

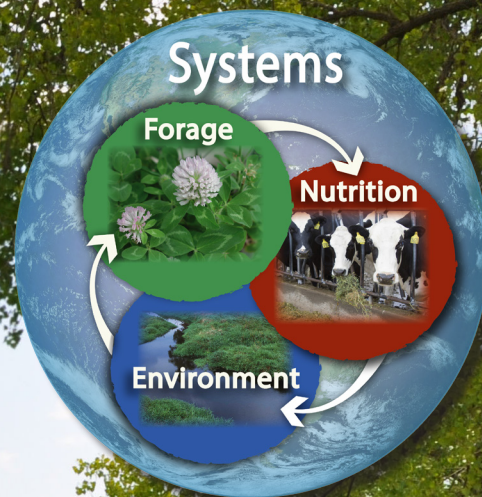


United States  
Department of  
Agriculture

# Year in Review

## U.S. Dairy Forage Research Center

FY 2016, October 2015 through September 2016



*Leading the world in integrated  
dairy forage systems research.*

U.S. Dairy Forage Research Center • Madison, Marshfield and Prairie du Sac, Wisconsin  
USDA Agricultural Research Service



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**Leading  
the world in  
integrated dairy  
forage systems  
research.**

**U.S. Dairy  
Forage  
Research  
Center**

Providing dairy industry solutions for food security, environmental sustainability, and economic viability. We build uniquely valuable, science-based research initiatives focused on improving dairy production systems, soil ecology, forage production, forage quality, nutrient management, and ecosystem services.

**Visit the USDFRC Web Site:**

**[www.ars.usda.gov/mwa/madison/dfrc](http://www.ars.usda.gov/mwa/madison/dfrc)**

# Research Accomplishments

The following summaries of research were taken from the 'accomplishments' section of the AD-421 annual reports that the researchers write for each of the five CRIS (Current Research Information System) projects in FY 2016.

**IMPROVING  
FEED  
EFFICIENCY  
OF FORAGES**



Forage characteristics that alter feed utilization, manure characteristics and environmental impacts of dairy production.

## **Substitutions of corn silage, alfalfa silage, and corn grain in cow rations impact nitrogen use and loss from dairy farms.**

USDFRC researchers used whole-farm computer simulations and field experiments to show that growing more corn silage and less alfalfa silage reduces the land requirement for feed production up to 27%, maintains milk production, increases whole-herd nitrogen use efficiency (from 20 to 25%), and decreases manure nitrogen excretion by 22%. Growing more corn silage however, requires more fertilizer nitrogen (46 lbs N/acre) and increases nitrogen losses from the field. Feeding more corn grain does not impact milk production or animal nitrogen use efficiency, but requires up to 40% more corn grain land area and more fertilizer nitrogen (18 lbs N/acre), and increases nitrate leaching.

When manure was applied to the land, the subsequent crop was able to take up more nitrogen from the manure produced by cows fed alfalfa silage or corn grain compared to the cows being fed corn silage. This information shows that trade-offs in nitrogen use and loss need to be more fully considered by producers, consultants and policy makers when considering more corn silage and corn grain in dairy cow rations.

J. MARK POWELL

## **Dairy heifer feeding habits are characterized to better optimize heifer growth, development.**

Dairy heifers often gain too much weight and are too large and over-conditioned at breeding or calving. Dairy producers typically control this problem by diluting diets with low-energy forages like straw and/or by limiting consumption of feed.

With detailed observations of dairy heifer feeding habits, USDFRC researchers found that eastern gamagrass, wheat straw, or corn fodder can all be used effectively as dilutants to reduce the amount of energy in typical diets; in this trial, heifers did not sort out the gamagrass, but did sort out the straw and especially corn fodder. However, heifers consumed the straw and corn fodder even though they sorted it out because all diets were offered for a minimal amount of refusal after a 24-hour period; this requires a higher level of feeding management, but is consistent with recommendations for including dilutants in blended diets.

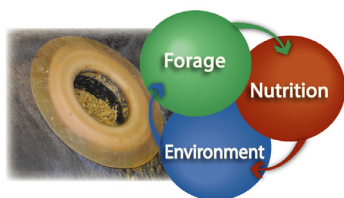
With this management approach, sorting did not significantly affect growth performance, and dilution with straw was most effective in maintaining heifer weights in the recommended range. Dairy producers and nutritionists can use this information when looking for options to prevent excessive heifer weight gains, and can overcome sorting behaviors with good feeding management.

WAYNE COBLENTZ



Study shows that sorting of high-fiber energy dilutants such as wheat straw in heifer diets can be overcome with proper management.

## UNDERSTANDING RUMEN INTERACTIONS

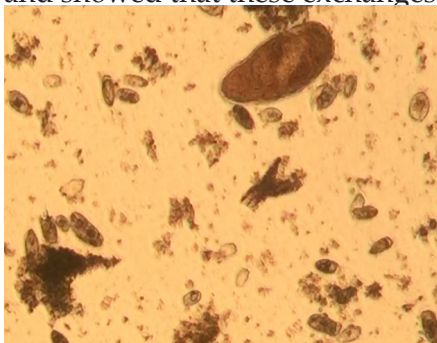


Determining influence of microbial, feed, and animal factors on efficiency of nutrient utilization and performance in lactating cows.

### Rumen microbial community changes milk production efficiency.

The efficiency of conversion of feed to milk (production efficiency) is a major factor affecting how the U.S. dairy industry impacts the environment, economics, and food supply of the country. Dairy cows vary in milk production efficiency, but only part of the variation among cows is explained by cow genetics. Dairy cows also have different communities of microbes in their rumens.

In an effort to determine how these differences affect production efficiency, USDARC researchers performed near-total exchange of rumen contents between high- and low-efficiency cows, and showed that these exchanges respectively decreased or increased milk production efficiency of each cow for about 7 days before returning to their previous levels. Experiments with collaborators at the University of Wisconsin showed that, after the rumen digesta exchange, the species composition of the rumen bacterial community gradually returned to a composition similar to the original unique profile of each host cow.



Bacteria and protozoa in a cow's rumen fluid.

The results directly implicate the rumen bacterial community as determinants of milk production efficiency. Improvement of milk production efficiency with its concomitant decrease in environmental impact and improvement in farm return over feed costs may be possible if the natural resistance of change in rumen microbial community can be overcome.

PAUL WEIMER

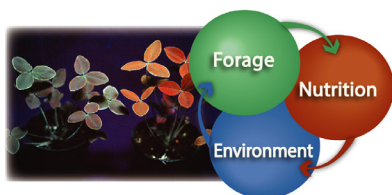
### Rumen microbes identified as a cause of milk fat depression in dairy cows.

Milk fat depression is a costly problem for dairy producers because fat reduction decreases the price producers are paid for their milk. Known mechanisms of milk fat depression suggest a role for rumen microorganisms, but a specific causative agent had not been identified. USDARC researchers dosed cows with strains of a bacterial species (*Megasphaera elsdenii*) along with a supplemental energy source for this organism, to examine its effects on milk fat levels. Individual cows varied greatly in their fat production response, but there was a consistent relationship between milk fat levels and the rumen population density of *M. elsdenii*. The data suggest that control of this bacterium in the rumen may provide a route to preventing or overcoming milk fat depression. The ability to remedy milk fat depression in dairy herds will improve farm income.

PAUL WEIMER



## BASIC FORAGE RESEARCH



Removing limitations to the efficient utilization of alfalfa and other forages in dairy production, new bioproducts, and bioenergy.

### Major advance in long-term research to improve protein utilization of alfalfa.

USDFRC researchers have shown that an enzyme called polyphenol oxidase (PPO) and an abundance of its substrate, special chemicals called o-diphenols, prevent protein degradation in forage crops preserved by ensiling. This system of protein protection is naturally present in red clover, but not in alfalfa, the most widely used forage crop in the U.S.

USDFRC researchers are conducting basic, long-term research in order to genetically transfer this PPO/o-diphenol system into alfalfa. If successful, it is estimated that the improved protein/nitrogen utilization would save farmers more than \$100 million annually through fewer purchases of supplemental protein. In addition, substantially less nitrogen waste from ruminant animal systems would end up in the environment.

The researchers previously transferred a gene for the PPO enzyme to alfalfa. More recently they identified the gene that is responsible for the accumulation of phasic acid, one of the major o-diphenols found in red clover, and have successfully inserted this gene into alfalfa. The modified alfalfa produces sufficient phasic acid to work with the PPO and reduce post-harvest protein breakdown in laboratory experiments. This accomplishment shows the PPO/o-diphenol system should be able to be reconstituted in alfalfa and ultimately improve the economic and environmental sustainability on dairy farms.

MICHAEL SULLIVAN, RON HATFIELD

### First-of-its-kind searchable condensed tannin database created to aid researchers.

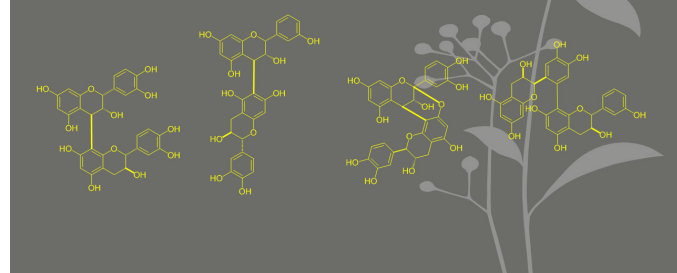
Condensed tannins are natural protein-binding substances present in some forage species; they have been found to protect forage protein from degradation during silage fermentation and rumen digestion. One research goal is to decipher what chemical characteristics and concentrations of con-

densed tannins are optimal for improving protein utilization and milk production of dairy cattle.

To this end, USDFRC researchers have created a database, based on data from the scientific literature, which allows scientists to search for information about condensed tannins by structure, molecular formula, and more. Citations for all literature references used in this database are also provided. The database will be available, free of charge, from the USDFRC website in the near future. This database is a valuable resource for scientists around the world working in the growing field of condensed tannin research.

WAYNE ZELLER

### U.S. Dairy Forage Research Center (DFRC) Condensed Tannin NMR Database



An NMR database compiled at USDFRC will help all scientists working with condensed tannins.

### Discovery allows for more targeted research on the effects of condensed tannins.

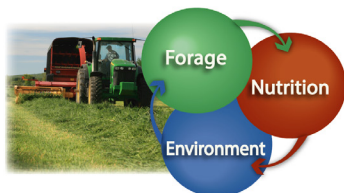
Condensed tannins (CTs) are found in many forage species and appear to affect protein utilization in dairy animals. However, this effect is not well understood and is likely to be highly dependent on the specific CT building blocks and the bonds that hold them together.

USDFRC researchers have demonstrated that some bonds making up a given CT can be easily changed in the laboratory. This discovery will allow generation of well-defined, targeted CTs that will be extremely useful in the study of the positive and negative effects of CTs on protein binding and utilization in stored forages and during rumen fermentation, which subsequently will lead to a better understanding of the changes that may occur naturally during storage and how this impacts animal response. Knowing what changes have occurred ahead of time will help remove questions of why animal responses may differ from one feeding trial to the next.

WAYNE ZELLER

## REDESIGNING FORAGES AND FORAGE SYSTEMS

Redesigning forage genetics, management and harvesting for efficiency, profit, and sustainability in dairy and bioenergy production systems.



### Wrapping silage bales within 24 hours improves forage quality and economic sustainability.

Many small or mid-sized dairy farms prefer to produce round silage bales for alfalfa storage and feeding instead of dry hay. However, research is needed on improved procedures for wrapping silage bales with enhanced feed quality.

USDFRC researchers found that: 1) a prototype bale wrap with an oxygen-limiting barrier did not improve feed quality of bales compared to the same commercially available wrap without the barrier;



2) the energy content of baled silage decreased by about 5% as the time between harvest and wrapping increased from 4 hours to 3 days; and 3) internal bale temperatures were elevated

Silage bales should be wrapped within 24 hours of baling to reduce internal heating and improve silage quality.

when wrapping was delayed, resulting in poorer feed quality of the silages. This information will encourage forage growers to wrap silage bales within 24 hours and therefore produce better quality silage that is more economically sustainable.

WAYNE COBLENTZ

### Fall oats improve sustainability of dairy production.

Dairy producers in the north-central U.S. often need stored forages to maintain livestock through the winter. Fall-grown oat is an excellent candidate because it has good yield potential as a late-season crop, provides an opportunity during summer to spread manure, and aggressively uses nitrogen in the soil to help reduce loss to the environment. Fall oats can also be used for managed grazing. However, research is needed to determine soil fertility requirements and management for oats as stored feed, and to determine grazing management for optimum cow performance.

USDFRC researchers found that using nitrogen fertilizers increased oat yields for stored feed by 50% or more, that dairy manure applied in summer provided adequate nitrogen, and that oats aggressively take up nitrogen in soil. It was further determined that, for heifers in central Wisconsin, grazing of oats established in August should begin in late September; delaying grazing until mid-October consistently decreased heifer growth, particularly if rapidly maturing oat types were used. This improved fall-oat management information provides dairy producers with additional options to produce quality animal feed, stored or grazed; and to reduce the environmental risk of nitrogen leaching to groundwater.

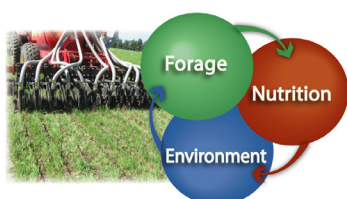
WAYNE COBLENTZ



Research helps producers improve management of fall-grown oat.



## MANAGING MANURE NUTRIENTS



Improving nutrient use efficiency and mitigating nutrient and pathogen losses from dairy production systems.

### Health risk from dairy manure irrigation is quantified for the first time.

Applying liquid dairy manure to fields through spray irrigation can reduce manure-hauling costs and increase flexibility for application times during a growing season. However, there is a concern that pathogens in the manure might be transported downwind, potentially causing illness in people and livestock.

USDFRC researchers at Marshfield found that manure microorganisms in air decreased with distance downwind from an irrigated site, but could still be detected 700 feet away. However, the risk for acute gastrointestinal illness was determined to be minimal, with exposure 500 feet downwind in the range of 1 in 10,000 to 1 in 100 per irrigation event, which is the same as deemed acceptable for drinking municipal water or swimming at a beach.



The study is the first to use measured concentrations of airborne pathogens during manure irrigation to estimate human health risk from spray irrigation, and it will be used by policymakers and public health officials to establish safe setback distances.

MARK BORCHARDT, TUCKER BURCH

### Simulation shows which strategies are most effective at reducing P runoff from farm fields.

Loss of phosphorus from farm fields pollutes local waters, and spreading dairy manure in winter or just before large storms may significantly increase the risk of phosphorus loss. USDFRC researchers used the SurPhos computer model (developed at

the Center) and 108 site years of runoff data to compare how much P loss could be reduced by avoiding manure spreading on frozen ground or before storms.

This analysis showed that when manure is spread on frozen ground, phosphorus loss was 3-7 times less when the manure was applied to low runoff fields instead of high runoff fields. Additionally, spreading manure outside of winter reduced phosphorus loss by 3-4 times compared to winter spreading. In contrast, delaying manure application when runoff was likely due to forecasted precipitation reduced phosphorus loss by only 6-14%.

Therefore, spreading manure on low runoff fields or outside the winter period is a much more effective strategy to reduce phosphorus loss than trying to time manure applications around precipitation events. This study helps producers and policy makers determine when and where it is best to spread manure to minimize environmental phosphorus loss.

PETER VADAS

### Phosphorus model improves restoration efforts for the Chesapeake Bay.

Water quality restoration efforts for the Chesapeake Bay are focused on reducing phosphorus loss from farm fields. The Chesapeake Bay Watershed Model has been used for two decades to simulate hydrology and phosphorus loss and set policy goals, but how the model simulates phosphorus loss from fields is limited.

USDFRC researchers, in collaboration with the University of Maryland, used the Annual Phosphorus Loss Estimator (APLE) computer model, developed at the USDFRC, for field phosphorus loss as an alternative to the Bay Model, and found that APLE improved Bay Model prediction performance at 75% of river monitoring stations. Incorporating APLE into the Bay Model will improve its ability to assess phosphorus loss and the impact of farm field management on Chesapeake Bay water quality.

PETER VADAS

### Measuring gas emissions from experimental dairy barnyards.

The manure deposited in dairy barnyards is often not collected. This manure accumulation can be a large source of nutrient loss including greenhouse gas emissions. To quantify the extent of

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these emissions under different farm management scenarios, USDFRC researchers measured fluxes of carbon dioxide, methane, nitrous oxide, and ammonia from experimental barnyards over four years. When looking at gas emissions alone, the research showed that barnyards having bark surfaces had the most gas emissions, especially after bark replenishment and after cattle corralling in barnyards, followed by sand and soil surfaces. However, trade-offs between gas emissions, manure nutrient runoff and leaching, and cow comfort must be more fully assessed before recommending overall beneficial practices for barnyard construction and management.

J. MARK POWELL and PETER VADAS

### **Study determines that Hepatitis E virus from swine is common in Iowa surface water.**

The gastrointestinal Hepatitis E virus (HEV) is common in swine herds, has been detected in swine manure lagoons, and can be transmitted between people, swine, and wildlife such as deer. There is a need to know how HEV moves from farms and survives in the environment.

USDFRC researchers at Marshfield found that 45% of water samples from the South Fork Iowa River basin in Iowa were positive for HEV, and that HEV occurrence increased from 20% of samples before manure application to 80% of samples after application. Swine manure samples from two farms and deer fecal samples in the basin were all positive for HEV; and HEV in river water, swine manure, and deer feces were genetically identical. This research establishes a basis to improve assessment of pathogen health risks for people and livestock in the region.

MARK BORCHARDT

### **Detection Limits are established for waterborne pathogens.**

Scientists commonly use a genetic method called qPCR to detect pathogenic microorganisms in environmental water samples. However, Detection Limits (the concentration where 95% of the time a sample that does have a pathogen will not be incorrectly reported as negative) are not reported.

USDFRC researchers at Marshfield developed an efficient approach to determine 95% Limits, and they found those Limits were 1.3 gene copies per liter for Salmonella, 1.5 for adenovirus, and 4.0 for

enterovirus. This new Detection Limits approach gives scientists a critical tool for comparing methods, designing effective studies, and helping data interpretation.

MARK BORCHARDT, TUCKER BURCH

### **Health risks from pathogens confirmed for Great Lakes beaches.**

People who swim in lakes and rivers polluted by human or livestock wastewater can become sick. Guidelines for when a beach should be closed rely on testing for indicator bacteria that are not pathogenic but only indicate that water could be contaminated. USDFRC researchers at Marshfield found that actual pathogens were present in almost all water samples from three Lake Michigan beaches, with most pathogens from human wastewater.

By accounting for environmental factors and swimming behaviors, researchers determined the risk of becoming ill even with pathogens present was less than 3 chances in 100,000. This risk level is consistent with ones that rely on indicator bacteria, which confirms that current guidelines can help prevent swimmer illness.

MARK BORCHARDT, TUCKER BURCH

### **First report of Avian influenza virus in groundwater.**

During the 2015 outbreak of avian influenza virus (HPAI) on Midwest poultry farms, heavy spring rains and manure spreading created conditions where groundwater was polluted in some areas. However, it was not known if HPAI could spread through groundwater.

USDFRC researchers at Marshfield sampled 20 wells on 13 outbreak-affected poultry farms in Iowa and Wisconsin and found that 3 wells were positive for a gene indicating influenza A virus. One well was also positive for a gene unique to the HPAI outbreak strain. Seven wells were positive for a parvovirus unique to poultry, which demonstrated a link between contaminated manure and groundwater.

This was the first report of avian influenza virus in groundwater, and shows groundwater could be an overlooked route for transmission. This work will help policymakers and public officials establish practices for safe water supplies on poultry operations.

MARK BORCHARDT



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# Staff Changes in FY 2015

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## October, 2015

**Anthony Johnson** joined the USDFRC staff as a Biological Science Lab Technician in Michael Casler's lab. A native of Sheboygan Falls, WI, Tony received a B.S. in Biological Sciences from UW-Milwaukee in 2011, and an M.S. in Natural Resources from Cornell University in 2015. Previously he worked as an ecological restoration technician at Applied Ecological Services, and he had an internship with the Bureau of Land Management.



Johnson

## January 2016

**Rick Walgenbach**, Management Agronomist and Farm Manager at the Prairie du Sac farm, has retired after 34 years of service with the USDFRC – 8 as a Research Agronomist and 26 as the Farm Manager. In his 26 years at the farm, Rick is most proud of his efforts to improve the land. He converted almost all of the land to no-till and conservation tillage for improved soil conservation and labor efficiency. He implemented a nutrient management plan for the farm. And he began the process of planting winter wheat in fields after they have been harvested for corn silage or soybeans to provide a cover crop during the winter months.



Walgenbach

**Tucker Burch** was hired as a Research Agricultural Engineer at the Marshfield location. Previously he had been working in the Marshfield lab as a Research Hydrologist with the U.S. Geological Survey, heading a project to investigate the human health risk of spray-irrigating dairy manure in Wisconsin. As an ARS employee he will continue to research manure management, including microbiological issues related to manure and reducing costs/optimizing the value of manure. Tucker received his BS in Civil Engineering from Marquette University in 2009, and a PhD (also Civil Engineering) from the University of Minnesota in 2013. He is a native of Marshfield; in fact, he grew up on a farm adjacent to the Marshfield lab!



Burch

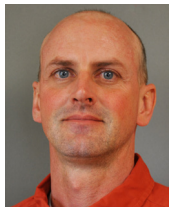
## February 2016

**Geoffrey Brink**, a Research Agronomist at the Center since 2002, was named Research Leader of the Dairy Forage Research Unit. He replaced the retired Richard Muck as the RL for that unit. As RL, he will supervise six scientists in addition to conducting his own research which focuses on improving the productivity, utilization, and quality of temperate grass pastures with emphasis on grazing-based dairy systems.



Brink

**Michael Stanek** began his duties as the new Management Agronomist/Farm Manager at the Prairie du Sac farm. Mike is a native of Wisconsin with a BS in Resource Management and an MS in Agriculture. He previously worked as a Sauk County soil and resource conservationist; a Dodge County soils and crops Extension agent; and an independent agronomy consultant. Mike is looking forward to using his skills in precision agricultural systems and technologies at the USDFRC farm.



Stanek

Also in February, **Gary Flock** began his duties as a Mechanic at the Prairie du Sac farm. A native of Cashton, WI, he has mechanical experience with agricultural equipment, heavy equipment, and over-the-road fleet vehicles. For the previous 14 years he worked for the Army at Fort McCoy, WI, as a heavy equipment mechanic and forklift operator.



Flock

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## April 2016

Soil Scientist **Bill Jokela** retired from the Environmentally Integrated Dairy Management Research Unit in Marshfield. Bill came to USDA-ARS in September 2005, and he pioneered the paired watershed technique for assessing runoff following the harvest of corn silage. At the time of his retirement, he was conducting a similar experiment with alfalfa/grass mixtures. Bill spent much of his career evaluating different techniques for dairy manure application, with the goals of reducing the associated environmental burdens, maintaining crop productivity, and facilitating technology transfer to dairy producers. Prior to working for USDA-ARS, Bill enjoyed a long and productive career in research and Extension with the University of Vermont.



Jokela

Also retiring in April was **Chris Odt**, a Biological Science Lab Technician in Paul Weimer's lab for 27 years. Chris was a major contributor to the microbiology of ruminal fiber digestion; development of continuous culture systems for rumen bacteria; and characterizing the bacterial species composition of the rumen and its effect on the production of milk and milk fat. For several years, Chris organized the popular Science Day for Kids outreach event which brought 4th grade students from a Madison elementary school to the USDFRC to learn about science. Chris is also an accomplished artist working in pottery and fiber arts.



Odt

## June 2016

After 2-1/2 years of service, **Tony Sternweiss** left his job as a Biological Science Lab Technician for Bill Jokela at the Marshfield location. He returned to work at his family dairy farm near Marshfield.



Sternweiss

## August 2016

Animal Geneticist **Wenli Li** joined the USDFRC in August. Her research program will be based on applying a high-throughput sequencing-based strategy to identify genetic/genomic determinants of dairy feed efficiency and production. Wenli grew up in southwestern China where she earned a BA in Biology. She came to the U.S. to pursue her graduate training and obtained an MS degree in Plant Developmental Biology at the University of Georgia. Driven by the interest in deciphering the interplay between genotype and phenotype diversification, she decided to pursue a PhD in Population Genomics at Indiana University-Bloomington. Before joining the USDFRC, Wenli was a Kern Innovation Fellow and American Heart Association Fellow at the Medical College of Wisconsin with her research focusing on medical genomics.



Li

Also starting in August was **Kristan Reed**, a post-doctoral scholar for the Dairy Agroecosystem Work Group's Reactive Nitrogen Initiative. She is working with the Integrated Farm Systems Model to identify potential avenues for reducing nitrogen losses in dairy systems and to improve estimates of nitrogen flows within the model. Kristan grew up in St. Croix, U.S. Virgin Islands, received a BS in Animal Science from Cornell University in 2007, and received a PhD in Animal Biology from the University of California, Davis, in 2016. She became interested in ruminant nutrition during a semester abroad in Madagascar studying herding practices in the southwestern part of the country.



Reed

**Ron Skoyen**, Dairy Herd Manager (UW employee) at the Prairie du Sac research farm, resigned to take a position as a Dairy Farm Co-Manager at Iowa State University. Ron joined the farm staff as an Ag Supervisor in 2007, and he was promoted to Herd Manager in 2012.



Skoyen



# Technology Transfer in FY 2016

Each year the Agricultural Research Service compiles a list of technology transfer activities – ways that ARS research and technology is being transferred to and used by the public. These are the activities that were reported by the U.S. Dairy Forage Research Center.

## Research Results Being Implemented

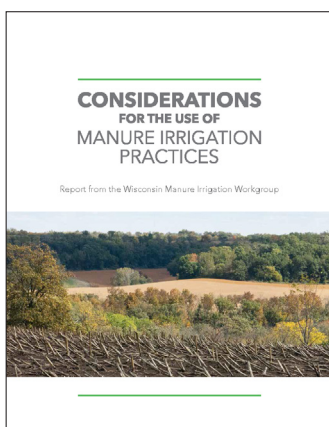
The Chesapeake Bay Watershed Model has been used for two decades to simulate hydrology and phosphorus loss and set policy goals, but the versatility of how the model simulates phosphorus loss from fields is limited. **Peter Vadas**, in collaboration with the University of Maryland, used the Annual Phosphorus Loss Estimator (APLE) computer model developed at the Center for field phosphorus loss as an alternative to the Bay Model. They found that APLE improved Bay Model prediction performance at 75% of river monitoring stations. Incorporating APLE into the Bay Model will improve its ability to assess phosphorus loss and the impact of farm field management on Chesapeake Bay water quality.

On June 10, a variety of meadow fescue that was developed by **Michael Casler** at the USDFRC, “Azov,” was released to the public. Azov meadow fescue has been tested in Wisconsin and New York and found to be well adapted to forage production in both regions. It has high yield compared to other meadow fescue varieties and comparable forage quality.

For the past four years, **Mark Borchardt** has been serving on the Wisconsin Manure Irrigation Workgroup with collaborators from the Wisconsin DNR, the Wisconsin Department of Health Services, the University of Wisconsin, dairy producers, agronomists, and county health officials. Borchardt and Engineer

**Tucker Burch** conducted a study to understand the human health risks associated with manure irrigation. At the foundation of this study was an extensive, largest of its kind, field sampling for airborne microorganisms during 23 manure irrigation events.

When the workgroup’s report was released in April 2016, Borchardt participated in a series of webinars



Report on manure irrigation.

and presentations across the state. He and Burch authored “Airborne Pathogens from Dairy Manure Aerial Irrigation and the Human Health Risk” as both a scientific report and a fact sheet intended for a general audience. The scientific paper describing the study is currently in review.

## Training, Advising

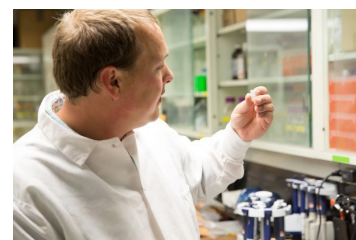
On June 8, **Mary Beth Hall** conducted a training webinar, “An Update on ‘Sugars’ in Dairy Cattle Nutrition,” for 12 dairy nutritionists as a part of their Minnesota and Dakotas Vita Plus training meeting. The update was designed to give these nutritionists, who work directly with dairy farmers, the latest information from ARS and other research that would give them ideas on how to better work with sugars in diet formulation to get the desired production performance from dairy cows.

In June, **Tucker Burch** was asked to submit materials about his research for an ARS handout given to members of the Presidential Advisory Council on Science and Technology who held a meeting in late June specifically focused on the environmental dimensions of antibiotic resistance.

On June 20-21, **Geoffrey Brink** represented US-DA-ARS at the American Forage & Grassland Council Board of Directors meeting. Brink is chair of the Research Committee which is proposing an industry-led effort to develop a forage maturity index for temperate grasses.

During the summer, **Paul Weimer** trained a PhD student from the University of Nevada-Reno in methods of DNA isolation, 16S amplicon generation, DNA library preparation, and Illumina sequencing.

Also during the summer, **Michael Casler** hosted a student intern from the Madison Area Technical College as part of the Research Experience for Undergraduates program funded by the Great Lakes Bioenergy Research Center at the University of Wisconsin-Madison. The



Summer intern from Madison Area Technical College.

student helped collect 30,000 switchgrass samples from the field, extract DNA from them, and analyze them for winter hardiness.

Casler also hosted a high school science teacher who was participating in the Research Experience for Teachers program funded by the Great Lakes Bioenergy Research Center and the Wisconsin Energy Institute at the University of Wisconsin-Madison.

The teacher's research project was to analyze genetic data from cross-bred switchgrass plants in an effort to determine which genes are associated with delayed flowering time.



High school teacher learns about genetics during summer internship.

During the year, **Mark Borchardt** advised the following people on issues related to groundwater quality: Cathy Stepp, Secretary, Wisconsin DNR; Reid Ribble, Wisconsin 8th District U.S. Representative; Lori Miller, Senior Staff Officer, USDA APHIS; the Peninsula Pride Dairy Farmers Association; and approximately 40 homeowners with private wells that are pathogen-contaminated in Kewaunee County, WI.

## Presentations

On October 30 to November 1, 2015, **Paul Weimer** traveled to Vicos, Brazil to give a presentation, "Relationship between feed efficiency of dairy cows and their ruminal environment: New advances in the knowledge of microbiology," to about 250 students, university faculty, government researchers and dairy producers at the 5th National Symposium on Dairy Cattle and the 2nd International Symposium on Dairy Cattle.

On November 6 and 7, **Paul Weimer** traveled to Cuiaba, Brazil to give a presentation, "Ruminal microbiology applied to nutrition and health of dairy cows," to about 220 students and university faculty at the 1st Brazilian Rumen Microbiology Symposium. Weimer also met with students and faculty at the Federal University of Mato Grosso on November 3 and 4.

At the annual meeting of the American Society of Agronomy/Crop Science Society of America/Soil Science Society of America in Minneapolis, MN, USDFRC scientists helped organize and spoke at a symposium, "The value of condensed tannins in forages," on November 17. **Wayne Zeller** presented

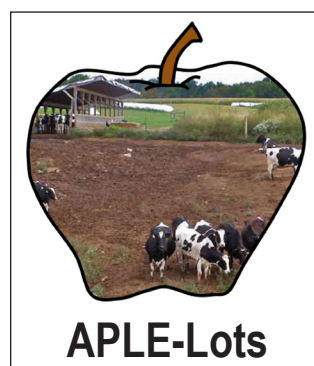
"Activity, purification, and analysis of condensed tannins;" **J. Mark Powell** presented "Effects of forage polyphenols on chemistry of ruminant excreta and fate of nitrogen in the environment;" and **John Grabber** presented, "Can forage tannins reliably improve protein and nitrogen utilization on confinement dairy farms?" There were about 40 researchers in attendance.



Also at the Tri-Societies meeting, **Bill Jokela** gave a presentation, "Effects of low-disturbance manure application methods on N<sub>2</sub>O and NH<sub>3</sub> emissions in a silage corn-rye cover crop system," to about 50 people on November 16. And **Geoffrey Brink** presented "Grass-legume mixture response to nitrogen source and application date" to about 30 people on November 18.

On January 7, 2016, **Paul Weimer** presented "Ruminal content exchange effects on bacterial community composition and subsequent ruminal introductions of *Megasphaera elsdenii*" to about 20 students and faculty, including visitors from China Agricultural University, at a UW Animal Science Department Seminar.

On January 12, **Geoffrey Brink** gave a talk, "Performance and economics of rearing dairy heifers on pasture vs confinement" to 60 forage producers and industry reps at the American Forage and Grasslands Council meeting in Baton Rouge, LA.



On January 13, **Peter Vadas** gave a talk on APLE-Lots, the new computer model he developed to estimate erosion and phosphorus loss from barnyards, to about 100 producers, crop consultants and custom operators at the Wisconsin Crops Management Conference in Madison, WI.

And **Bill Jokela** presented "Manure on perennial forages: Benefits and challenges" at the same meeting.



On January 15, **J. Mark Powell** presented “Feed-cows-manure-environmental linkages in dairy production systems” to approximately 40 faculty and students at the WK Kellogg Biological Station, Michigan State University, Hickory Corners, MI.

On January 22, **Paul Weimer** presented “*Megasphaera elsdenii* and milk fat depression: A ‘good bug’ gone bad?” as a webinar recorded for FattyAcidForum.com, a stakeholder group interested in lipid metabolism in livestock animals. The webinar is available for viewing to over 100 members of the forum.

On January 26, **Wayne Coblentz** presented “Double cropping options to stretch forage yields” to 125 dairy and forage producers, custom harvesters, and manure applicators at a symposium hosted by the Wisconsin Custom Operators, the Professional Nutrient Applicators Association of Wisconsin, and the Midwest Forage Association at Wisconsin Dells, WI.

On February 2, 3 and 4, **Wayne Coblentz** was the keynote speaker at three Midwest Forage Association Winter Forage Meetings, in Floodwood, Albany and Rochester, MN. His presentations, “Double cropping options to stretch your forage yield” and “Dairy slurry application on alfalfa,” were given to a total of 240 dairy and forage producers.

On February 5, **Tucker Burch** presented “Microbial risk assessment for dairy manure irrigation” to about 30 students and members of the public at the UW-Green Bay Natural and Applied Science Seminar. He gave the same presentation on March 2 to about 50 producers at the UW-Extension Central Wisconsin Processing Crops meeting and on March 3 to policy makers and natural resource managers at the Wisconsin Land + Water Conference.

On February 10, **J. Mark Powell** presented the seminar, “Dairy manure impacts on Wisconsin’s soils, air, and water: Reflection on 20 years of research,” to approximately 60 scientists, Extension educators, students and policy makers at the Department of Soil Science, University of Wisconsin-Madison.

The week of February 14, **J. Mark Powell** traveled to Melbourne, Australia to present “Gas emissions from dairy barnyards” to approximately 300 producers, scientists, Extension educators, students,

and policy makers at the 6th Greenhouse Gas and Animal Agriculture Conference. At the end of the conference, he also reported on U.S. research related to mitigating greenhouse gases from livestock at the annual meeting of the Global Research Alliance (GRA) on Agricultural Greenhouse Gases. Dr. Powell is the US Representative to the GRA-The Livestock Research Group.

On February 18 and 19, **Mary Beth Hall** gave two presentations, “Right-quality vs. high-quality forages” and “Protein and carbohydrate interactions in rumen fermentations,” to about 100 dairy producers, industry reps, university faculty and students at the 2016 Virginia Tech Nutrition Cow College in Roanoke, VA.

On February 25, **Peter Vadas** spoke to about 40 people via a webinar hosted by the University of Maryland Cooperative Extension. He gave an overview of the Annual Phosphorus Loss Estimator (APLE), a computer model that he developed to help reduce the amount of phosphorus in runoff from agricultural fields and farmsteads.

On February 26, **Geoffrey Brink** gave a presentation, “Organic dairy nutrition with grazing,” to 105 producers at the Midwest Organic and Sustainable Education Service Conference in LaCrosse, WI.

During the week of March 7-11, **Wayne Coblentz** gave a presentation, “Key components to making baleage,” to 150 dairy/forage producers, industry reps and Extension educators at five separate sessions of the Virginia Tech Area Dairy Conferences at five different communities in Virginia.

On March 9, 2016, **Heathcliffe Riday** gave a presentation, “Red clover breeding,” to about 10 students and university faculty at the UW Agronomy Colloquium Spring 2016 in Madison, WI.

On March 15, **J. Mark Powell** presented “Nutrient cycles in mixed crop-livestock production systems” to approximately 35 faculty and students in the Department of Agronomy, University of Wisconsin-Madison.

On March 18, **J. Mark Powell** gave a seminar, “Agricultural greenhouse gas mitigation: Global initiatives and measurement from dairy production systems,” to approximately 15 students and faculty at the Nelson Institute Center for Climatic Research, University of Wisconsin-Madison.



Gas emissions from dairy barnyards are being studied at the USDFRC research farm.

On March 16, **Heathcliffe Riday** gave a presentation, "New traits and improvements in old traits in forage legumes," to about 100 producers, researchers, Extension educators, and NRCS personnel at the Northeast Pasture Consortium Annual Meeting in Freeport, ME.

On March 17, **Geoffrey Brink** gave a presentation, "Management practices to improve pasture productivity and quality," to 167 producers at the Heart of Wisconsin Grazing Conference in Wausau, WI.

On March 30-31, **Mary Beth Hall** gave two presentations, "Making or breaking rations with forage digestibility" and "On-farm evaluation of manure," to about 150 dairy producers at the Dairy Focus 2016 meeting in Halifax, Canada.

On March 31, **Paul Weimer** presented a lecture, "The ruminant-microbe symbiosis," to 15 students in a graduate-level class (Microbial Symbioses) in the Department of Bacteriology at the University of Wisconsin-Madison.

On May 2 and 3, **Geoffrey Zanton** presented "Protein and amino acid nutrition" to about 400 researchers, educators, students, and industry professionals at the American Dairy Science Association's Large Herd Dairy Management Conference in Oak Brook, IL.

On May 12, **John Grabber** gave a presentation, "Update on interseeding alfalfa into corn as a dual-purpose cover and forage crop," to about 75 forage researchers, Extension educators, and seed production and sales people at the Industry Extension Forage Advisory Council meeting in LaCrosse, WI.

On May 18, **Paul Grabowski** presented "Genome-wide associations with flowering time in switchgrass," to 15 researchers at the Great Lakes Bioenergy Research Center Annual Meeting in Lake Geneva, WI.

On May 20, **Paul Weimer** presented "Dynamics of the ruminal microbiome and its relationship to dairy production" to a group of 10 scientists at the University of Nevada-Reno.

On June 15-16, **Michael Sullivan** presented a poster, "A reverse genetics approach to elucidating

substrate specificity of a hydroxycinnamoyl-CoA hydroxycinnamoyl transferase using transgenic alfalfa," at the Gordon Research Conference on Plant Molecular Biology in Holderness, NH.

On June 22, **Mary Beth Hall**, gave a presentation, "NDFD and Sugars," to 165 field dairy nutritionists and specialists at the 2016 Purina Dairy Production Consultant Conference in Wisconsin Dells, WI.

On June 15 and 16, **Wayne Coblenz** presented, "Heifer stocking density and performance," to 65 Extension educators, industry reps, and producers at the Four-State Dairy Nutrition and Management Conference in Dubuque, IA.

On July 13, four USDFRC scientists gave presentations to about 120 scientists and educators at the North American Alfalfa Improvement Consortium annual meeting in Madison, WI. **Mark Boggess** presented "USDA-ARS Dairy Forage Research Center Update;" **Michael Casler** presented "Use and breeding of forage grasses in north central USA;" **Heathcliffe Riday** presented "Rate of forage yield breeding gains in a red clover breeding program;" and **John Grabber** presented "Alfalfa varieties differ markedly in seedling survival when interseeded into corn and treated with prohexadione-calcium."

On July 21, **Paul Weimer** presented "Ruminal dosing with *Megasphaera elsdenii* and strain persistence are associated with milk fat depression in Holstein cows" to about 100 researchers, Extension educators and students at the Joint Annual Meeting of the American Dairy Science Association and American Society of Animal Scientists at Salt Lake City, UT.

At the same meeting, **Mary Beth Hall** presented "Analysis methods differ in recovery of microbial glycogen" and "Utilization of lactose by mixed ruminal microbes is affected by nitrogen type and level, and differs from utilization of glucose," to about 100 researchers, Extension educators and students.

Additionally, 9 USDFRC scientists were primary or secondary authors for 15 poster presentations at the Joint Annual Meeting.



Research on management practices improves pasture productivity and quality.



Research continues on interseeding alfalfa into corn as a dual-purpose cover and forage crop.



On July 29, **John Grabber** presented “Prohexadi-one-calcium responsive alfalfa varieties ensure success of corn-interseeded alfalfa production systems” to about 50 scientists and industry representatives at the Plant Growth Regulator Society of America meeting in Raleigh, NC.

On August 10, **Michael Sullivan** presented “A reverse genetics approach to elucidating substrate specificity of a hydroxycinnamoyl-CoA hydroxycinnamoyl transferase using transgenic alfalfa” to about 120 scientists at the 55th annual meeting of the Phytochemical Society of North America in Davis, CA.

On August 24, **John Grabber** presented “Establishing alfalfa in silage corn” to about 80 producers and industry representatives at the Agronomy/Soils Field Day, UW-Arlington Agricultural Research Station. At the same meeting, Michael Casler presented “Breeding cool season grasses.”

On September 13, Agronomist **Geoffrey Brink** gave a grazing research update to 25 county Extension and NRCS personnel at the Team Forage and Grazing In-Service Training in Marshfield, WI.

### Special Recognition

In October 2015, **Wayne Coblenz** was notified that his article, “Growth performance and sorting characteristics of corn silage-alfalfa haylage diets with or without forage dilution offered to replacement Holstein dairy heifers,” in the November issue of the *Journal of Dairy Science*, was selected as an “Editor’s Choice” article. As such, it was featured on the journal’s home page and was accessible to all.

In November 2015, **Michael Casler** received the Crop Science Research Award from the Crop Science Society of America at the annual meeting of the CSSA, American Society of Agronomy, and Soil Science Society of America in Minneapolis, MN.

In January 2016, **Heathcliffe Riday** learned that he was selected to receive a Citation of Excellence related to his service as an Associate Editor for Crop Science. He was featured in articles in CSA News and Crop Science.

Also in January, **Peter Vadas** learned that he was selected to receive a Citation of Excellence related to his service as an Associate Editor for the Soil Science Society of America Journal. He was featured in an article in CSA News.

In April, **Peter Vadas** received notice that his article,

“A new model for phosphorus loss in runoff from outdoor cattle lots,” was selected to receive a 2016 Superior Paper Award from the American Society of Agricultural and Biological Engineers (ASABE).

### Collaborative Research Events

On February 1-3, **J. Mark Powell** and **Peter Vadas**, along with ARS scientists from three other locations, met in University Park, PA, for a meeting of the Dairy Agroecosystems Working Group. At this meeting they focused on modeling the fate of reactive nitrogen in integrated dairy systems. The four ARS locations participating include Northwest Irrigation and Soils Research Lab, Kimberly, ID; the Pasture Systems and Watershed Management Research Unit, University Park, PA; the Soil and Water Management Research Unit, St. Paul, MN; and the U.S. Dairy Forage Research Center, Madison, WI.

On February 23-25, the U.S. Dairy Forage Research Center co-hosted the annual conference of the NIRS Forage and Feed Testing Consortium. The conference included a tour of the USDFRC; research updates from **Geoffrey Brink**, **Heathcliffe Riday**, **Wayne Coblenz**, and **Mary Beth Hall**; a presentation from **Mary Beth Hall**, “Measuring nonstructural carbohydrates and reference methods for NIRS;” and a presentation from **Wayne Coblenz**, “Protein and nitrogen fractions for forage analysis.”



### North American Alfalfa Improvement Conference

On July 14, the U.S. Dairy Forage Research Center co-hosted a tour it helped organize for the North American Alfalfa Improvement Conference meeting in Madison, WI. About 100 scientists and educators were taken to research plots at the USDFRC Research Farm in Prairie du Sac, WI and at the University of Wisconsin Ag Research Station in Arlington, WI. **Michael Casler**, **Heathcliffe Riday**, and **John Grabber** explained current research being conducted.

## Trade Journal and Association Publications

*Are we prisoners of the technology moment?*  
**Progressive Forage Grower**, Oct. 1, 2015  
Author: Mark Boggess

*Letter to the Editor (re: cow size and efficiency)*  
**Progressive Dairyman**, Oct. 14, 2015  
Authors: Mark Boggess, Kent Weigel, and Mike VandeHaar

*Overcoming seed dormancy in switchgrass*  
**CSA News**, Nov. 2015  
Adapted from Michael Casler article

*Yes, you can feed cows while saving the environment*  
**DairyBusiness East**, Nov. 2015  
Interview with J. Mark Powell

*How much forage can we feed to dairy cows?*  
**Forage Focus** (Midwest Forage Assn.), Dec. 2015  
Author: Kenneth Kalscheur

*Managing fermentation with baled silage*  
**Forage Focus** (Midwest Forage Assn.), Dec. 2015  
Author: Wayne Coblenz

*One-third of wells in Kewaunee County unsafe for drinking water*  
**Milwaukee Journal Sentinel**  
Interview with Mark Borchardt

*Hidden Valley meadow fescue: The grass that won't be forgotten*  
**Hay&Forage Grower**, Jan. 2016  
Authors: Michael Casler and Lori Bocher

*Baleage quality hinges on fermentation*  
**Hay&Forage Grower**, Jan. 2016  
Based on research & presentation by Wayne Coblenz

*Rumen microbes: A cow's best friend*  
**Hoard's Dairyman**, Feb. 10, 2016  
Authors: Paul Weimer and Lori Bocher

*Redesigning alfalfa for improved protein utilization*  
**Hay&Forage Grower**, Feb. 2016  
Author: Lori Bocher

*Forage "quality" makes or breaks rations*  
**Hoard's Dairyman**, Feb. 25, 2016  
Author: Mary Beth Hall

*Canola meal edges soybean meal as dairy cow protein source*  
**Progressive Dairyman**, Feb. 7, 2016  
Author: Glen Broderick (retired)

*Fermentation is different for baled silages*  
**Hoard's Dairyman**, March 25, 2016  
Based on research by Wayne Coblenz

*Soil ramifications of continuous corn silage*  
**Forage Focus** (Midwest Forage Assn.), March 2016  
Author: Mark Boggess



*Researchers strive for a better red clover*  
**Hay&Forage Grower**, March 2016  
Author: Heathcliffe Riday

*Manure after alfalfa: Consider the options*  
**Hay&Forage Grower**, April/May 2016  
Author: Bill Jokela

*High-quality or right-quality forage?*  
**Progressive Dairyman**, May 7, 2016  
Author: Mary Beth Hall

*Manure on forages: Benefits & challenges (Part 1)*  
**Forage Focus** (Midwest Forage Assn.), May 2016  
Author: Bill Jokela

*Why Kewaunee County is a flashpoint for CAFOs and water quality*  
**Wisconsin Public Radio**, June 30, 2016  
Interview with Mark Borchardt

*Manure on forages: Benefits & challenges (Part 2)*  
**Forage Focus** (Midwest Forage Assn.), Aug. 2016  
Author: Bill Jokela

*Study identifies public health risk from irrigating dairy manure*  
**Progressive Dairyman**, Aug. 25, 2016  
Interview with Mark Borchardt

*Is overstocking affecting your heifer management?*  
**Progressive Dairyman**, Aug. 25, 2016  
Interview with Wayne Coblenz

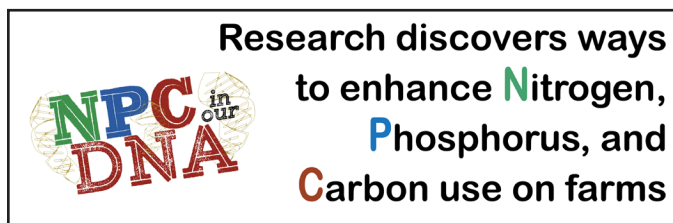
[Link to scanned copies of these articles.](#)



# Outreach and Events

## World Dairy Expo, 2015

The U.S. Dairy Forage Research Center participated in four technology transfer and outreach efforts at World Dairy Expo in Madison, WI on September 29 to October 3; the 2015 show attracted more than 72,000 dairy producers and industry reps from across the U.S. and 94 countries. First, the USDFRC is an organizing partner for the World Forage Analysis Superbowl, an event that encourages farmers to grow high-quality forage for dairy cattle. As such, the Center organized an educational seminar series that attracted more than 420 stakeholders and included USDFRC scientists *Wayne Coblenz*, *Mary Beth Hall*, *Ken Kalscheur*, and *Paul Weimer* as speakers.



Second, the Center created an educational display, "Research discovers ways to enhance nitrogen, phosphorus, and carbon use on farms." Third, the USDFRC organized the FFA Dairy Forage Quiz which brought more than 800 FFA students to the USDFRC educational display where they searched for the correct answers to the quiz questions. This event was organized by *Lori Bocher*. Also volunteering were *Mary Becker*, *Ursula Hymes-Fecht*, *Robin Ogden*, and *Jan Pitas*.



FFA students search for quiz answers in 12 educational posters.

Fourth, *Diane Amundson* created a display, "Reduce, Reuse, Recycle," that highlighted the role dairy cows play in turning waste into milk, fertilizer, and energy; this display was part of tours given to approximately 1,500 4th grade Madison area school children.

## Teaching Elementary Students

*Robin Ogden* and *Meridith Anderson* hosted 160 4th-grade students at the Marshfield location. Their goal was to teach the students about the wonders of a cow's rumen. The students were from Wisconsin Rapids and Spencer, WI, and they visited on October 16 and October 21, 2015.

## Volunteer Work at Second Harvest Foodbank

On January 21, 14 USDFRC employees volunteered a total of 35 hours of work in honor of the Martin Luther King Day of Service. The employees worked at the Second Harvest Foodbank of Southern Wisconsin, a distribution center that works with grocery stores and food processors to collect their unused food and distribute it to local food



John Bleier, Laurie Reinhardt, and Lisa Koch box and weigh frozen meats at Second Harvest Foodbank of Southern Wisconsin.

pantries. According to the food bank, the value of their volunteer time equates to meals for 2,275 people. Participating were *Mary Becker*, *Jon Bleier*, *Lori Bocher*, *Geoff Brink*, *Julie Grogan*, *Terry Gureno*, *Rebecca Heidelberger*, *Tony Johnson*, *Lisa Koch*, *Kris Niemann*, *Chris Odt*, *Laurie Reinhardt*, *Michael Sullivan*, and *Lila Walters*. Based on the success of this event, *Michael Sullivan* and *Lila*



*Michael Sullivan* and colleagues volunteer monthly at the Second Harvest Foodbank.

*Walters* organized a monthly volunteer session at Second Harvest. Each month about 10 employees volunteer on their own time.



Robin Ogden shows a cow's rumen to students from a technical college.

## Teaching about Rumen

On February 10, **Robin Ogden** of the Marshfield location taught 12 students from the Mid-State Technical College about a cow's rumen, nutrients (with a focus on bypass protein), and particle size of feedstuffs. She used a cannulated cow as an

aid, allowing the students to reach inside a cow's rumen.

## Baraboo Circus Heritage Days

On May 21, USDFRC employees created detectives out of youth and their parents at the Baraboo Circus Heritage Days, an event that draws more than 1,000 Boy Scouts and Girl Scouts from Wisconsin and surrounding states. The youth were encouraged to sift through a dairy cow's Total Mixed Ration to find the individual ingredients. They also learned about why cows eat what they do. Volunteering for the project were **Mary Becker, Lori Bocher, Laurie Reinhardt** and **Geoffrey Zanton**.

# You be the detective!

Can you find these ingredients in a dairy cow's **Total Mixed Ration**?

	field	feed	byproduct feeds	
alfalfa silage				soy hulls
corn silage				cottonseed
soybeans				beet pulp
corn grain				

## USDA People's Garden

In June, employees planted a USDA People's Garden on the south side of the Madison building. Organized by **Diane Amundson**, the deep-mulch garden grew an assortment of vegetables, herbs, and flowers that attract pollinators. The vegetables harvested in the fall were given to employees and donated to local food pantries. Also working on the project were **Mark Boggess, Dorene Hensler**, and student employees Kyle Freimuth, Lauren Giese, and Ashley Riederer.



Lila Walters, Dorene Hensler, and Diane Amundson with People's Garden produce ready to go to a local food pantry.



# Seminars at USDFRC

The U.S. Dairy Forage Research Center conducts two types of seminar series. The 'Lunch and Learn' series features USDFRC employees and graduate students giving updates about their research. The 'Seminar @ USDFRC' series invites guest speakers from a wide variety of disciplines to inform about a wide range of issues that affect USDFRC research directly or indirectly. All seminars are open to USDFRC employees, stakeholders, and UW staff and students.

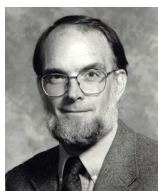


## Michael Russelle

October 6, 2015

Emeritus Research Soil Scientist,  
Plant Science Unit, USDA-ARS

*"Our trouble with nitrogen: What's soil  
got to do with it?"*



## Jerry Hatfield

October 6, 2015

Director, National Lab for Agriculture  
and the Environment, USDA-ARS

*"Understanding landscape-scale interac-  
tions for agronomic production systems"*

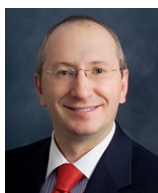


## Juan Tricarico

February 29, 2016

Vice President, Sustainability Re-  
search, Innovation Center for U.S.  
Dairy, Dairy Management, Inc.

*"U.S. dairy sustainability update"*



## Greg Thoma

March 2, 2016

Professor of Chemical Engineering,  
University of Arkansas

*"Climate change adaptation and mitiga-  
tion: Focus on northeast dairies"*



## Marlena White

March 15, 2016

Program Officer, Sustainable Food,  
World Wildlife Fund

*"Dairy and sustainable food in the 21st  
Century"*



**Ron Hatfield** November 12, 2015  
Research Plant Physiologist, USDFRC

*"The challenges for forages in the future"*

**J. Mark Powell** December 16, 2015  
Research Soil Scientist, USDFRC

*"Feed and manure nitrogen use in low- and high-nitrogen  
input dairy production systems"*

**Geoffrey Zanton** April 20, 2016  
Research Dairy Scientist, USDFRC

*"Nutritional opportunities and challenges to increasing  
both the efficiency of nitrogen utilization and feed efficien-  
cy in dairy cows"*

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# USDFRC Contact Information

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## Madison



### USDFRC at Madison, WI

Laboratories, greenhouses, engineering lab, and the administrative offices on the west side of the University of Wisconsin-Madison campus.

1925 Linden Dr.  
Madison, WI 53706  
Phone: (608) 890-0050

## Prairie du Sac



### USDFRC at Prairie du Sac, WI

The research farm consists of 2,200 acres and about 350 cows in milk.

S8822 Sunset Dr. (off of Hwy. 78)  
Prairie du Sac, WI 53578  
Phone: (608) 643-2438

## Marshfield



### USDFRC at Marshfield, WI

The Environmentally Integrated Dairy Management Research Unit (EIDMRU) is researching manure and nutrient management options.

2615 Yellowstone Dr.  
Marshfield, WI 54449  
Phone: (715) 387-4609

## Stratford



### USDFRC at Stratford, WI

Research farm for the EIDMRU. Same contact info as above.

### Web Site

[www.ars.usda.gov/mwa/madison/dfrc](http://www.ars.usda.gov/mwa/madison/dfrc)

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## Mark Boggess, Center Director

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# USDFRC Research Scientists

Research at the U.S. Dairy Forage Research Center is directed by 18 scientists who manage the personnel and activities in their respective laboratories in Madison and Marshfield, and also the research conducted at the farms in Prairie du Sac and Stratford. Three of these scientists are also Research Leaders for their respective management units.

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