

LOUISIANA Agriculture

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Assuring Our Future Through Scientific Research and Education



Forage-Fed Beef Production

LSU AgCenter Provides Research-based Education for Animal Sciences, Natural Resources

Philip H. Elzer

I am honored to introduce this special issue of Louisiana Agriculture, which focuses on forage-fed beef management and production. AgCenter scientists, extension specialists and professors work on many aspects of the cattle industry to bring our clientele the most up-to-date knowledge and operating procedures to support their needs. Regional differences affect both small and large producers, and our goal is to anticipate industry trends to supply scientifically-based research and best practices to our producers. With the Louisiana climate, forage is available year-round and can result in a leaner, market-desired end product. This issue highlights the changes involved in a sustainable forage-based production system, which is economically beneficial to our state, the producer and the consumer.



Philip H. Elzer

One of the priorities of the LSU AgCenter has been updating, expanding and strengthening the Master Cattle Producer program. We have revised the curriculum and changed the name to Louisiana Master Cattleman program. The program will be delivered within each of our five regions, and it will be facilitated by the regional beef coordinators in each of these regions. These individuals are Kenny Sharpe, Southeast; Guillermo Scaglia, Southwest; Vince Deshotel, Central; Jason Holmes, Northeast; and Ryon Walker, Northwest.

The coordinators reworked and standardized the curriculum so all the producers across the state get the necessary knowledge about raising cattle. The uniqueness of the program is the flexibility to tailor to regional issues. The coordinators are working with county agents to disseminate the Louisiana Master Cattleman program at the parish level. In addition to offering the new curriculum, we will host field days in the regions to allow producers to have advanced hands-on experience, applying what they have learned in the classroom.

Along with the forage theme of this issue, it is time to announce the relocation of the LSU AgCenter Forage Quality Analysis Laboratory. The laboratory is being moved to the School of Plant, Environmental and Soil Sciences on the LSU campus in Baton Rouge from the Southeast Research Station in Franklinton. The shipping address is SPESS-STPAL, 125 M.B. Sturgis Hall, 110 LSU Union Square, Baton Rouge LA 70803. A new, state-of-the-art near-infrared reflectance spectrometer (NIRS) instrument has recently been purchased, which will be used for accurate and precise forage sample analysis. A wet chemistry lab will also be housed in SPESS to provide validation analysis for the NIRS.

As program leader and associate vice chancellor for animal sciences and renewable natural resources, I am very proud to work with our researchers, educators and county agents. I am committed to facilitating the best programs to meet your needs. Please let me know if you have concerns or questions. The LSU AgCenter is here to serve Louisiana.

Philip H. Elzer is program leader and associate vice chancellor for animal sciences and natural resources.

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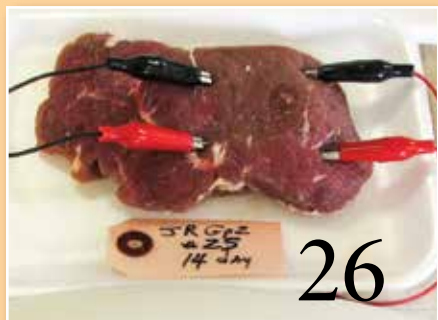
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On the Cover: These three steers were part of a major research project on the feasibility of producing forage-fed beef as an economic development opportunity for Louisiana. The steers are grazing on annual ryegrass on a pasture at the LSU AgCenter Iberia Research Station in Jeanerette. The photo was taken in April 2012 by Guillermo Scaglia, the lead scientist for the project and a researcher at the station. The four-year study, which began in 2011, was funded for \$500,000 from the U.S. Department of Agriculture National Institute of Food and Agriculture through the Agriculture and Food Research Initiative.

Cow replacement suggestions featured at field day

Cattle owners considering an increase in their herds should be mindful of paying too much for heifers, LSU AgCenter beef cattle experts advised at the Acadiana Cattle Producers fall field day held in Vermilion Parish on Oct. 2.

AgCenter beef economist Ross Pruitt said recouping the costs of buying and maintaining a heifer should be considered before a purchase.

"If you are paying more than \$2,200 for females, you are running the risk of having cash flow problems in the last few years of a loan if the purchase is financed," Pruitt said.

Beef prices inevitably will decline after the cattle industry is able to add females and increase production after several years of herd inventory declines, Pruitt said. Prices should continue to increase next year, but not as rapidly as this year as pork and poultry levels expand. An additional increase of \$3 to \$5 per hundredweight in 2016 is also possible.

The peak has not been reached, he said, and prices are about two to three years away from declining.

LSU AgCenter beef specialist Karl Harborth said producers should consider whether older cows should be culled because their prime years are between ages five and 10.

LSU AgCenter beef nutritionist Guillermo Scaglia said bull selection is the first

consideration to be made for replacement heifers.

A bull with a larger scrotal circumference results in heifers capable of reaching puberty earlier, he said.

Quality of nutrition of a pregnant cow also will determine an offspring's muscle development and birth weight, he said. A nutritional deficit in the second trimester of gestation may reduce the number of muscle fibers in the offspring, and if the deficit is in the third trimester, the size of these fibers will be reduced, reducing birth weight and possibly affecting the age and weight at puberty, Scaglia said.

Hay should be analyzed for nutritional value to determine which supplement and how much of it is needed for a 550-pound heifer to gain 1.5 pounds per day, he advised. With very poor quality hay, "there is nothing you can do to help that heifer accomplish that goal."

A heifer's weight at breeding time should be monitored, Scaglia said.

"A heifer needs to be gaining weight at the start of the breeding season, and she needs to keep gaining weight," he said. Development of a productive female does not stop with the first pregnancy, and a cow reaches full maturity at five years.

Stan Dutile, LSU AgCenter county agent in Lafayette Parish, said medium-frame cows are

the most efficient for a herd. It becomes more difficult for a cow to conceive if she is thin and not in proper body condition going into her second breeding season.

LSU AgCenter forage specialist Ed Twidwell showed producers a test of different treatments for broomsedge in pastures.

Pasture with adequate fertilizer applications tends to suppress the weed, he said. "Broomsedge likes a low-fertility situation."

The biggest surprise from the study was the effectiveness of glyphosate herbicide at 1.5 pints per acre applied in late April with a broadcast sprayer, Twidwell said.

■ **Bruce Schultz**

Minerals help in cattle reproduction

Injectable trace minerals may improve reproductive rates in cattle. This was one of several research projects cattle producers heard about at the LSU AgCenter beef cattle and forage field day on Oct. 16 at the Dean Lee Research and Extension Center in Alexandria.

AgCenter reproductive physiologist Glen Gentry has conducted two studies looking at how trace minerals can affect pregnancy rates. In the first study, young heifers that were moved to the Dean Lee Research Station were run through a chute, and every other



Andrew Granger, LSU AgCenter county agent in Vermilion Parish, far right, holds up a foxtail plant while talking about different ways to control the weed in pastures during the Acadiana Cattle Producers fall field day held on Oct. 2 in Vermilion Parish. Photo by Bruce Schultz

animal was given a shot of the minerals, which contain zinc, manganese, selenium and copper. The minerals seemed to play a role in reproductive performance.

"At the end of the breeding season, we had a difference of 30 percent impregnate rates of the animals that got the injections versus the ones that did not," Gentry said.

Weight also can affect reproductive ability, so Gentry looked at weights at the time of injection. He said heifers that received the injections were lighter overall than those that did not.

Gentry conducted a larger study on the entire cow herd on the station. He said there was no significant difference in pregnancy weight, except with two-year-old heifers. Pregnancy rates were 20 percent higher in that population.

"The minerals seem to work better in younger animals," he said. ■ **Tobie Blanchard**

Good weather helps sweet potato harvest

Favorable weather has helped Louisiana sweet potato producers have a successful harvest, according to Tara Smith, LSU AgCenter Sweet Potato Research Station coordinator.

"The weather has cooperated with us this season. We've had some wet weather in the southern part of the state, but for the most part, we've been able to stay on track and get the crop in the shed," Smith said.

While acreage is slightly higher than last year's, it's still near a historical all-time low, according to Smith. But, there are signs that the industry is rebounding.

"We think the trend is reversing. There are a lot of positive things going on in the industry. The processing sector has also brought some new blood into the industry, so we're excited about the potential," she said.

Myrl Sistrunk, AgCenter sweet potato specialist, said producers are seeing good yields in their fields. "I would say most producers are reporting around 450 to 500 bushels per acre. There have been a few reports of even higher yields," he said.

Sistrunk said acreage is down significantly from what it was 10 years ago. "We are going to have right around 8,000 acres this year. That figure is less than half of what it was before the hurricanes of 2005 (Katrina and Rita) and 2008 (Gustav). Those wet years really hurt the growers," he said.

While sweet potatoes can be profitable, they are costly to produce. "On average, sweet potatoes cost about \$4,000 per acre, and about 40 to 50 percent of that input cost is

directly related to the labor that is required to plant and harvest the crop," Smith said.

The AgCenter has recently released two varieties, Orleans and Bayou Belle, with the hopes they will provide greater yields than Beauregard, which has been the industry mainstay since the late 1980s.

"Orleans is aimed at the fresh market. Producers will see a little yield bump and a more consistent quality, which translates to a better pack-out percentage. Bayou Belle is for the processing industry, and producers are realizing about a 20 percent yield increase when compared to varieties like Beauregard," Smith said. ■ **Craig Gautreaux**



Newly harvested sweet potatoes. Photo by Linda Foster Benedict

Brahman influence good for Louisiana cattle industry

The traditional stereotype for cattle with high Brahman influence has been that the meat is too tough. But with improved genetics, that is changing.

Research that began at the LSU AgCenter to evaluate the Brahman-influenced cattle for tenderness has developed into a program that has become national in scope.

For nearly three decades, beginning in the 1980s, now-retired LSU AgCenter researcher Don Franke conducted crossbreeding research with the Brahman breed.

More recently, Franke studied the meat quality of purebred Brahman steers and found that genetic markers could be used to identify those that will produce acceptable carcasses based on quality grade and tenderness.

AgCenter scientists agree that the industry is more accepting of carcasses with up to one-quarter Brahman breeding. The problem comes when the one-quarter threshold is exceeded.

"We're part of the American Brahman Breeders Association's National Carcass Evaluation," said Matt Garcia, AgCenter animal scientist. "The carcass scores from Louisiana steers improve every year."

The carcass reports on purebred Brahman steers sent to the feedlot in 2011 all graded choice, which is one level below prime, Garcia said.

Producers believe Brahman-influenced cattle take a price deduction at the sale barn, said LSU AgCenter economist Ross Pruitt.

"In reality, when those cattle hit the feedlots and they perform, the price for that animal will be passed on down to the person it was bought from," Pruitt said.

According to the American Brahman Association, the breed is the first beef breed developed in the United States. It is ranked No. 1 in hybrid vigor, heat tolerance and efficiency compared with all other beef breeds.

■ **Johnny Morgan**



Brahman-influenced cattle at the LSU AgCenter Ben Hur Farm in Baton Rouge. Photo by John Wozniak



LSU AgCenter researcher Witoon Prinyawiwatkul explains a texture analyzer that's used to measure the hardness and springiness of food samples. The equipment is in the new Animal and Food Sciences Laboratories Building on the Baton Rouge campus. Photo by Rick Bogren

Researcher tries to make less salty foods still tasty

Changing people's perceptions of how foods taste – or even how foods feel in the mouth – can help direct them to more healthful food choices, said Witoon Prinyawiwatkul, a researcher in the LSU AgCenter School of Nutrition and Food Sciences.

Prinyawiwatkul is leading a team of AgCenter researchers evaluating how people respond to sensory differences to assess the effectiveness of changing sodium content in processed foods. They're studying how different approaches to modifying the salt content in foods can improve the healthfulness of the food while reducing the amount of sodium.

Americans consume unhealthy amounts of sodium, mostly in the form of salt, or sodium chloride, Prinyawiwatkul said. Although sodium is a critical element in the human body for such functions as retaining fluids, balancing electrolytes and controlling nerve function, too much is unhealthy.

"It's a silent killer," Prinyawiwatkul said.

Citing results from the Centers for Disease Control and Prevention, Prinyawiwatkul said more than 90 percent of Americans consume more sodium than the recommended intake. More than 65 percent of the sodium comes from processed foods and other retail products, 25 percent is consumed in restaurants, and the remaining 10 percent is added by consumers.

The solution to this problem is reducing sodium intake in the diet.

"We can use different salts, such as potassium chloride, or simply reduce sodium consumption through a stepwise approach or both," Prinyawiwatkul said.

Potassium chloride is the most common salt substitute, but when used at high concentrations, it imparts bitterness and a metallic aftertaste. The AgCenter researchers use sensory trials to measure consumer attitudes to taste, texture and appeal of foods with modified salt content.

In one study, researcher Damir Torrico is blending emulsions of oil and water in a process similar to making mayonnaise to see if the size of the oil droplets affects the saltiness and bitterness of the product. While the size of the oil droplet had no effect on saltiness, Torrico discovered the emulsion suppressed the bitterness of potassium chloride, which wasn't observed in a water solution. He now is looking at replacing some of the sodium with potassium to maintain saltiness while adding another compound to block the bitterness of the potassium.

"We're adding potassium chloride along with bitterness suppressors to see if we can impart saltiness with minimal bitterness," Prinyawiwatkul said. "We also want to reduce sodium and manipulate the taste

bud receptors by modifying the emulsion characteristics."

In another study, Kennet Carabante and Chuck Boeneke are focusing on reducing the sodium content of cheddar cheese. Working in the AgCenter creamery, the researchers have changed the sodium content in typical cheddar cheese recipes to find out how the changes affect cheese quality. They have successfully produced low-sodium cheese by replacing a portion of the sodium chloride with potassium chloride and a bitterness blocker.

■ Rick Bogren

AgMagic exhibit wows at Shreveport State Fair

Thanks to the LSU AgCenter's AgMagic exhibit, students Jamaria Clark and Jordan Fuller went on a cotton harvesting tour during the 2014 State Fair of Louisiana in Shreveport Oct. 23.

"I felt like I was driving the tractor," said Clark, a fourth grader.

"Yeah," said Fuller, a seventh grader. "It was pretty cool."

The combine Clark and Fuller are referring to was one of the highlights in the exhibit. A computer screen inside the combine's cab showed the combine traveling through a cotton field.

"I like watching the tractor as it goes through the field on the screen," Clark said.

AgMagic is an interactive set of exhibits designed to show people where their food and fiber comes from, said Karen Martin, 4-H coordinator for the AgCenter's Northwest Region.

Each year, exhibits are set up to show people how products used every day come from forests, field crops and livestock produced by Louisiana farmers, ranchers and forest landowners. Featured crops are displayed in various stages of development, and the importance of interaction between agriculture, the environment and society at large are highlighted.

In the World of Wonder area, Ricky Kilpatrick, LSU AgCenter forestry agent, had information about camping, fishing, forestry, hiking, wildlife and other outdoor activities available.

At the animal exhibit area, visitors could watch chicks hatch.

"We want the youth to understand food that is bought in grocery stores comes from a farm first," said Gary Stockton, an AgCenter agent in Lincoln Parish.

Other exhibits provided information about biofuels, compost, farmers markets, 4-H and healthy eating. ■ A. Denise Attaway

Kids learn about science on 'super' Saturday

Sodium alginate in LSU purple and gold attracted youngsters to the LSU Food Science Club's booth at Super Science Saturday on Oct. 11 at the LSU Pete Maravich Assembly Center.

The LSU College of Agriculture students in the club were showing visitors how gummy candies can be made with two simple ingredients. Sodium alginate is a food-safe substance extracted from seaweed. When it is mixed with calcium chloride, a salt solution, the calcium ions replace the sodium ions and the mixture becomes gummy.

Kevin Driggers, a graduate student in food science, handed a pipette of purple sodium alginate to Faith Bridges of Walker. Bridges squeezed the pipette, releasing the alginate into a glass dish filled with the calcium chloride solution. The purple mixture immediately formed a gummy substance, resembling a gummy worm. Driggers took it from the water

and showed it to the group assembled in front of him. Smiles broke out. Everyone wanted to touch it.

"It feels squishy," said 9-year-old Luke Losavio.

The LSU Food Science Club called their experiment "Molecular Gastronomy: making alginate gummies."

"Molecular gastronomy is a subfield of food science that explores the physical and chemical transformations of ingredients that occur in cooking," said Namrata Karki, club president and a graduate student in food science.

The club chose its experiment to go along with the theme of this year's Super Science Saturday – "Candy: The Sweet Side of Chemistry." They gave out gummy bears and gummy worms to kids who participated in the experiment.

George Stanley, an LSU professor of chemistry who coordinates the event, said it is



Kevin Driggers, a graduate student in food science and member of the LSU Food Science Club, holds up a purple gummy. Tristen (right) and Christen Bridges reach for it, while their sister, Faith, looks on. Photo by Tobie Blanchard

something his department sees real value in because it reaches youngsters.

"Few K-12 students get to do much hands-on science in their schools," Stanley said. "Here they get to see first-hand how exciting science really is." ■ **Tobie Blanchard**

LSU food science team takes home prestigious DuPont award

An LSU College of Agriculture nutrition and food science team placed first in the DuPont Knowledge Award, winning \$10,000 for a new food product the team developed. Graduate students José Estrada, Namrata Karki, Kennet Carabante and Samantha Stein beat out 33 other universities with their savory cottage cheese crumbles.

Team leader, Jose Estrada, and faculty advisor and food science professor, Jack Losso, received the award at the Prepared Food's New Product conference at Amelia Island, Florida, on Sept. 16.

This was LSU's first time in the competition, Losso said.

According to DuPont, the award encourages development of innovative new food and beverage products using two or more DuPont ingredients.

The team calls their product Medittage and describes it as a low-fat cottage cheese with a crumbly texture that has sun-dried tomatoes and dressing with Mediterranean herbs and a touch of olive oil.

"It's a delicious, high-protein snack, dip or side item," Karki said.

The LSU team used three DuPont ingredients for their product – a natural antimicrobial to promote shelf life, a rosemary extract, which helps prevent lipid oxidation of the olive and sunflower

oils, and a starter culture to make the cottage cheese curd.

Estrada said inspiration for the product came from a friend who was making cottage cheese in a food science lab and infused it with rosemary grown behind Miller Hall on campus. They decided to take their product further with additional herbs and flavors.

"We had passion for this product from the beginning," Estrada said.

They worked with it until they had the right look and taste. In April, they sent 18 samples to DuPont's nutrition and health division in New Century, Kansas, for judging. In June, they received word their product had won the competition.

"It was like a dream come true," said Karki.

Estrada said it was rewarding to apply what he learned in his classes and have it validated by people who devote their lives to food science.

"It was good confirmation that we are well-trained," he said.

The team split the award four ways. DuPont owns the rights to their product for a year, but if they do not manufacture it within the year, the team gets back the rights.

"This award is very prestigious," Losso said. "Winners of this award get jobs in industry just like that."

■ **Tobie Blanchard**



The LSU College of Agriculture nutrition and food science team consisting of José Estrada, Samantha Stein, Namrata Karki and Kennet Carabante with their faculty advisor Jack Losso receive a check for \$10,000 as their award for placing first in the DuPont Knowledge Award. The competition encourages development of new food products using DuPont ingredients. Photo by Tobie Blanchard



Medittage, a low-fat cottage cheese with sun-dried tomatoes and a dressing with Mediterranean herbs and olive oil, was the winning product of the DuPont Knowledge Award. Medittage was developed by LSU College of Agriculture's nutrition and food science team. Photo provided by Namrata Karki

International Programs

LSU food science student studies in Honduras



Maria Moore (far left) at a product development fair with her classmates from Zamorano Pan-American Agricultural School in Honduras. Moore spent three months at Zamorano learning about food processing, packing and product development. Photo provided by Moore

With roots in Central America and a good grasp of the Spanish language, Maria Moore felt comfortable being one of the first students from LSU to do an exchange with Zamorano Pan-American Agricultural School in Tegucigalpa, Honduras.

The LSU AgCenter has been collaborating with Zamorano since the early 1990s and has hosted about 60 visiting scholars from the school since 2005. Zamorano was interested in hosting a student from LSU.

Moore, a senior in the School of Nutrition and Food Sciences from Baton Rouge, spent three months this past summer at the university working in eight different food processing

facilities run by the school and two laboratories, including one where she learned to make biodiesel. She also took a food packaging and a product development class.

"My goals were to enrich my Spanish language skills, learn the processing techniques at different plants and visit processing facilities across the country," Moore said.

Moore worked in a dairy processing facility where she learned about milk pasteurization and homogenization and how to make cheese and other

dairy products. She also worked in a bakery, honey facility, a meat processing plant, a feed and grain facility and two post-harvest fruit and vegetable facilities where she learned to grade and sort produce and make salsa, jams and marmalades.

"The products made at the school go to the supermarkets in the city and on campus," Moore said.

In her product development class, Moore and her classmates were paired with food companies in Honduras to develop a new product. Her group made an oblea – a thin wafer-style cookie filled with a dulce de leche and topped with coconut and cocoa.

"We had a big fair at the end of the semester showing off all the products that we had developed for all those companies," she said.

Zamorano has 1,000 students that mainly come from Central and South America. All students live on campus. Moore was the only American at the school. Moore's mother is from Nicaragua, and Moore speaks Spanish, but technical terms at the processing facilities often stumped her.

"A lot of the employees at the facilities did not speak English. They would explain to me how to run a machine, and they would often use a word that I didn't understand, so that was hard," she said.

Moore has conducted research at LSU on the health benefits of cocoa and presented her findings to the American Chemical Society. She said she was interested in visiting a cacao plantation and processing facility in La Masica, Honduras. A friend of her family who lives in Honduras agreed to take her to the facility so she would not have to travel alone.

She said she was lucky to have someone take her because otherwise she would not have gone, and the experience was one of her favorite parts of her stay in Honduras.

"They showed me everything you need to know about how to harvest the cacao plant, how to get the beans from it and to tell a good fruit from a bad fruit," she said. ■ **Tobie Blanchard**

U.S., Slovakia share agriculture concerns

While the United States and Slovakia are different in many ways, the two countries' agriculture industries share similar challenges.

In Slovakia, where farms were state-run from 1949 until 1993, the agriculture industry is struggling to recruit young people, said Danka Moravčíková, associate professor in the College of Continuing Education at the Slovakia University of Agriculture (SUA) in Nitra. The American workforce faces a similar shortage of new blood, with farms and life science companies unable to hire enough trained ag scientists.

Moravčíková and other SUA faculty were the featured speakers at the Oct. 6 Global Agriculture Hour, an event sponsored by LSU AgCenter International Programs that highlights the significance of international activities to Louisiana agriculture.

Representatives from the AgCenter, College of

Agriculture and SUA formed an exchange program and signed a research agreement in July in Slovakia. SUA students will visit LSU in February, and LSU students will visit SUA in June, said David Picha, director of AgCenter International Programs.

SUA has about 10,000 students and offers bachelor's, master's and doctoral

programs, including 20 that are taught in English, said Natália Turčeková, assistant professor in the SUA Department of Economics.

Not many SUA graduates become farmers, Moravčíková said, which is concerning because the average age of a Slovakian farmer is over 50. Likewise, the average

Louisiana farmer is 58.5 years old, according to the 2012 Census of Agriculture.

"We need to revitalize the sector," Moravčíková said. "We need to attract young people."

SUA Rector Peter Bielik said exchange programs like the one with LSU could help achieve that. Researchers will also benefit from the relationship by collaborating on research topics important to both Louisiana and Slovakia. ■ **Olivia McClure**



From left to right, David Picha, director of LSU AgCenter International Programs; Ivana Tregenza, a coordinator with International Programs; Stuart Bell, LSU executive vice chancellor and provost; F. King Alexander, LSU president; Peter Bielik, Slovakia University of Agriculture rector; Bill Richardson, LSU vice president for agriculture and dean of the College of Agriculture; and Natália Turčeková, Izabela Adamičková, Olga Roháčiková and Danka Moravčíková, all with Slovakia University. Photo by Olivia McClure

Forage-Fed Beef Production

An Overview and Perspective

Guillermo Scaglia

Much of the beef produced and sold in the U.S. before World War II was from grass- or limited-grain-fed cattle. Development of the modern large-scale cattle feeding industry in the 1950s and 1960s increased supplies of grain-fed beef. By the early 1970s, many American consumers found beef in supermarkets from only heavy, grain-fed cattle. Consumers soon became conditioned to the flavor, juiciness and tenderness of well-marbled beef. Proponents of forage- or limited-grain-finishing systems found little support at any marketing level. Corporate consolidation in the beef industry has narrowed the marketing options for small-scale producers. It is increasingly hard for the family ranch at the bottom of the food processing chain to maintain acceptable profit as evidenced by annual cost and returns estimates for cow-calf production. These have pushed many ranchers out of business and inspired others to bypass the industry and market their own products.

In recent years, consumer demand has grown for products produced through more natural and holistic production systems. Included in this class of less industrialized animal production systems are forage-finished beef programs.

The economic sustainability of the forage-fed beef systems must be evaluated in controlled conditions. The definition of forage-fed beef published by the U.S. Department of Agriculture-Agricultural Marketing Service in the 2007 Federal Register indicates that it is considered such “when grass and forage are the feed source consumed for the lifetime of the ruminant animal, with the exception of milk consumed prior to weaning.” Additional labeling claims are usually made that forage-fed beef is produced without using growth promoters, ionophores – a type of antibiotic that improves gain efficiency – or sub-therapeutic antibiotics. It is important then to follow these or any other established guidelines in producing forage-fed beef so that production information can be transmitted to consumers. Most importantly, variation in forage-fed beef prices and palatability may add to consumer confusion and negatively affect consumer confidence. Product attributes are the basis for willingness to pay a premium for forage-fed beef.

Several of Louisiana’s forage-fed beef producers are selling their product directly to consumers and to restaurants in New Orleans and Baton Rouge. A large influx of immigrants from Central America and Asia into Louisiana has expanded the marketing potential to ethnic groups. There is also proximity to large Texas ethnic markets in Houston and Dallas. If preferences are known for forage-fed beef, such as willingness to pay for specific attributes – leanness, color and flavor – then producers will have the marketing information necessary to

sell forage-fed beef in these communities.

Environmental and health concerns, food safety recalls, and changing domestic demographics have encouraged beef producers to look for alternative production systems like forage-fed beef. Consumer interest in the benefits of forage-finished beef and the increasing demand for locally produced products have had a multiplicative effect on this niche market. If managed properly, Louisiana has solid opportunities to produce forage year-round. Locally produced forage-finished beef offers high value, while enhancing economic, environmental and social sustainability. Forage-finished animals produce leaner meat compared with that from the higher-marbled, grain-finished animals. In addition, forage-finished beef is a healthier product that can be beneficial in the human diet because of greater concentrations of conjugated linoleic acid and omega-3 fatty acids.

Several aspects that must be considered in developing a sustainable forage-beef system include appropriate cattle types, forage systems, production and economic factors of existing forage-beef operations, demand for forage-fed beef among different consumer groups, and the influences of cookery type on forage-beef palatability. With this in mind an interdisciplinary team was formed in 2010 with scientists from the LSU AgCenter and Southern University with the common goal of seeking external funding to support research. The proposal was presented to the USDA-National Institute of Food and Agriculture (NIFA) for funding through a grant from the Agriculture and Food Research Initiative (AFRI). NIFA is charged with funding integrated research, extension and education grants that address key problems of national, regional and multi-state importance in sustaining all components of agriculture, including farm efficiency and profitability, ranching, renewable energy, forestry, aquaculture, rural communities and entrepreneurship, human nutrition, food safety, biotechnology and conventional breeding. By the beginning of 2011, the Louisiana project was funded for a total of \$500,000 for four years (USDA-AFRI 2011-67023-30098). Some of the findings are summarized in this issue of Louisiana Agriculture.



Guillermo Scaglia

FORAGE-FED BEEF
“when grass and forage are the feed source consumed for the lifetime of the ruminant animal, with the exception of milk consumed prior to weaning.”

United States Department of Agriculture
Agricultural Marketing Service, 2007

Guillermo Scaglia is an associate professor at the Iberia Research Station in Jeanerette.

Beef Cattle Performance on Three Forage Systems

Guillermo Scaglia

Consumer interest in the benefits of forage-finished beef has led to an increased demand for this product and prompted the U.S. Department of Agriculture-Agricultural Marketing Service to define forage-fed beef. According to the 2007 Federal Register, forage-fed beef is considered such “when grass and forage are the feed source consumed for the lifetime of the ruminant animal, with the exception of milk consumed prior to weaning.” Additional labeling claims are usually made that forage-fed beef is produced without using growth promoters, ionophores – a type of antibiotic that improves gain efficiency – or sub-therapeutic antibiotics.

Based on this definition, the evaluation of three different year-round forage systems (Figure 1) began in May 2009 with the main objective of developing a feasible forage finishing program that would allow for the production of 1,100-pound steers at 17 to 19 months of age. This provided the opportunity to evaluate production systems differing in complexity that can result in an economic and sustainable alternative to produce forage-fed beef in the Gulf Coast region of the country. It should be emphasized that these are not the only forage systems possible in this region, which has weather that allows year-round grazing. Some challenges that the region faces are the heat and humidity of summer and the transition periods when summer and winter forages are not available.

Annually from June to May and for four consecutive years, 54 crossbred steers (25 percent Brahman influence) were assigned to one of three forage systems (three groups of six steers per system) a few days after weaning with an average weight of 550 pounds. The steers remained in their systems until harvest. The area dedicated to each system was 45 acres (15 acres for each group of six steers), so steers were stocked at 2.5 acres per steer. All pastures were rotationally stocked and

grazed until a pre-determined forage stubble height, which differed depending on the forage grazed. It may appear that the number of acres per animal (stocking rate) is too high. However, in a year-round system the fluctuations of forage mass and nutritive value of the different forages limit the performance of animals. When defining annual stocking rates, these fluctuations must be considered as well as the animal’s nutritional requirements.

Excess forage in summer was harvested as hay and fed within the system when needed (Figure 2). Hay produced but not consumed was considered revenue for the system. Records of inputs and outputs were kept for economic evaluation of the forage systems. Figure 2 shows when the different pastures were grazed during the course of the year and the time and duration of the hay feeding period.

System 1 represented a very common system with bermudagrass for the summer, ryegrass for the winter and bermudagrass hay for the transition period. Ryegrass was no-tilled on bermudagrass sod (BG/RG) in a section of the system.

Systems 2 and 3 should have had greater animal performance because there was an increase in forage mass production and quality, although management complexity and inputs used increased, too. Systems 2 and 3 incorporated an area of dallisgrass – a high nutritive value summer grass – and a mix of white, red and berseem clovers for multiple-season grazing. In addition, the same clover mix and cereal rye were added to ryegrass for winter grazing. Since these clovers have a different growth pattern, determined through pasture measurement, they extended the time that, with some overlap, clovers are available. Berseem is available first, then red and, finally, white clover. Cereal rye provided forage mass earlier than annual ryegrass, but it was not enough to start the winter grazing period earlier.

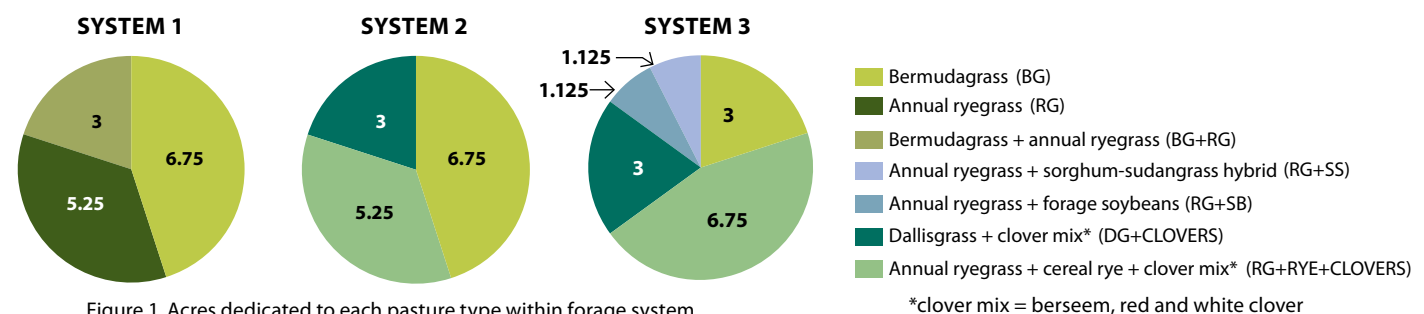


Figure 1. Acres dedicated to each pasture type within forage system.

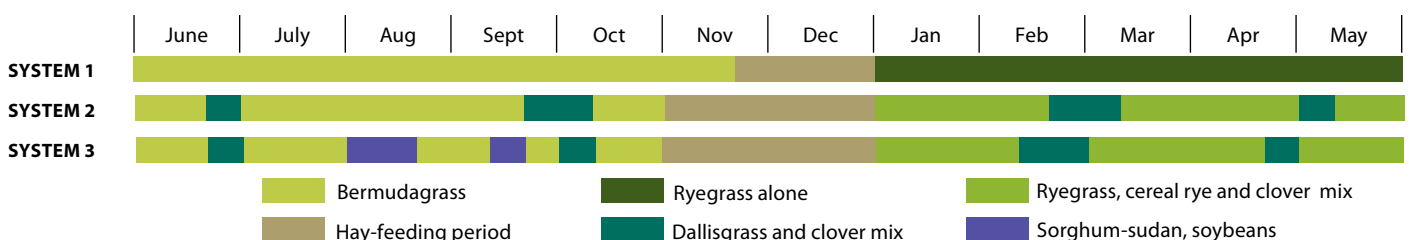


Figure 2. Schematic representation of the forage sequence for the different forage systems evaluated at the Iberia Research Station.

System 3 was the most productive in terms of dry matter production and nutritive value because sorghum-sudangrass hybrid and forage soybeans (only difference to System 2) were added for summer grazing. This same area was planted with ryegrass for winter grazing (RG/SS and RG/SB) (Figure 1). The rest of the forages for System 3 were similar to System 2 (Figure 1).

Average daily gains of the steers in the different forage systems were similar across the systems regardless of the time of year (Figure 3). Even though the sorghum-sudangrass/soybeans area produced better-quality forage during summer in System 3, the period during summer when animals grazed that area was too short (45-60 days, depending on the year), and they spent the rest of the time on bermudagrass (Figure 2). Although gains were greater during that period, the overall gain for summer of steers in System 3 did not differ from the other two systems. It should be emphasized that steers were young (recently weaned, 8 to 9 months of age) when placed on summer pastures. Steers' nutrient requirements are greater than bermudagrass or sorghum-sudangrass can provide, hence their small gains. Older steers (14 to 16 months old) could gain more on the same pastures. Because of the greater area dedicated to bermudagrass in System 1 (Figure 1), it was possible to extend the grazing season for this system, reducing the hay feeding period (Figure 2) and allowing a small weight gain while steers in Systems 2 and 3 with longer hay-feeding periods lost weight (Figure 3).

Overall, gains were very similar across forage systems allowing steers to reach the target final weight of 1,100 pounds. Under the conditions of the present project, complex and high-input year-round forage systems did not guarantee greater body weight gains. Partial improvements of performance provided during summer when steers grazed forages other than bermudagrass were offset by the shorter grazing season.

Another key period is the time between when summer forages play out and before winter forages are ready to graze. This is the so-called transition or gap period, which is represented as the hay-feeding period. Better quality of the conserved forages used or other forages can be used to ameliorate the negative effect of this period on animal performance. In the following articles, researchers will present additional information concerning the economics of these systems, carcass characteristics of the steers, meat quality, properties and consumer evaluation of the meat produced, marketing possibilities, and producers' attitudes toward forage-fed beef.

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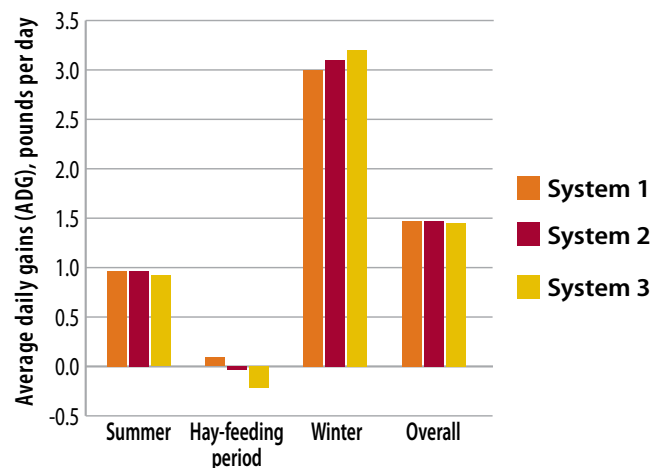


Figure 3. Average daily gains (pounds per day) of steers in different periods (summer, hay-feeding and winter) and overall (year-round) by forage system.



Steers on ryegrass, rye, clover mix pastures (March 2012)



Pastures were rotationally stocked. Ryegrass, rye, clover mix (February 2012).



No-till planting of sorghum-sudan (May 2011)



Steers on Tifton-85 bermudagrass (July 2012). Photos by Guillermo Scaglia

Is Forage-Fed Beef a Healthier Choice for Louisiana Families?

Fatemeh Malekian, Witoon Prinyawiwatkul, Damir D. Torrico and Guillermo Scaglia

Forage-fed and grain-fed beef differ in a number of qualities, including their fat content. Meat from forage-fed cattle is lower in total fat, and if the meat is very lean, it can have one-third the fat as beef from grain-fed animals.

In a study conducted by LSU AgCenter and Southern University Agricultural Research and Extension Center scientists, a total of 54 fall-born steers, which were purchased from a single source to minimize initial variations, were randomly assigned to one of the three forage feeding systems as described in the article on pages 10-11. Ribeye steak samples from steers finished on one of the three forage systems (labeled S1, S2 and S3) and a grain-fed choice steak (labeled C), purchased from a local supermarket, were analyzed in duplicate for total lipids, protein, moisture, ash and fatty acids.

Fat content in grain-fed beef was four times higher than forage-fed beef (Table 1). Because meat from forage-fed animals is lower in fat than meat from grain-fed animals, it is also lower in calories. The protein concentration was much greater in forage-fed beef (Table 1). Mineral content (ash) was greater in forage-fed beef (Table 1).

Red meat has high saturated fatty acid content. Saturated fatty acids build up on artery walls and make them hard, a condition known as atherosclerosis. This condition makes the heart beat faster to push blood through arteries, which in the long run will cause high blood pressure. There are three main types of saturated fatty acids found in red meat: stearic acid, palmitic acid and myristic acids. In this study, forage-fed beef and commercial grain-fed beef had almost the same portion of stearic acid, 28 percent to 29 percent. Palmitic acid content was similar for forage-fed and commercial grain-fed beef at 28 percent. Myristic acid was as follows in the samples: S1, 2.9 percent; S2, 3.8 percent; S3, 2.4 percent; and C, 3.3 percent.

Polyunsaturated fatty acids are subdivided into two categories, omega-6 and omega-3, based on location of the

double bonds in the fatty acid chain. Omega-6 fatty acids are common in grains and vegetable oils. Omega-3 fatty acids are common in plant lipids and fish oils.

Omega-3 fatty acids are essential nutrients for human health. “Essential” means that our body cannot make them, and we must get them through food. There are two critical omega-3 fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic (DHA), that the body needs. Sources such as walnuts and flaxseeds contain a precursor to omega-3, alpha-linolenic acid, that the body must convert to EPA and DHA. EPA and DHA are the building blocks for hormones that control immune function, blood clotting and cell growth, as well as components of cell membranes.

Omega-6 fatty acids are also considered essential fatty acids. Along with omega-3 fatty acids, omega-6 fatty acids play a crucial role in brain function, as well as normal growth and development. In general, hormones derived from the two classes of essential fatty acids have opposite effects. Those from omega-6 fatty acids tend to increase inflammation, blood clotting and cell proliferation, while those from omega-3 fatty acids decrease those functions. Both families of hormones must be in balance to maintain optimum health. For general health a balanced ratio of omega-6 to omega 3 should be in the range of 2:1 to 4:1. However, even lower ratios are recommended (1:1). In the literature, the average ratio of omega-6 to omega-3 in forage-fed beef is 1.53:1. In grain-fed beef, this ratio increases to 7.65:1.

In this study, the concentration of omega-3 fatty acids was three times greater in forage-fed beef (S1, S2 and S3) than in grain-fed beef (C) (Table 2). The ratio of omega-6 to omega-3 in forage-fed beef was much healthier than in grain-fed beef (Table 2).

Conjugated linoleic acid (CLA) has been shown to possess anticarcinogenic effects. Beef is an excellent dietary source of CLA, and forage-fed beef contains an average of two to three

Table 1. Analyses of samples obtained from steaks of steers from three forages systems (S1, S2 and S3) and commercial grain-fed steak (C) classified as Choice.

	Moisture (%)	Fat (%)	Protein (%)	Mineral content (ash) (%)
S1	74.07 (±0.99)	3.8 (±0.89)	22.22 (±0.46)	1.00 (±0.05)
S2	75.13 (±0.45)	2.42 (±0.34)	22.76 (±0.32)	1.02 (±0.09)
S3	75.35 (±0.47)	2.76 (±1.12)	22.56 (±0.80)	1.02 (±0.02)
C	86.76 (±0.6)	14.16 (±0.39)	18.80 (±0.28)	0.76 (±0.06)

Table 2. Fatty acid composition in beef samples from steers from three forages systems (S1, S2 and S3) and commercial grain-fed steak (C) classified as Choice.

	Total omega-6 (% of total fatty acids)	Total omega-3 (% of total fatty acids)	Ratio of omega-6 and omega-3
S1	3.87 (±0.23)	1.76 (±0.18)	2.23 (±0.22) : 1
S2	4.30 (±0.88)	1.96 (±0.26)	2.21 (±0.40) : 1
S3	3.29 (±0.30)	1.52 (±0.26)	2.19 (±0.25) : 1
C	5.39 (±0.42)	0.51 (±0.05)	10.55 (±0.38) : 1

times more CLA than grain-fed beef. In this study, beef from all three forage-fed systems showed significantly greater concentrations of CLA compared to commercial grain-fed beef.

Based on the results from this study and others, forage-fed beef is lower in fat content and higher in protein content. It contains more omega-3 fatty acids and more CLA. Forage-fed red meat is more nutrient dense than grain-fed. Even though forage-fed beef is more expensive, it may be a better choice for Louisiana families than grain-fed beef. Louisiana has one of the highest rates of obesity in the country, estimated at 34.7 percent. A scientific consensus on the relationship of obesity to such diseases as diabetes, heart disease, stroke and some forms of cancer has been documented.

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Top to bottom, a boneless sirloin, boneless stew and ground beef from Gonsoulin Land & Cattle of New Iberia, Louisiana. The Gonsoulin family raises forage-fed beef and sells it through the CajunGrocer.com website. Photos courtesy of Shannon Gonsoulin



Because forage-fed beef has a lower moisture content than grain-fed beef, it benefits from moist-heat cooking methods. Ben Blanchet, one of the owners of Brookshire Farms of Meaux, Louisiana, which sells forage-fed beef, prepares a dish from Argentina called *matambre*. It is made with a Brookshire Farms round steak and stuffed with spinach, carrots, corn, onion, cilantro and chopped hard-cooked eggs. It is browned and then braised in red wine and beef stock and sliced across for serving. Photo by Anne Blanchet

Consumer Acceptance of Ribeye Steaks from Forage-Finished Steers

A Comparison of American, Asian and Hispanic Populations

Damir D. Torrico, Wisdom Wardy, Kennet Carabante, Kairy Pujols, Guillermo Scaglia, Fatemeh Malekian, Marlene E. Janes and Witoon Prinyawiwatkul

Demand for forage-finished over grain-finished beef is rapidly growing because of its benefits for human health and the environment. However, there are some differences in flavor between forage- and grain-finished beefs, mainly due to differences in their chemical compositions. In general, U.S. consumers prefer grain-finished over forage-finished beef in some sensory attributes including flavor, juiciness, tenderness and overall acceptability. Differences in sensory quality between forage- and grain-finished beef can most likely be explained by the production systems that also affect the levels of energy intake, days on feeding, growth rate, age of the animal, fat deposition, fat composition and carcass weight.

Sensory perception of food is influenced by memory, emotions and culture. For instance, Hispanic and Asian consumers may have a different preference for forage-finished beef compared to Americans because steers in these regions are mainly fed with forage. The challenge, therefore, is to not only understand the effect of feeding regimens of steers on consumer acceptance of steaks, but also the influence of demographics to help identify niche markets.

According to the 2013 U.S. Census Bureau, Hispanics and Asians are the two fastest growing ethnic groups in the U.S and important ethnic groups to consider for product marketing. The Hispanic population is expected to grow in the U.S. from 53.3 million in 2012 to 128.8 million in 2060; the Asian population is expected to grow in the U.S. from 15.9 million in 2012 to 34.4 million in 2060. However, little information is available

on the perception of the sensory characteristics of forage- versus grain-finished ribeye steaks of these two populations in comparison to Caucasian and African-American populations.

LSU AgCenter researchers evaluated sensory acceptability of cooked ribeye steaks from forage-finished steers and commercial grain-fed steaks across Hispanic, Asian and American (white and African-American) populations as affected by the feeding regimes and cooking methods. A total of 336 consumers (112 Hispanics, 112 Asians and 112 Americans) participated in the sensory evaluation of ribeye steaks. They evaluated ribeye steaks from three forage systems as described on pages 10-11 and one commercial grain-finished steak. The steaks from forage-fed cattle are labeled S1, S2 and S3. The grain-fed steak is labeled with a C (Figure 1).

The ribeye steaks were cooked by two methods: one-sided grilling or two-sided grilling. For the one-sided grilling method, thawed steaks were placed on a pre-heated iron stove plate. For the two-sided grilling method, thawed steaks were placed in a pre-heated clamshell-style grill. Consumers indicated their preferred degree of doneness and cooking methods, then evaluated cooked steaks for sensory liking of appearance, beef aroma, beef flavor, juiciness, tenderness and overall liking, as well as purchase intent.

Researchers found that grilling was the most preferred steak cooking method among the three populations, although differences between one-sided and two-sided grilling were not observed. Regarding the degree of doneness, Hispanics and Asians preferred medium and medium-well, while Americans

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preferred medium and medium-rare. Hispanics and Americans liked the raw appearance (Figure 1) of S3 steaks better than S1, S2 (leaner steaks) and C (more marbling). For cooked steaks, Asians reported lower liking scores compared to Hispanics and Americans. For juiciness and tenderness, C and S3 consistently had higher mean scores compared to S1 and S2 across all three populations. Among forage-finished steaks, the slightly higher scores for juiciness and tenderness of S3 may be attributed to the type of forage. The grazing period that potentially affects beef characteristics is the last 60-80 days before the animal is harvested. This means that in this study only ryegrass in S1 and only ryegrass and clovers in S2 and S3 likely contributed to texture differences. Generally, commercial steaks (C) and S3 steaks had higher scores for all sensory attributes across the three populations. Purchase intents of all forage-finished steaks (S1, S2 and S3) were higher for Hispanics and Americans compared to Asians (Figure 2).

In conclusion, consumer liking of forage-finished ribeye steaks differed among Hispanics, Asians and Americans. Results indicated that the

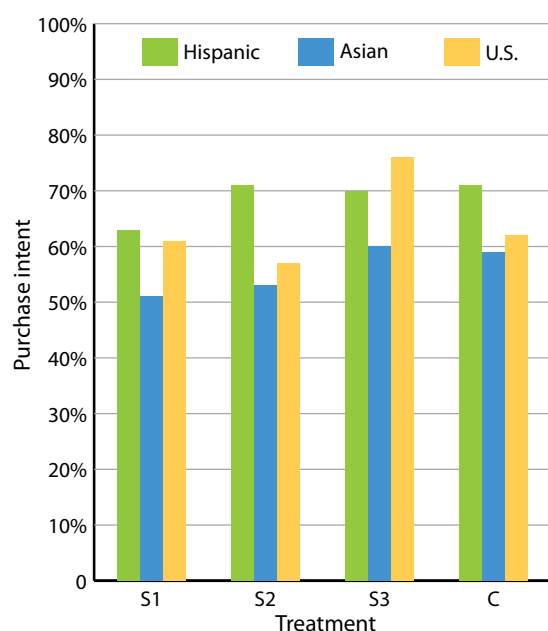


Figure 2. Purchase intent (%) of different cooked steak treatments (S1, S2, S3 and C) among Hispanics, Asians and Americans populations

*Purchase intent (%) was calculated from the willingness to buy after panelists had evaluated all sensory attributes of the cooked steaks.

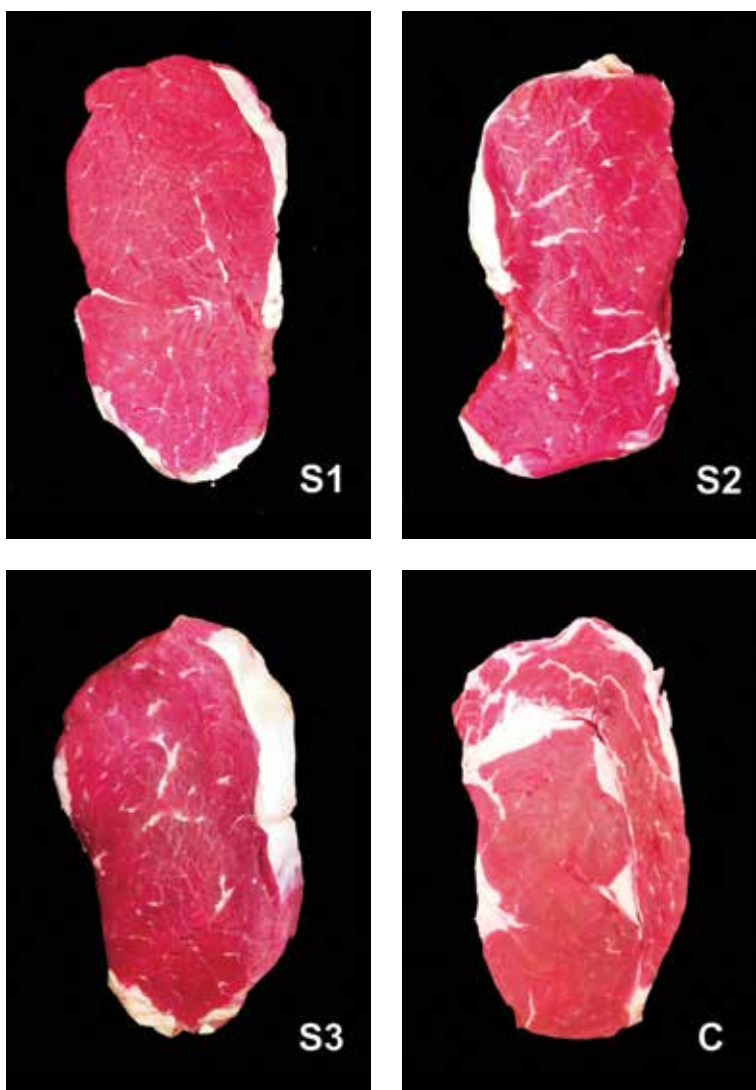


Figure 1. Consumers compared the raw appearance and cooked characteristics of ribeye steaks from cattle raised on three different forage systems (S1, S2, S3) and a ribeye steak from a cow that was grain-fed (C). The three forage systems are described on pages 10-11. Photos by Damir D. Torrico

raw appearance and overall fat appearance of S3 steaks were the most visually preferred for Hispanics and Americans. However, Asians visually preferred S1 and S2 over S3 and C (Figure 1). For all populations, overall liking for C and S3 steaks was higher compared to the other systems. Specifically for Hispanics, tenderness was the most relevant sensory attribute, whereas overall cooked steak appearance was more important for Asians. However, for Americans, overall beef flavor was considered the most significant attribute.

Prevalence of *Escherichia coli* O157:H7 in Small-Scale Cow-Calf Operations in Louisiana

Evelyn Gutierrez and Marlene Janes

According to the U.S. Centers for Disease Control (CDC) and Prevention, *Escherichia coli* (*E. coli*) are a large and diverse group of bacteria. Most of them are harmless and naturally found in the human intestinal tract, but others can be deadly. *Escherichia coli* O157:H7 has become an important problem in human health in the United States since it was first reported in 1982. In the past five years, CDC has reported several multistate *E. coli* O157:H7 outbreaks related to beef, dairy products, fruits and vegetables. People who become infected with *E. coli* O157:H7 will experience severe stomach cramps and diarrhea with

or without blood and vomiting within three to four days after eating contaminated food.

Scientific studies have indicated that cattle herds worldwide are the primary reservoirs of *E. coli* O157:H7. Cattle carrying *E. coli* O157:H7 have no symptoms and shed it intermittently and seasonally in their feces. Several outbreaks of *E. coli* O157:H7 associated with fruits and vegetables in the U.S. between 1986 and 2014 were due to contamination with animal manure during production and at harvest, contamination of water used for washing, or cross-contamination of the raw produce with raw meat products during food preparation. The ability of *E. coli* O157:H7 to survive in soil and manure for extended periods of time could explain its spread into the water supply and onto crops.

In Louisiana, calves are raised with cows mainly on grass forage until shipped to finishing sites in other states. Knowledge of the prevalence of *E. coli* O157:H7 associated with small-scale cow-calf farms can help with assessing risks and developing risk management strategies needed to control the colonization of this pathogen within the farm environment.

Large cattle ranches have more resources to purchase specialized equipment that can help prevent cross infection of cattle. Conversely, smaller-scale cattle farms mainly use existing equipment with less sanitary designs that can promote cross infection of cattle. There is a lack of knowledge on the optimal conditions required for the control, reduction and removal of foodborne pathogens from the surfaces of water troughs, feed bins and equipment.

LSU AgCenter scientists have conducted research that could provide additional information to better understand how cattle at the cow-calf stage of production become infected by *E. coli* O157:H7. From June to December 2011, samples were collected from 27 small-scale cow-calf farms across Louisiana for detection of *E. coli* O157:H7. Environmental samples collected and tested included fresh fecal pats on the ground, water from troughs and ponds, and swabs from troughs, salt and hay bunks.

From all the samples tested on the 27 farms, *E. coli* O157:H7 tested positive in 9 percent of the fecal pats, 7 percent of the water samples and 2 percent of the swabbed surfaces, for a total of 51 (8 percent) positive samples. From the 51 *E. coli* O157:H7-positive samples, 74 percent were fecal pats, 24 percent were water



Evelyn Gutierrez, instructor in the School of Nutrition and Food Sciences, collects fecal samples from fields at the LSU AgCenter Hill Farm Research Station in Homer, Louisiana. Photo by Miguel A. Gutierrez-Orellana.

Evelyn Gutierrez is an instructor, and Marlene Janes is a professor in the School of Nutrition and Food Sciences.



Miguel A. Gutierrez, LSU AgCenter research associate, collects water samples from ponds at LSU AgCenter Hill Farm Research Station in Homer. Photo by Evelyn Gutierrez

and 2 percent were from swabbed surfaces (Figure 1). Farms from the central region of the state had a higher number of positive samples, compared with the northwest and southwest regions. These results include fecal pats, water and swabs (Table 1).

The results in this study show that although fecal pats had a higher prevalence, water troughs are a source of *E. coli* O157:H7 as well. On the other hand, the low percentage of positives for the swabs indicated that surfaces in the farm environment have a minor role in the prevalence of this pathogen in cattle operations. The overall prevalence of *E. coli* O157:H7 in the environment of small-scale cow-calf operations in Louisiana was 8 percent. Additionally, it is important to mention that a proportional relationship between *E. coli* O157:H7 in fecal pats and in water indicates water could be the principal carrier for the spread of *E. coli* O157:H7 on farms.

These AgCenter findings can be used to help establish good animal husbandry practices and pre-harvest food safety conditions for small-scale cow-calf operations to reduce *E. coli* O157:H7 in cattle.

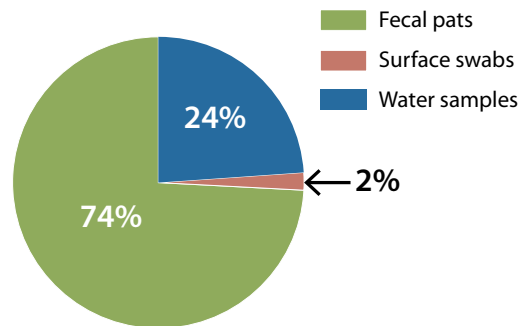


Figure 1. Positive environmental samples found on 27 cow-calf farms in Louisiana.

Table 1. Percentage of positive *E. coli* O157:H7 in environmental samples on small-scale cow-calf farms in different regions of Louisiana.

Region	Fecal Matter	Water	Swabs
Northwest	1 percent	2 percent	0 percent
Central	13 percent	11 percent	4 percent
Southwest	11 percent	6 percent	0 percent

AgCenter findings can be used to help establish good animal husbandry practices and preharvest food safety conditions for small-scale cow-calf operations to reduce *E. coli* O157:H7 in cattle.

Louisiana MarketMaker and Forage-Fed Beef Production

John Westra, Todd Cooper and Roger Hinson

A “market maker” is usually an individual or a firm ready to buy and sell stock on a regular basis at a publicly quoted price. This person helps buyers and sellers connect so as to “make” the market. In a similar manner, the Louisiana MarketMaker website connects buyers and sellers of food. The Louisiana site is part of a national MarketMaker website, a partnership between land-grant universities and state agriculture departments that features food products from across the country.

MarketMaker has its origins with the Illinois Cooperative Extension Service working with livestock producers trying to sell their meat in Chicago area meat markets and grocery stores. In response to the difficulty they experienced in identifying likely buyers in Chicago, and in meat market buyers trying to contact livestock producers, extension personnel devised the MarketMaker program. The website was created in 2004 by a University of Illinois team to connect farmers with economically viable food markets.

From those beginnings with Illinois beef cattle producers, it has evolved into one of the most extensive collections of searchable food-industry-related data in the country, with 20 states participating. Over the past decade, the website has been continuously updated so that all the information can be mapped and queried by the user, including most recently apps for smartphones to locate producers or buyers in the MarketMaker database.

The LSU AgCenter joined the MarketMaker program in July 2010. Initial funding to help support the program in Louisiana was secured in response to the Deepwater Horizon oil spill, which added further strain to the shrimp and fishing industries along the U.S. Gulf Coast that had been struggling following hurricanes Katrina and Rita in 2005. Though initial funding and efforts were focused on the seafood industry, outreach and extension efforts were directed to all producers, ranchers, brokers and buyers of food in Louisiana.

As a result, Louisiana has consistently been ranked among the top three state MarketMaker sites in the country in terms of website traffic and unique users. Nationally, four of the top 10 most viewed MarketMaker businesses are from Louisiana.

Of the nearly 500 farmers and farmer’s markets registered on the Louisiana MarketMaker website, there are 23 beef cattle producers with 13 identifying their operation as grass-fed or grass-finished beef. To understand how these producers market their beef and to determine how MarketMaker is inte-



Photo above: Shannon Gonsoulin, center, is the owner of Gonsoulin Land and Cattle of New Iberia, Louisiana, which produces of forage-fed beef. Sid Derouen, at left, is in charge of farmers market sales and promotion, and Stuart Gardner is a business partner. Gonsoulin Land and Cattle partnered with Dickie Brennan’s Steakhouse in New Orleans on Aug. 27, 2014, for a “Down Home Eats Downtown” food event to benefit Good Shepherd School in New Orleans. *Photo upper right:* Richard Parker prepares forage-fed flank steaks. *Photo lower right:* Ben Thibodeaux slices up a beef leg quarter. Customers can purchase Gonsoulin beef products online at www.glc ranch.com or at www.cajungrocer.com. Photos by Peter Forest used with permission from Shannon Gonsoulin for Louisiana Agriculture

grated into this marketing program, LSU AgCenter staff interviewed several beef cattle producers. Following is information on two farms.

Gonsoulin Land and Cattle, New Iberia

Since the late 1700s, the Gonsoulin family has been raising cattle in south central Louisiana. The current generation of cattle producers formed the Gonsoulin Land and Cattle LLC in 2006. They aim to produce quality grass-fed beef using no antibiotics or growth hormones and try to conserve natural resources by following land and water conservation practices from the Natural Resources Conservation Service. All of their cattle are raised within an intensively grazed pasture system. Additionally, they work their cattle on horseback, which results in a low-stress, low-pressure environment. Though this may be more labor-intensive and time-consuming, they claim the cattle prefer the decreased noise levels and gentle handling. Overall, they view their system as good for the cattle, the environment and, most importantly, their family. Their cattle are inspected by the American Grassfed Association at their ranch, a process that allows their compa-

ny to label its products as certified grass-fed beef. Additionally, they participate in the Louisiana Branded Beef Program, a program of the Louisiana Cattlemen's Association to ensure the beef is Louisiana grown. They are licensed to use the "Certified Louisiana Product" label from the Louisiana Department of Agriculture and Forestry. Using these certifications and labels, the Gonsoulin family markets 400-450 head of cattle annually, both retail and wholesale, via the Internet, local papers, farmers markets and word of mouth.

Brookshire Farm, Abbeville

Since 1840, cattle have been raised for seven generations on land in south central Louisiana where Brookshire Farm is located. Brookshire focuses on healthy pastures of native forages they claim give pastured beef its distinctive flavor. When the latest generation took over about 10 years ago, they began selecting cattle and calves with easy-going dispositions they could finish on grass that resulted in tender beef. Pastures are managed to optimize pasture growth and to meet the animals' nutritional requirements. Brookshire Farm cattle spend their whole lives on forage and receive no growth stimulants, antibiotics or other synthetic

additives. These practices reflect their view that grass-fed is a healthier and more sustainable practice for beef. This operation markets 30-40 head of cattle annually as live animals, shares of animals or retail cuts. The company markets through its website, Facebook, email, farmers markets and word of mouth.

Most beef cattle producers using Louisiana MarketMaker indicated their customers sought grass-fed beef or beef that was locally produced. Wholesale and retail markets were used by all producers, but most producers would prefer more retail sales direct to consumers or sales of whole animals direct to consumers at a price intermediate between retail and wholesale. Most producers have noticed an increasing trend for online sales and online media promotion of products like grass-fed beef.

With increased awareness, particularly by the buying public in urban areas, Louisiana MarketMaker will have a larger, positive impact on sales for grass-fed beef in Louisiana.

John Westra is a professor, Todd Cooper is an extension associate, and Roger Hinson is a former professor, now retired, in the Department of Agricultural Economics and Agribusiness.



Photo above: Anne and Ben Blanchet sell their forage-fed beef products at the Hub City Farmers Market in Lafayette, Louisiana. Photo upper right: The Blanchets sell frozen meat products out of an ice chest at farmers markets. Photo lower right: The Blanchets raise forage-fed beef at their farm, Brookshire Farm, of Abbeville, Louisiana. They are in business with their son, Bob, and his wife, Cat. In addition to participating in farmers markets, they do a brisk business through their website, which also features recipes for their products – www.brookshirefarm.com. They are also on Facebook. The two photos of the Blanchets are by Linda Foster Benedict. The top right photo by Anne Blanchet

Economic Sustainability of Forage-Fed Beef Systems

Basu D. Bhandari, Jeffrey M. Gillespie, Guillermo Scaglia, Jim J. Wang and Isaac Sitienei

A wide range of pasture systems can be used to produce forage-fed beef. Each system results in different levels of productivity, profitability and sustainability outcomes. Forage-fed beef refers to beef from cattle whose lifetime diet consists of only grass and other forages, with the exception of milk consumed prior to weaning. No grain is fed.

Although forage-fed beef accounts for a small portion of the U.S. beef industry, it has been increasing over the past two decades. Current and potential forage-fed beef producers are looking for the most profitable production systems. Research was carried out at the LSU AgCenter’s Iberia Research Station from 2009 to 2012 to analyze the economics of three different pasture systems. See the explanation of these systems on pages 10-11. These systems were chosen as representative of the systems being used in the U.S. Gulf Coast region.

System 1 consists of bermudagrass in summer and ryegrass in the winter. This is the most common and simplest system analyzed. System 2 consists of bermudagrass in the summer and ryegrass, rye, clover mix (white, red and berseem) in the winter. System 3 includes bermudagrass, a sorghum-sudan hybrid and forage soybean in the summer and ryegrass, rye and a clover mix in the winter. Each year, 54 fall-born steers at the age of 7-8 months were weaned. These steers were divided into nine groups (six steers per group) and randomly assigned to one of the three treatments, which were replicated three times. They remained on the same treatment until harvest at the age of 17-19 months. During periods when pasture was not available, animals were fed with hay made from the paddocks where they were assigned.

Detailed costs of inputs and outputs were recorded on a daily basis. The input costs were categorized into variable

costs and fixed costs. Variable costs included costs of fertilizers, seed, pesticide, minerals, medication, twine, fuel, purchased weaned steers, repair and maintenance for machinery and equipment, and interest on operating capital. Fixed costs included depreciation and interest on machinery and equipment, and permanent and temporary fencing. The opportunity cost of land rental was also included. Prices of inputs were based on annual LSU AgCenter cost of production estimates. Output prices were based on U.S. Department of Agriculture sources.

Table 1. Revenue, expenses and profit per treatment (dollars per animal).

Item	System 1	System 2	System 3
INCOME			
Steer Income	1,327.83	1,333.67	1,315.06
Hay Income	804.20 ^a	653.37 ^b	460.31 ^c
Total Income	2,132.04 ^a	1,987.04 ^b	1,775.37 ^c
EXPENSES			
Total Direct Expense (D)	1,183.70	1,161.72	1,199.57
Return over Total Direct Expense	948.20 ^a	825.24 ^a	575.57 ^b
Fixed Expense (F)	218.15 ^a	172.98 ^b	150.35 ^c
Total Expenditure (D+F)	1,401.89	1,334.80	1,350.17
Return over Specified Expenses	730.04 ^a	652.19 ^a	425.15 ^b
Residual Return	645.80 ^a	577.93 ^a	353.07 ^b

Note: Different superscripts within a row indicate the figures are statistically different.

Results on economic profitability are presented in Table 1. Results showed that Systems 1 and 2 were more profitable than System 3. The residual returns from Systems 1, 2 and 3 were \$646, \$578 and \$353 per steer on per year bases, respectively. Steer income did not differ among systems, but hay income did. Total variable costs did not differ among these systems even though the fertilizer costs were higher in System 1 than in Systems 2 and 3. Seed costs were higher in System 3.

To analyze the environmental sustainability of the systems, carbon dioxide (CO₂) equivalent emissions from each system were computed including that from the production of nitrogen fertilizer and pesticides; digestion; emissions of carbon dioxide, nitrous oxide and methane; and the diesel fuel used in fertilizer and pesticide application, tillage and hay operations. The carbon dioxide equivalent emissions from nitrogen production and digestion were based on published literature. All other sources were based on the data collected in this experiment.



A group of steers in the winter of 2011 in the System 3 forage system used in this study. See pages 10-11 for an explanation of the study. Photo by Guillermo Scaglia

From an environmental perspective, System 3 was the best since it produced the least CO₂ equivalent emissions as shown in Table 2. System 3 produced 17,539 kilograms equivalent CO₂ emissions per steer while Systems 1 and 2 produced 23,040 and 19,196 kilograms equivalent CO₂ emissions per steer, respectively.

A trade-off can be made between economic profitability and environmental sustainability. If reduced carbon dioxide equivalent emissions were valued at \$0.05 per kilogram, then Systems 1 and 3 would be economically equivalent. Similarly, if reduced carbon dioxide equivalent emissions were valued at \$0.14 per kilogram, then Systems 2 and 3 would be economically equivalent. Therefore, when deciding which system to use

for forage-fed beef production, both economic and environmental factors must be considered.

Table 2. Climate change potential as kilograms of CO₂ equivalent emissions per year.

	Kg of CO ₂ Equivalent Emissions per Year	
	Climate Change Potential	Climate Change Potential/ Steer
System 1	414,725	23,040
System 2	345,528	19,196
System 3	315,707	17,539

Basu D. Bhandari is a graduate research assistant and Jeffrey M. Gillespie is Martin D. Woodin Endowed Professor in the Department of Agricultural Economics and Agribusiness. Guillermo Scaglia is an associate professor at the Iberia Research Station, Jeanerette. Jim J. Wang is a professor in the School of Plant, Environmental and Soil Sciences. Isaac Sitienei is a graduate research assistant in the Department of Agricultural Economics and Agribusiness.

Practices and Systems Used in Southeastern U.S. Grass-Fed Beef Production

Jeffrey M. Gillespie, Isaac Sitienei, Basu D. Bhandari and Guillermo Scaglia

Prior to what has become standard practice of feeding grain to beef cattle for finishing, grass finishing was the conventional method for producing cattle for beef. Recent years have seen an upsurge in interest in grass-fed beef production by both consumers and producers. This article reports on the production practices and systems currently used by grass-fed beef producers in the Southeastern United States. Data for this report were collected from a nationwide U.S. survey of 1,052 grass-fed beef producers who were identified via a Web search using sites such as Eatwild.com and MarketMaker. A total of 384 useful surveys were received, which constitute an overall return rate of 41 percent.

Of the 384 surveys received, 65 respondents were located in the Southeast, including Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia and West Virginia. Of these, 13 were in Virginia, 12 in Louisiana, eight in

Kentucky and six in Florida with five or fewer in each of the remaining eight states. These 65 farms are the basis for the results presented in this article.

Of the 65 farms surveyed, the average number of animals finished per farm was 105; the average number of acres on the farm was 278; the average number of acres devoted to the grass-fed beef enterprise was 205.

British breeds were by far the most common for grass finishing, with 66 percent of the farms using British breeds and 88 percent of the total finished animals being British breeds. The second-most common breed type used was the British-Continental cross, which was used by 9 percent of the producers and constituted 4 percent of the total finished animals.

Of the reproductive management practices, 29 percent of the producers used artificial insemination, 7 percent used embryo transfer and 2 percent used sexed semen. Compared with available national data for cow-calf producers, these are higher rates of usage. Breeding

management practices used by at least 50 percent of the producers included keeping breeding records, checking pregnancy and using a defined breeding season. Other usage included 10 percent for DNA marker-assisted selection, 44 percent for bull testing and 25 percent for expected progeny differences.

General animal management practices used by more than 50 percent of the producers included:

- 64 percent used vaccinations.
- 65 percent used an animal identification system.
- 73 percent used deworming.
- 54 percent used insect control.
- 91 percent used castration.
- 86 percent kept individual animal records.
- 82 percent accessed the internet for grass-fed beef information.
- 97 percent used rotational grazing.

Compared with available national cow-calf farm data estimates, the use of animal identification is lower for

Almost all grass-fed beef producers (97 percent) sold at least some of their animals and meat by direct sale to consumers.

... close attention and substantial effort afforded to marketing are important aspects of grass-fed beef production.

the grass-fed beef producer population, possibly because many of the animals remain on the same operation throughout their lives. However, keeping individual animal records, accessing the Internet for beef information and using rotational grazing are higher for grass-fed beef producers. Moderate usage of 10-50 percent included scoring body condition, dehorning, consulting a veterinarian regularly, testing forage quality and negotiating price discounts with dealers or input suppliers. Compared with available national data for cow-calf producers, the use of regular veterinary services and forage quality testing are higher for grass-fed beef producers. Only 9 percent of the producers used forward purchasing, and 8 percent operated farms that were either certified organic or transitioning to certified organic production.

Almost all grass-fed beef producers (97 percent) sold at least some of their animals and meat by direct sale to consumers. Of the marketing channels identified, 47 percent used farmers markets, 38 percent sold to restaurants, 31 percent marketed online, 25 percent marketed through wholesalers and retailers, and 20 percent sold to grocery stores. Cooperatives accounted for 10 percent of the markets used. Dealers, brokers and meat packers together accounted for 10 percent of the markets used.

Summary

Survey results suggest that in the Southeast, British breeds are by far the most popular animals raised for grass-fed beef. Comparing grass-fed beef producers' use of reproductive management practices with those of the general cow-calf producer, grass-fed beef

producers tended to be greater adopters of advanced reproductive management practices in general. General animal management practices were moderately used except for 9 percent of this group being certified organic or transitioning to certified organic beef production. This is higher than the general cow-calf producer, as are estimates for several other general animal management practices.

Grass-fed beef is sold through a number of different marketing outlets, but the vast majority of producers appear to be using direct sales to consumers for at least one of their outlets. Farmers markets and restaurants are also used by substantial portions of the group. Given the nature of these marketing outlets, their high percentage of use suggests close attention and substantial effort afforded to marketing are important aspects of grass-fed beef production.

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Attitudes of Forage-Fed Beef Producers in the Southeast

Isaac Sitienei, Basu D. Bhandari, Jeffrey M. Gillespie and Guillermo Scaglia

Grass-fed beef production has recently emerged in the United States as an alternative to conventional feedlot beef, although it still represents a very small percentage of U.S. beef produced. Farmers with an interest in producing grass-fed beef are asking questions about its viability, and those producing it need research information. A study was conducted to determine grass-fed beef producers' perceptions of the challenges associated with the enterprise, their goal structure and their reasons for selecting the enterprise. The findings are based upon 65 responses from a randomly selected sample of grass-fed beef producers from the Southeastern United States, including Alabama,

Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia and West Virginia. All states were surveyed (384 total responses), but this article is reporting results only for the Southeast. The list of producers was obtained from an extensive Internet search. The two main website sources were Eatwild.com and MarketMaker.

The survey was sent to farmers on August 20, 2013. To participate, respondents were to indicate that they had raised grass-fed beef cattle during 2012. A definition for grass-fed beef was provided at the beginning of the survey to ensure that responses from grass-fed beef producers only were obtained.

Reasons for selecting the grass-fed beef enterprise

The three most important reasons cited were those related to consumer health and the conservation of the natural environment: to produce healthy beef; grass-fed beef production is good for the environment; and grass-fed beef systems are more sustainable than grain-fed beef systems (Table 1). Producers were generally in agreement with most of the listed reasons for operating a grass-fed beef enterprise. The economic reason that producing grass-fed beef is low-cost was the least important in explaining why producers chose a grass-fed beef enterprise.

Goals of grass-fed beef producers

It is common to assume profit maximization or cost minimization as the only important goal for a firm. However, producer goals are generally multi-dimensional rather than uni-dimensional. LSU AgCenter researchers measured the relative importance of different goals held by grass-fed beef producers by asking respondents to compare pairs of eight potential goals they might have for their operations. The goals “maintain and conserve land” and “produce healthy beef” were most important for Southeastern grass-fed beef producers while the goal “increase farm size” was least important (Table 2). Note that “maximize profit” ranked seventh of eight in goal importance.

Challenges facing grass-fed beef producers

Producers were asked to weigh the importance of specified challenges facing grass-fed beef operations. The long period of time required to get animals to slaughter weight, lack of a clear marketing system, and shortage of processors emerged as the three most important challenges facing Southeastern grass-fed beef producers (Table 3). Producers generally disagreed that diseases and lack of steady demand for grass-fed beef were major challenges to their enterprises.

Results from both the reasons for selecting a grass-fed beef enterprise and the relative importance of goals indicate that producing healthy beef and conserving the environment are two of the most favored goals and reasons for producing grass-fed beef. Reasons associated with the economic aspects of the enterprise, such as profitability and cost, were of lower importance. It appears that some of the most important challenges faced by grass-fed beef producers include developing a clear marketing system, increasing processing capacity and working on strategies to shorten the time to slaughter weight.

... producing healthy beef and conserving the environment are two of the most favored goals and reasons for producing grass-fed beef.

Table 1. Reasons for selecting grass-fed beef enterprise.

Reasons	% of farmers who agreed	Mean*
I want to produce healthy beef	98	3.82
Producing grass-fed beef is good for the environment	91	3.76
Grass-fed beef systems are more sustainable than grain-fed beef systems	90	3.65
Producing grass-fed beef is enjoyable	89	3.60
There is strong demand for grass-fed beef in my area	85	3.35
Grass-fed beef production is profitable	82	3.25
Raising grass-fed beef is a good activity for my family	76	3.23
I have ample land suitable for grazing	75	3.00
Producing grass-fed beef is low-cost	68	2.78

* 1 = Strongly disagree; 2 = Somewhat disagree; 3 = Neutral; 4 = Somewhat agree; 5 = Strongly agree

Table 2. Goals of Southeastern grass-fed beef producers.

Goals	Rank	Percentage
Maintain and conserve land	1	14.82
Produce healthy beef	2	14.82
Have time for other activities	3	13.86
Have family involved in agriculture	4	13.64
Avoid years of loss/low profit	5	13.30
Increase net worth	6	11.00
Maximize profit	7	10.83
Increase farm size	8	7.74

Table 3. Importance of challenges facing Southeastern grass-fed beef producers.

Challenge	% of Farmers Who Agreed	Mean*
Long period of time required to get to slaughter weight	61	3.66
Lack of a clear marketing system	56	3.45
Shortage of processors	53	3.42
Limited land available for grazing	50	3.37
Pasture management problems	49	3.33
High cost of grass-fed beef production	47	3.22
Labor intensive relative to cow-calf production	38	3.04
Transportation and distribution problems	37	2.92
Market competition from feedlot beef	31	2.76
Lack of steady demand for grass-feed beef	25	2.63
Diseases	8	2.59

* 1 = Strongly disagree; 2 = Somewhat disagree; 3 = Neutral; 4 = Somewhat agree; 5 = Strongly agree

Isaac Sitienei is a graduate research assistant in the Department of Agricultural Economics and Agribusiness. His co-authors are Basu D. Bhandari, graduate research assistant, and Jeffrey M. Gillespie, Martin D. Woodin Endowed Professor, both in the same department, and Guillermo Scaglia, associate professor at the Iberia Research Station in Jeanerette.

Consumer Preferences for Forage-Fed Beef

R. Wes Harrison, Jeffrey M. Gillespie, Guillermo Scaglia and Bo Lin

In a forage-fed beef operation, cattle are fed grass and forage for their lifetime, with the exception of milk consumed prior to weaning. Animals are not fed grain or grain byproducts and have continuous access to pasture during the growing season. Health claims associated with grass-fed beef relative to grain-fed include reduced fat content, less saturated fat, and greater concentrations of beneficial nutrients, such as omega-3 fatty acids and conjugated linoleic acid. Other benefits often attributed to grass-fed cattle include better animal welfare, improved environmental sustainability, and antibiotic- and hormone-free beef production. Grain-fed beef is the most common way beef is produced in the United States. Animals are fed a grain-based feed, which is primarily corn, in a feedlot during the final 90-180 days before slaughter.

In 2012, LSU AgCenter researchers sent a survey to a national sample of 2,000 beef eaters regarding consumer preferences, attitudes and consumption of grass-fed beef. The purpose of the survey was to better understand consumer attitudes toward grass-fed beef and how often grass-fed beef is consumed compared to grain-fed beef. Researchers also wanted to determine

if consumers prefer a U.S. Department of Agriculture program that certifies specific production methods for grass-fed beef.

Results from the survey showed that 58.9 percent of respondents recall eating grass-fed beef at least once in the past year. The average respondent indicated that of the last 10 times they consumed meat or seafood, they ate grass-fed beef 1.41 times as compared to 2.32 times for grain-fed beef. Chicken was the most common meat consumed with an average frequency of 3.47 times. Seafood averaged 1.47 times and pork, 1.33 times.

... most consumers do not know how beef is produced in the United States.

That the average respondent indicated eating grass-fed beef 1.41 times out of 10 is not consistent with other national data, which show grass-fed beef remains a relatively small percentage of total beef consumption. One explanation for this is that most consumers do not know how beef is produced in the United States. As part of the survey design, researchers asked

questions about consumers' knowledge and consumption of grass-fed beef before providing a definition of the production method. Results showed that 52.2 percent of respondents associated the raising of cattle on open pasture with grass-fed production, even though most cattle spend some period of their lives on pasture before being finished on grains in a feedlot. In contrast, only 9.5 percent of respondents associated grass-fed production with cattle that have never been fed grains.

Researchers also asked questions about consumer attitudes regarding the benefits of grass-fed beef. The statement pertaining to animal welfare received the highest percentage of agreement among both grass-fed and grain-fed beef eaters (Figure 1). More than 50 percent of those claiming to be grass-fed beef eaters agreed with the statement that grass-fed beef is produced in a way that is better for the animal's welfare. Higher percentages of grass-fed beef eaters agreed with all statements tested, with animal welfare and environmental and health benefits receiving the top three rankings. Aside from the statement pertaining to animal welfare, all other statements received less than 50 percent of agreement from both grass- and grain-fed beef eaters.

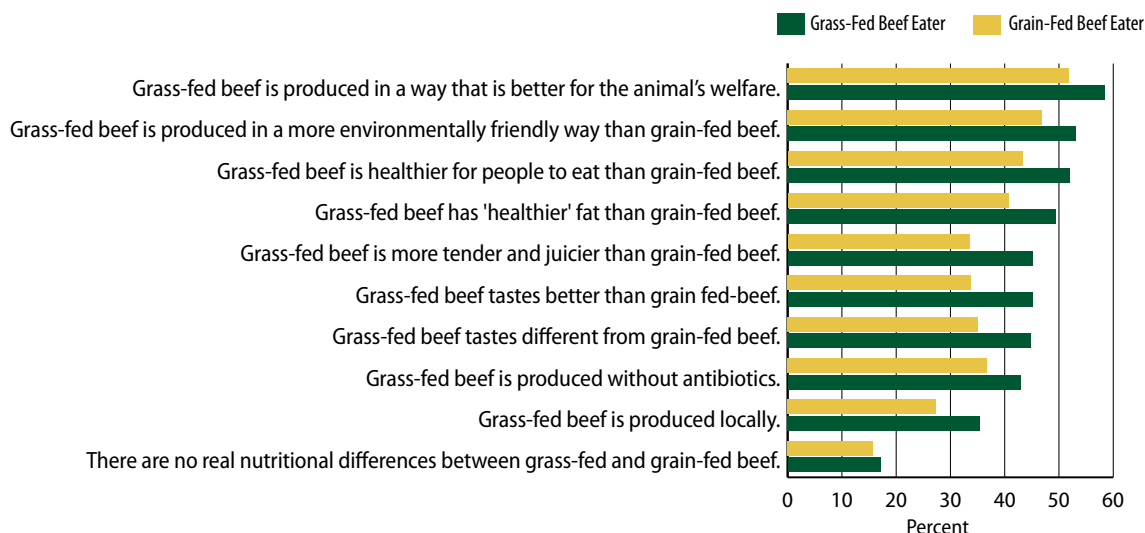


Figure 1. Percentage of consumers agreeing with selected statements about grass-fed beef.

... results also show a higher preference for beef that is produced locally and domestically, compared to imported beef.

Analysis of respondent ratings of grass- and grain-fed beef showed that the average respondent preferred a grass-fed product with a USDA certification, as compared to uncertified grass-fed or grain-fed beef products. This result is somewhat counterintuitive since grain-fed beef is purchased in greater quantities relative to grass-fed beef in the United States. This is likely caused by a relatively higher price for grass-fed products, which reduces consumption of grass-fed beef relative to grain-fed beef. In addition, results also show a higher preference for beef that is produced locally and domes-

tically, compared to imported beef. Consumers prefer choice and prime beef steaks compared to select beef steaks. Individuals who live in the West expressed a stronger preference for grass-fed beef relative to those living in other regions of the United States.

Figure 2 shows the relative importance of top-rated attributes by the average respondent in the sample. The two most important attributes are grass-fed with a USDA certification and local production. This is a significant result indicating a relatively strong preference for a USDA certification, similar to the popular Black Angus beef

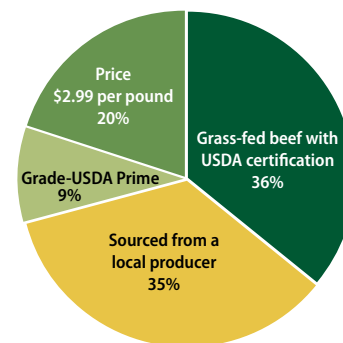


Figure 2. Relative importance of selected product attributes for grass-fed beef.

certification program. The results also indicate a relatively strong preference for locally produced beef, which is consistent with national trends that show an increased preference for local foods.

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Carcass Traits of Steers Finished on Three Forage Systems

Kenneth W. McMillin, Manuel A. Persica III, J.C. Gregorie and James N. Maynard

A market for forage-fed beef exists in the United States. Research has shown that one-third to one-half of consumers prefer the taste of forage-fed beef to grain-fed beef. Another benefit of forage-fed beef is increased support of locally produced products. Previous research in the LSU AgCenter has shown that forage-finished beef can be produced using forage resources available in Louisiana. The present study was conducted to determine the impact of the three forage production systems on carcass traits and composition.

Each year for three years, cattle were obtained by random selection of six steers from each forage system for a total of 54 steers of 3/8 Gelviah, 3/8 Red Angus and 1/4 Brahman breeding. The forage systems were:

System 1 was primarily bermudagrass during summer, fall and spring and ryegrass in winter.

System 2 was bermudagrass in summer, a dallisgrass-and-clovers



Beef carcasses of steers finished on three forage systems. Photo by Kenneth W. McMillin

mix during fall and spring, and a ryegrass-clovers mix during winter.

System 3 was bermudagrass and sorghum-sudangrass hybrid with forage soybeans during summer, a dallisgrass-clovers mix during fall and spring, and a ryegrass-clovers mix during winter.

Carcass traits of finished cattle are important because they determine the relative value in yield and predicted palatability of the meat. Quality grades estimate the eating properties or palatability of the lean beef, and yield grades estimate the amount of meat, or yield, expected from the carcass after removing bones and trimming excess fat.

Quality grades are determined primarily by the relative bone maturity and the marbling in the *Longissimus dorsi* – ribeye muscle – with consideration to muscle color.

Yield grades are determined by combining the carcass weight; subcutaneous fat thickness at the 12th and 13th ribs; kidney, heart and pelvic fat percentage; and the area of the ribeye muscle at the 12th and 13th rib junction. Yield grades estimate the percentage of the carcass that will produce boneless, closely trimmed retail cuts, often 45 percent to 50 percent of the carcass for feedlot-finished cattle.

Cattle finished in feedlots usually have quality grades of Select or Choice, which are desired by grocery stores and many restaurants because of the level of fat marbling within the muscle, and yield grades of 2, 3 or 4. Carcass grading is typically done at 24 to 48 hours after slaughter before carcasses are divided into primal cuts for shipment as chilled boxed beef. Beef produced on forages usually have lighter carcass weights, less subcutaneous fat, and lower marbling levels when slaughtered at the same age as cattle finished on silage or grain. This results in lower quality grades of Select or Standard and lower yield grades of 1 and 2.

Each year 18 steers were selected after approximately 324 days on their respective forage systems and were randomly assigned to two groups for humane slaughter in a Louisiana state-inspected meat plant. Carcasses were chilled in a 36-degree F cooler overnight before evaluation. After trained meat scientists evaluated the carcass traits based on U.S. Department of Agriculture specifications, primal rib cuts were removed from each carcass side.

The 9-to-11-rib section from one side was divided into ribeye muscle, other lean tissue, fat and bone while the

remaining portion of that primal cut and the rib primal cut from the other side were cut into steaks for determining cook yield, tenderness, electrical conductivity and sensory panel palatability. Boneless, closely trimmed retail cuts were calculated from carcass weight, ribeye muscle area, 12th rib fat thickness and percentage of kidney, pelvic and heart fat. These data were analyzed along with the year, forage system and individual steers with each system.

Live weights of the randomly selected steers did not differ among years or forage system, but carcass weights were heavier in 2013 and tended to be heavier for steers finished on forage systems 2 and 3. The heavier carcasses produced higher dressing percentages in the third year and with systems 2 and 3. The ribeye muscle area was not different among years or forage systems; however, carcass fat thickness and percentage of kidney, heart and pelvic fat increased in the second and third years. The yield grades were slightly higher in the second and third years but were not different within year or among forage systems.

The percentage of boneless, closely trimmed retail cuts is predicted by yield grades, with no differences by year or type of forage system. Percentages of

ribeye muscle and the other separable lean tissue were higher and bone percentages were lower in the 9-to-11-rib sections in 2011 than for the other two years. This corresponded to the slightly lower yield grades and slightly higher percentage of retail cuts in 2011.

Marbling scores are based upon the visible intramuscular fat in the ribeye muscle at the 12th rib. Carcasses had slightly higher amounts of marbling in 2013 than in 2011 and 2012, which was expected since fat deposition was also higher in the third year. Quality grades based upon the skeletal maturity, lean color and marbling were minimally different, and most carcasses graded Standard, a grade lower than the commercial beef target of Select for retail merchandising. Several producers, however, are successfully marketing forage-finished beef in Louisiana with minimal amounts of marbling.

Although there were some differences in availability of forage mass and nutritive values among the forage systems during the grazing seasons, these did not result in large differences in carcass characteristics of the forage-finished steers. Additional studies may be justified to determine carcass characteristics of cattle finished on other forage systems.

Kenneth W. McMillin holds the Mr. & Mrs. Herman E. McFatter Endowed Professorship in Animal Science. His co-authors are Manuel A. Persica III, research associate in the School of Animal Sciences; J. Cole Gregorie, research associate at the Sweet Potato Research Station in Chase; and James N. Maynard, graduate assistant in the School of Animal Sciences.

Tenderness and Electrical Impedance of Ribeye Steaks from Steers Finished on Forage

Kenneth W. McMillin, Manuel A. Persica III, J. Cole Gregorie and James N. Maynard

The study of meat allows for the identification of animals, production systems or processing techniques that result in desired properties. Among the desired attributes of meat, tenderness is the most important palatability trait to consumers. Estimates of tenderness in laboratory settings have used Warner-Bratzler (W-B) shear force techniques to provide an objective measure of the amount of force required to cut through cooked meat samples. A more recent development for tenderness determination is the use of slice shear force, which

measures the force through a larger sample of the cooked meat. Both techniques require cooking the sample and measuring the shear force required to cut through the cooked sample.

Various methods of estimating or predicting tenderness of cooked meat based on raw meat properties have been investigated. Several studies have linked electrical values of meat to tenderness, flavor, freshness and other properties, but results vary because myofibrillar proteins that degrade and connective tissue that does not degrade have vary-

ing electrical values. One study suggested electrical impedance as the most effective means of identifying cattle carcasses that would produce tender beef. Electrical impedance is a measure of alternating electrical current that has two components or vectors – resistance and reactance – and indicates the capability of a material to oppose the flow of electric current

The objective of this study was to measure surface electrical impedance, resistance, reactance and phase distributed generation on raw beef steaks

and compare them with the W-B shear force and slice shear force of cooked beef steaks from steers finished on three different forage systems in three consecutive years. The forage systems were:

System 1 was primarily bermudagrass during summer, fall and spring and ryegrass in winter.

System 2 was bermudagrass in summer, a dallisgrass-and-clovers mix during fall and spring, and a ryegrass-clovers mix during winter.

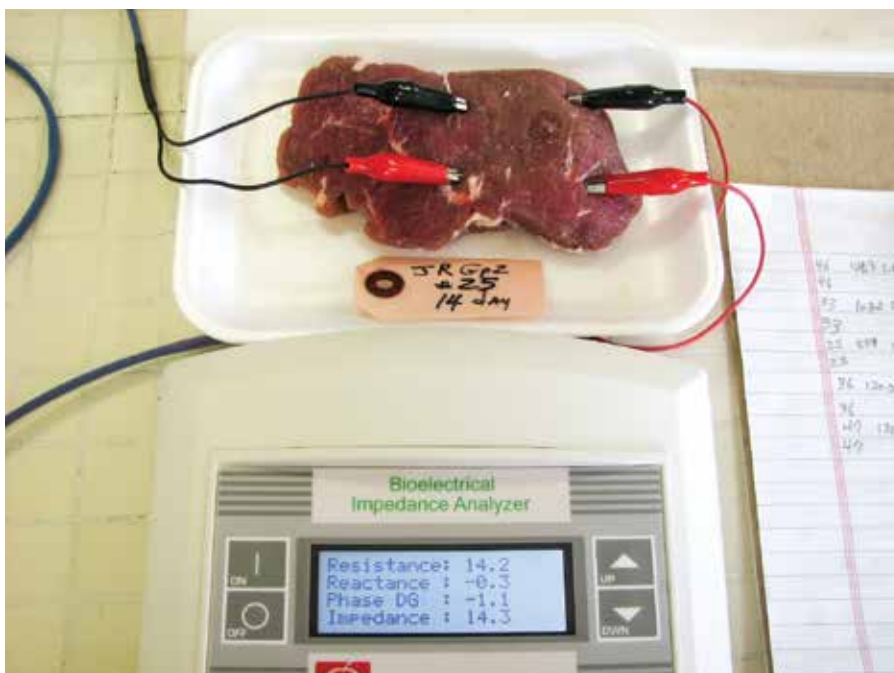
System 3 was bermudagrass and sorghum-sudangrass hybrid with forage soybeans during summer, a dallisgrass-clovers mix during fall and spring, and a ryegrass-clovers mix during winter.

Each year, six steers randomly selected from each of the three forage systems were humanely slaughtered in a Louisiana state-inspected meat plant. Carcasses were chilled in a 36-degree cooler overnight, and primal rib cuts were removed from each carcass side. A 9-to-11-rib section from one side was divided into Longissimus dorsi – ribeye muscle – other lean tissue, fat and bone while the remaining portion of that rib primal cut was cut into 1-inch-thick steaks for determination of cook yield, shear force tenderness and electrical conductivity.

Each steak was vacuum packaged, labeled and stored for seven days at 37 degrees before measuring electrical resistance, reactance, phase distributed generation and impedance with a bioelectrical impedance analyzer. After measuring electrical parameters, the steaks were weighed and then cooked on an open hearth grill to 158-degree internal temperature. After the steaks were cooled to room temperature and weighed, half-inch cores were removed for measuring W-B shear force, and 1-inch slices were removed for measuring slice shear force. Cook yields were calculated as the difference between initial weight and cooked weight.

Data were analyzed to compare differences among years, forage systems and steer groups and to determine correlations among shear and electrical variables.

Cook yield of steaks did not differ by year or forage system and ranged from



A bioelectrical impedance analyzer was used to measure electrical properties in ribeye steaks from steers finished on three forage systems. Photo by Kenneth W. McMillin

72.9 percent to 78 percent on steaks used for W-B shear and 72 percent to 79.5 percent on steaks used for slice shear force determination. There also were no differences due to year or forage system on shear forces of steaks with the W-B method or the slice shear method. Slice shear required higher force than the force to shear smaller samples with the W-B shear method, which was expected because of the larger thickness of the sample used for slice shearing. All steak samples using the W-B method were below the maximum shear force values to be labeled as “tender” under the USDA Agricultural Marketing Service certification standard, and steaks from the first two years would meet the “very tender” standard. Most steaks measured using slice shear force exceeded the maximum value for the “tender” labeling.

The reactance and phase distributed generation of steaks did not differ by year or forage system. The resistance and impedance electrical measurements were highest on steaks from the third year and lowest on steaks from the first year, but there were no differences in the electrical measurements of steaks from cattle finished on the three forage systems within each year.

The cook yields of steaks used for W-B shear and slice shear were not related. The cook yield of W-B steaks was highly negatively correlated with the W-B shear, which suggests the retention of fluids during cooking resulted in a lower force needed to shear the samples. The W-B shear force was highly related to the slice shear force, which was expected because both methods are used as objective measures of meat tenderness.

Impedance was the only electrical measurement moderately related to W-B shear force. Electrical resistance was highly related to reactance, and impedance was highly related to all three of the other electrical measurements. These results were expected because impedance is a function of resistance and reactance.

The year or type of forage system had no influence on cooking yields or objective shear force values of ribeye steaks from the three years and three forage systems. This study indicates the forage system did not influence the important palatability property of tenderness. Additional testing with more and diverse beef samples is needed to more adequately determine the relationships among electrical measurements on raw steaks with cooked beef palatability properties.

Kenneth W. McMillin holds the Mr. & Mrs. Herman E. McFatter Endowed Professorship in Animal Science. His co-authors are Manuel A. Persica III, research associate in the School of Animal Sciences; J. Cole Gregorie, research associate at the Sweet Potato Research Station in Chase; and James N. Maynard, graduate assistant in the School of Animal Sciences.

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Beef carcasses of steers finished on three different forage systems were similar in many traits.
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