown on marginal soils, it doesn't have to take up prime farmland. It's capable of high yields without heavy fertilization, and, in fact, there is usually no fertilizer applied the first year and only about 60 pounds of nitrogen each subsequent year unless a soil test shows that potassium and phosphorus are needed.

Establishment is the trickiest part of the process, he explained, and no-till appears to be the best way to plant the seed. In its first year, he added, the young switchgrass faces heavy competition from other grasses

and broadleaf weeds, but afterwards the dense crop usually overtakes the undesirable plants.

"That's another facet of our test," said Goddard. "Our weed scientists are studying different scenarios for weed control. Right now, only one herbicide, Cimmaron, is labeled for broadleaf control in switchgrass, and there are no grass control herbicides presently labeled. It's just an entirely new production strategy."

The crop will reach full capacity in its third year and can have a production life of up to 20 years. No diseases or insects have been identified that can reduce the plant's longevity, said Goddard.

For these experiments, switchgrass is usually harvested only once — in October after the first killing frost — and then rolled in round bales like any other hay crop. The difference, however, is the enormous yield of six to eight tons per acre, which is more demanding on regular hay equipment and makes the harvesting process more laborious.

"It's pretty easy to maintain and cut but not real easy to bale," said Don Cox, who is growing 27 acres of switchgrass in Henry County. "Farmers who are getting into growing switchgrass need to expect a different harvesting and baling experience. It's not what they're used to."

Cox, a Henry Farmers Cooperative customer who also raises corn, soybeans, and beef cattle in addition to serving as fire chief for Paris, said he was interested in the switchgrass project because he could see the potential.

"It's been a rewarding experience for me, and I'm proud to be a part of this movement," says Cox. "If the economics are there to convert switchgrass to ethanol and they can pay farmers a decent price, it's a good alternative. It's something we can do."

Richard Wilson, another Henry Farmers Co-op customer, said he also thinks switchgrass is a good fit for Tennessee farmers but adds that profitability for the producers will be key.

"I've had no trouble whatsoever out of the crop, and it really doesn't



ABOVE: Don Cox, a Henry Farmers Co-op customer and fire chief of Paris, is growing 27 acres of switchgrass for a study to see how well it replaces coal at a power plant. The part-time farmer, who also raises beef cattle, says he has enjoyed participating in the groundbreaking research. RIGHT: Another Henry County grower, Richard Wilson, is also growing 18 acres of switchgrass in that same study. He says the crop is "no trouble at all" and shows promise in the production of biofuels.



take much inputs, which is good since everything is so expensive these days," said Wilson, a full-time farmer who raises corn, soybeans, wheat, and beef cattle in addition to the 18 acres of switchgrass. "If the alternative fuel market would pay enough so you could make a profit, this thing could really be feasible."

Seed production may be next

Wilson and the other West Tennessee switchgrass growers still have another year left on their contracts with the Department of Energy, and then the next step may be seed production for the East Tennessee ethanol effort. Seed is scarce, since there has been no demand for switchgrass production until recently, and only one variety — Alamo — is recommended for use in Tennessee.

And, of course, there is still some skepticism about whether this effort can be a commercially viable solution to reducing petroleum-based fuel demand. Tiller said she hopes the Monroe County demonstration plant will help put those concerns to rest. She said the process definitely works in a laboratory setting and just has to be reproduced in the real world.

"We know what we're doing in the lab today is not competitive with petroleum, but we believe the technology is far enough along that it can be within three years," said Tiller. "We have to take what we're doing on a small basis in a controlled environment, scale it up, and factor in crops that are grown under real production situations. That's exactly what this research refinery is designed to do."

For farmers eager to take advantage of the biofuel buzz, UT officials urged patience. Large-scale production of ethanol from switchgrass is at least a decade away, according to Tiller, which means any significant benefits to farmers or consumers are definitely down the road. But with groundbreaking taking place soon for the Monroe County plant, there's no doubt that helping to produce gas from grass will be a reality for at least some Tennessee farmers.

"I am so proud of our government for stepping out front and doing something like this that's not just going to benefit Tennessee and Tennessee farmers, but the whole country," said Cox. "Somebody needed to take a stand. If it works, it's going to pay off big."



ABOVE: At an Aug. 29 public forum in Morristown, Kelly Tiller, UT Biofuel Initiative director of operations, announces that Monroe County is the site of UT's ethanol plant. RIGHT: Danny Sells of Washington County poses a question to a panel of politicians and UT experts at the forum.



For more information

A wealth of information about switchgrass and the biofuels initiative can be found online at the UT Institute of Agriculture's Office of Bioenergy Web site at www.utbioenergy.org/. Two fact sheets — "Biofuels 101" and "Growing and Harvesting Switchgrass for Ethanol Production in Tennessee" — were also recently released by UT Extension. Others will be available soon. Visit <http://utextension.tennessee.edu/publications/biofuels/> to download the publications, or check with your local Extension agent.