INDUSTRY NEWS

Research Update

► **Summaries** of current **beef cattle** research

Roslin Institute validates a new technology for the destruction of BSE prions

The Roslin Institute of the University of Edinburgh and Biosphere Technologies Inc. of Alberta, Canada, announce the successful completion of validation tests confirming inactivation of bovine spongiform encephalopathies (BSE) prions utilizing a new thermal hydrolysis process. The multiyear bioassay studies were conducted by the Neuropathogenesis Division of The Roslin Institute, a renowned British research center. Results were published by the *Elsevier* journal, Process Biochemistry, Vol. 44:2009.

This new BioRefinex technology destroys transmissible spongiform encephalopathies (TSE prions) and other microorganic pathogens by employing high-temperature saturated steam reactors to denature livestock residues, including cattle carcasses, specified risk materials (SRM) such as brains and spinal cords, and other waste meat, bone and food products. The high-capacity, two-hour process transforms the organic waste materials into safe, sterile amino acids, fatty acids, minerals and other nutrient fractions that have industrial value as organic nutrients.

This technology provides an alternative to incineration and land filling of SRM animal byproducts, which under ECC and international regulations must be destroyed to prevent the spread of prion diseases. This new technology avoids the negative environmental and economic effects of the current disposal practices, and uniquely creates a safe nutrient feedstock that can be used for the production of biomethane in anaerobic digesters, or incorporated in organic fertilizer formulations.

UK researcher studies ginger as meat tenderizer

University of Kentucky (UK) College of Agriculture researchers have been looking at ways to make underutilized beef cuts more palatable and, therefore, more profitable for meat processors.

Surendranath Suman, an assistant professor in UK's Department of Animal and Food Sciences, recently experimented with ginger as a meat tenderizer in underutilized beef muscles, primarily the *biceps femoris.*

"I think the general public would be surprised to know that ginger can successfully be used as a natural source of meat-tenderizing enzymes and a source of antioxidants as well," Suman said. "We worked with funding from the Kentucky Beef Council on this project and found it's quite useful to use ginger to improve meat tenderness as well as other beef quality attributes."

Suman co-authored a paper about his research with colleagues Gregg Rentfrow and Youling Xiong, both faculty members in the UK College of Agriculture, and presented his findings at the 55th International Congress of Meat Science and Technology in Copenhagen, Denmark, earlier this summer.

The paper was one of three Suman presented at the congress, and he subsequently won the 2009 International Meat Secretariat Prize for Meat Science and Technology. The prize recognizes meat scientists younger than 40 years old for their contributions that have the most impact on either knowledge or application for the industry or the furtherance of meat science and technology.

As part of his prize, Suman will receive $5,000 and travel expenses toward his attendance at the 18th World Meat Congress, in Buenos Aires, Argentina, in 2010. There he will deliver a keynote presentation about his research.

Evaluating an ethanol byproduct as a potential cattle feed ingredient

There may be no such thing as a free lunch, but a cheap meal is easy to come by — especially if you use the right ingredients.

With ethanol plants popping up across the nation, many cattle producers are weighing the effects of substituting a common ethanol byproduct for more costly traditional feed ingredients such as corn, soybean meal, urea and mineral supplements.

The byproduct, called "wet distillers' grains with solubles," or WDGS, has potentially significant economic benefits. WDGS typically costs about 10% less than corn when used as livestock feed.

ARS scientists at the U.S. Meat Animal Research Center (USMARC) in Clay Center, Neb., are investigating the effects of feeding WDGS to cattle. The scientists carried out a comprehensive study on the influence of diets including WDGS in four areas: feedlot performance, energy utilization efficiency, post-harvest meat characteristics, and cattle manure emissions. For these studies the cattle were fed diets containing 0%, 20%, 40% or 60% WDGS.

Research results show that WDGS, in moderation, may offer an inexpensive alternative to traditional feed ingredients.

Some of the USMARC research investigated the effect of WDGS diets on cattle performance and meat quality. In one study, nutritionist Calvin Ferrell and food technologist Steven Shackelford monitored growth rate, feed intake and feed efficiency for cattle in the "finishing phase," that is, the roughly 120-140 days leading up to harvest.

They found that for steers fed diets of 20% or 40% WDGS, performance in these areas was equal to or better than that of the control group. But cattle fed a diet of 60% WDGS had lower feed intake and average daily gain. Nonetheless, Ferrell is not willing to rule out the 60% diets.

"They could be a viable option, depending on relative costs of other feed ingredients," he says.

Another study, led by animal scientist Mindy Spiehs, took a closer look at feed efficiency by examining how much heat the animals produced while digesting their food. Among the different feeds, Spiehs and her colleagues observed no significant difference in heat production. But they did see lower energy utilization efficiency — a factor that could reduce feedlot performance — in the cattle fed WDGS diets. The decreased efficiency was particularly noticeable in the 60% diets.

The changes in cattle performance were similar to those observed in meat quality in the portion of the study conducted by Shackelford, research leader Tommy Wheeler, and food technologist Andy King. The heaviest, fattest carcasses were from cattle fed a diet of 20% WDGS. Cattle on the 40% diet also performed better than the control group, but the 60% group had the lowest performance of all. They were lighter, leaner, less marbled and had lower yield grades than cattle in the other three groups.

Like Ferrell, Shackelford is not entirely convinced that the disadvantages of this

CONTINUED ON PAGE 2

CONTINUED FROM PAGE 1

poor performance would outweigh the economic savings of the low-cost feed. This study only addressed the effects of diet during the finishing phase, he notes, not the approximate six-month growing phase that preceded it.

"There may be merit to pursuing research where cattle are fed high WDGS levels in the growing phase and lower levels of WDGS during the finishing phase," Shackelford says.

These studies also investigated the environmental effects of adding WDGS to cattle feed. Cattle diets that include WDGS often contain more crude protein and minerals than the animals need, which could result in greater nitrogen emissions, phosphorus runoff and odor problems.

A study led by microbiologist Vince Varel confirmed that WDGS diets can increase the amount of odorants in manure slurries. This is one area in which the control group performed better than those fed diets with WDGS.

"As the concentration of WDGS increased in the diet, greater concentrations of nitrogen, phosphorus and sulfur appeared in the manure," Varel says. This raised the potential for phosphorus runoff and increased the presence of malodorous compounds.

Another part of this study, conducted by microbiologists Jim Wells and Elaine Berry, examined how WDGS diets affected persistence of generic *E. coli* in cattle feces. Early results showed an inverse relationship between the amount of WDGS in a diet and the amount of L-lactate in cattle manure slurries. Slurries with more L-lactate had lower pH, resulting in less microbial fermentation, methane and *E. coli*. This suggests that feeding WDGS to cattle can lead to manure with less L-lactate and thus a greater potential for odor emissions and more persistent *E. coli.*

Further studies are needed to determine whether WDGS feeds raise the likelihood of pathogenic *E. coli* persisting in cattle manure.

These potential concerns will require more research. But from a holistic standpoint, the USMARC studies indicate that a cattle diet of 20%-40% WDGS may offer the most economic benefits with the fewest disadvantages. Future studies could examine the feed's environmental and food safety impacts and determine whether and how diets of 60% WDGS might be used.

—By Laura McGinnis, formerly with ARS.

Editor's Note: *"Evaluating an Ethanol Byproduct as a Potential Cattle Feed Ingredient" was published in the September 2009 issue of Agricultural Research magazine. This research is part of Food Animal Production (#101), Food Safety (#108), and Manure and Byproduct Utilization (#206), three ARS national programs described at www.nps.ars.usda.gov.*

Subsurface drip irrigation can cut crop irrigation needs by 25%

This year, 2009, will be remembered for many events, but for Kansas State University (K-State) scientist Freddie Lamm, it also signaled 20 years of research in subsurface drip irrigation (SDI) for crops grown in western Kansas.

Lamm, a research irrigation engineer with K-State Research and Extension, has worked with K-State colleagues around the state to study the pros and cons of irrigating crops by burying pipe several inches below the surface of the soil and releasing water that goes more directly to roots than alternative irrigation methods allow.

"Since we began in 1989, our SDI research and Extension efforts have had three primary purposes," said Lamm, who is based in semi-arid northwest Kansas, where the average annual rainfall is 17 inches (in.). "Those purposes are to enhance water conservation, protect water quality and develop appropriate technologies for Great Plains conditions."

Other K-State scientists currently active in the SDI research and Extension efforts are irrigation engineers Dan Rogers, Mahbub Alam, and Abdo Shehata; agricultural economists Dan O'Brien and Troy Dumler; and soil physicist Loyd Stone.

One of the first studies, conducted at Colby and Garden City from 1989 through 1991, examined the water requirement of subsurface drip-irrigated corn.

"Careful management of SDI systems reduced net irrigation needs by nearly 25%, and still maintained top yields of about 200 bushels per acre," Lamm said. "That 25% reduction in irrigation needs potentially translated into 35% to 55% savings when compared to sprinkler and furrow irrigation systems, which typically operate at 85% and 65% application efficiency."

SDI uses water more efficiently than other methods, primarily because there is less deep drainage during the crop season, less soil water evaporation, and no irrigation runoff as is found in other irrigation techniques. An added benefit, he said, is that drier surface soils allow for greater infiltration of those occasional intense rainfall events that occur in the Great Plains.

What may surprise some people, Lamm said, is that in most years, the results suggest that when using SDI in corn, irrigation frequencies from daily to weekly did not have much effect on corn yields.

Over the years, the scientists have studied the use of different irrigation amounts, frequency of irrigation, dripline spacing and depth and different plant densities. Most of the work has been with corn because it is the primary irrigated crop in the central Great Plains, but alfalfa, soybeans, grain sorghum, sunflowers, melons and vegetables also have been studied. Most of the research has been conducted on deep, well-drained silt loam soils, which are common in western Kansas.

"Because properly designed SDI systems have a high degree of uniformity and can apply small, frequent irrigation amounts, there are excellent opportunities to better manage nitrogen fertilizer with these systems," Rogers said. "Injecting small amounts of nitrogen solution into the irrigation water can spoon-feed the crop, while minimizing the pool of nitrogen in the soil that could be available for leaching into the groundwater."

The researchers also have studied the application of livestock effluent to agricultural fields using SDI technology and found that the practice can be successful. Irrigators should be mindful, however, of the more complex design considerations when SDI is used for effluent and the fixed location of the system, which can introduce the issue of nutrient overloading concerns.

Many of the K-State studies have used SDI systems installed in 1989-1990. These study areas have dual-chamber drip tubing installed at a depth of approximately 16 to 18 in. with 5-foot (ft.) spacing between dripline laterals. Corn was planted so each dripline lateral is centered between two rows of corn.

Studies also were done with 2.5-, 7.5- and 10-ft. spacing. The highest average yield was obtained with the 2.5-ft. dripline spacing and the 7.5-ft. and 10-ft. spacing worked well in higher-rainfall years. When all of the data was plugged into economic models, however, the standard 5-ft. dripline spacing was best when averaged over all years for both sites, Garden City and Colby.

"All of the corn has been grown using conventional production practices for each location," Lamm said.

The obvious downside to SDI, the researcher said, are the much higher investment costs as compared to other pressurized irrigation systems such as full-size center pivot sprinklers. But there are realistic scenarios where SDI can more directly compete with center pivot sprinklers for corn production in the Central Great Plains — particularly in smaller fields.

"We have developed a spreadsheet template for producers to make their own economic comparisons between SDI and center-pivot sprinkler systems. It is available

CONTINUED ON PAGE 3

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for free on our K-State SDI web site," Lamm said.

When a producer makes a substantial upfront investment, as is the case when installing an SDI system, there's the question of "how long will it need to last in order for it to be cost-effective," he said. The K-State studies show that SDI system life must be at least 10 to 15 years to approach economic competitiveness with full-sized center-pivot sprinkler systems that typically last 20-25 years.

"Using careful and consistent maintenance, a 20-year or longer SDI system life appears obtainable when high-quality water from the Ogallala aquifer is used," Lamm said. "The system performance of the K-State SDI research plots has been monitored annually since 1989 with few signs of significant degradation."

The benchmark study area has received shock chlorination approximately twice each season, but has not received any other chemical amendments, he said.

More information about SDI research, including detailed reports about various studies conducted by K-State over the last 20 years, is available on the web at *www.ksre.ksu.edu/sdi.*