October 2009

Fort Keogh Researcher

LIVESTOCK AND RANGE RESEARCH LABORATORY

In cooperation with

INSIDE THIS ISSUE:

Introduction

Greetings from Fort Keogh!

I hope you find our newsletter interesting and informative. We've had a busy spring and summer and want to share a few of the highlights and updates.

First we want to thank our Customer Focus Group, friends, industry partners, stakeholders, off-site collaborating scientists, technicians and students for the significant support that has been vital to our accomplishments. We would also like to thank our friends at Montana State University as we have refreshed the cooperative effort with them.

There were a number of grade school children from Miles City and the surrounding area that participated in field trips at the research laboratory during the spring. We had a successful meeting with our Customer Focus Group in May and they came back in September for a second productive meeting.

There were over 15 students working at the Fort this summer from several different schools. They ranged from high school to Ph.D. graduate students. Not only does this further education in the agricultural industry but it expands our exposure throughout the United States and foreign countries. We always welcome the opportunity to share with others our facilities and research.

We do have 2 positions open with our operations staff. One is with our farming crew and a second position is with the feedlot crew. If you know of someone who might be interested, please have them contact us.

In June we had an open house in conjunction with the Montana Stockgrowers Association's 125th anniversary celebration. At the open house, we had large tents set up in front of our headquarters building and the research staff displayed posters describing research accomplishments (you can view these posters on our website).

Mark Petersen
Research Leader

This type of setting allowed for participants to talk to scientists, technicians, as well as their neighbors also attending about research or any topic of interest.

In late June, the Animal Scientists traveled to the Western Section of the Society of Animal Science annual meeting and we presented several papers and posters. Mike MacNeil was presented with the Distinguished Service Award; Andy Roberts was recognized with the second place Applied Paper award and a graduate student of mine won first

place in the Applied Papers.

Also, in late June, Montana Range Days was held in Miles City. The youth range judging contest was held on Fort Keogh and our range scientists and technicians led a number of activities and tours. Range Days was considered a big success by all. Range Days will be back in Miles City in 2010 and we hope you can be here for it.

A science hallmark that occurred earlier this spring was the publication of the bovine genome. A Line 1 Hereford cow was the donor of the genetic material that was used. Our scientists were part of the 300 international scientist team.

Our scientists have spoken all over during the last 6 months including Argentina, Brazil, Canada, Chile, Kenya, Alaska, California, Colorado, Idaho, Kansas, Nevada, Ohio, Pennsylvania, Utah, Vermont, and Wyoming.

In February, our range scientists will be in Denver attending the annual meeting of the Society for Range Management and participating in Society affairs and presenting scientific papers.

Starting in April of 2010, our headquarters building will be undergoing modernization to the interior portions that were not finished in the 2002 modernization. The funding for these maintenance improvements come from the American Reinvestment and Recovery Act. We are very grateful for the support we have received from our Federal representatives, Senators Baucus and Tester and Representative Rehberg. We are appreciative of the support we have received from our Area ARS and National ARS offices. We are not looking forward to the disruption but look forward to the completed project and the benefits the project will yield.

We initiated our fall cattle work about a month ago. Most of the preweaning work is completed and we have started weaning and pregnancy testing the first groups of cattle. The cows look to be in good to fair condition although our initial pregnancy tests seem to be down 2 to 3 percent. Nearly all of our home grown feed has been harvested, stored, stacked or piled. The grasshoppers set back our farming a bit but not too bad. Right now it looks like we packed 29.45 tons per acre of corn silage. The first groups of cattle have been started in the feedlot. In March we will be holding our Line 1 excess sale. Watch our website for the list. You may want to bring a number of them home.

Fort Keogh values the input and support from our community, industry and scientific partners. We hope you will assist us in reaching our goals for the future. Your support is important as we develop effective and productive research and outreach programs. Please visit us! We would like to see you and we look forward to serving you in 2010.

Cattle Genome Blueprint
by Lee Alexander, Molecular Geneticist

Last spring livestock genomics reached a significant milestone. The publication of the sequence of the cattle genome. The genome represents the genetic blueprint of an organism. The DNA that makes up the nuclear genome encodes genes that direct the synthesis of proteins via mRNA (messenger RiboNucleic Acid), and regulatory RNAs. DNA molecules are very long polymers which consist of four units called bases which are G (guanine), A (adenine), T (thymine) and C (cytosine). These bases are arranged in two long linear polymers that are aligned against each other and form a double helix. Each double helix forms a chromosome. Humans have 23 pairs while cattle have 30 pairs of chromosomes. It was the determination of the linear order, or sequence of the bases, that was the basis of the bovine genome publication. The length of the human genome is 3.4 BILLION bases and cost about 3 billion dollars to sequence, however due to improving technologies the cattle genome cost about $38 million.

Fort Keogh played a very significant role in this milestone project. The animals that were chosen to be the basis of the sequencing project were from here. They were a father (Domino) and daughter (Dominette) from our Line 1 Hereford herd. They were selected, from all the other cattle in the world, because our Line 1 herd has been closed since 1934! This closure limited the DNA sequence diversity which simplified the sequence assembly. We supplied the DNA to the Human

"Fort Keogh played a very significant role in this milestone project."

Genome Sequencing Center at the Baylor College of Medicine in Houston, Texas, where the DNA sequencing was performed. The sequences are determined in short (800 base) stretches and then these stretches are assembled into the final genome. Once we have the linear order of bases we have to work out what they mean. Each gene is broken up by stretches of bases which are removed before the final mRNA is produced. In addition, there are many bases (thousands to millions) between genes. So the real challenge is to work out what stretch of DNA is a gene, what that gene's function is, in what tissue, and at what stage of the animals life it is expressed. Again Fort Keogh played an essential role by providing tissues from the offspring of Dominette for determination of genes expressed in those tissues.

The highlights of the findings from the project were that the bovine genome consists of 2.84 billion bases, slightly smaller than the human genome. It contained slightly more than 22,000 genes, similar to humans. When compared to other animals that have had their genomes sequenced (human, dog, mouse, rat, opossum and platypus; horse was not included) there were 14,345 genes that were in common between these organisms. When compared to humans, cattle had about 1,000 genes not found in humans. A lot of these cattle specific genes encoded proteins whose functions are to interact with the external environment such as immune proteins and sensory and/or olfactory receptors. One of the major differences between cattle and these other organisms is that cattle are ruminants. The bacterial load in the rumen that ferments foodstuffs is astounding. Once these bacteria leave the rumen they must be neutralized and digested. Many of the proteins in the digestive tract are found only in cattle and many genes have been derived from these proteins when compared to the other genomes. As cattle are a herding animal, it has been proposed that proteins with an immunological function evolved to protect against diseases that may spread through the herd. Other proteins were involved in reproduction and expressed in the placenta and in lactation. As opposed to humans, cows receive very little passive immunity via the placenta. Calves receive this protection via immunoglobulins in the milk.

Other products to come out of this project are genetic markers called SNPs (Single Nucleotide Polymorphisms). These are places in the genome where the sequence varies between the pair of chromosomes. Several million SNPs were identified in the project, of which 50,000 have been selected to be incorporated into a commercial assay to aid us in finding genetic variants responsible for differences between cattle such as growth rate, etc. The findings from the bovine genome project will be used for many years to come and will greatly aid in improving both beef and dairy industries.

Line 1 Dominette 01449 and her calf

RECENT PUBLICATIONS

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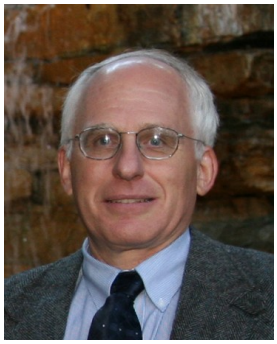
Please check our website http://www.ars.usda.gov/npa/ftkeogh or email sue.miles@ars.usda.gov for these and other publications.

Fort Keogh

AWARDS

Michael D. MacNeil, Quantitative Geneticist at Fort Keogh, received the Distinguished Service Award from the Western Section, American Society of Animal Science in Fort Collins on June 17, 2009. The Line 1 Hereford cattle population has a significant impact on beef cattle breeding research and applications worldwide and particularly in the western part of the United States. MacNeil is fully responsible for disseminating Line 1 germplasm and is point of contact for scientists to obtain genetic material from it. In addition to the research, administrative, and extension impact of MacNeil's programs and expertise, he has had significant outreach to the beef industry through his work in selection index development for beef breed organizations. MacNeil has been recognized nationally and abroad as an invited speaker and educator relative to genetic improvement and livestock production systems. MacNeil has the keen ability to interpret research results and develop and publish landmark manuscripts in professional scientific journals and other publications.



Dr. Michael D. MacNeil
Quantitative Geneticist

Andrew J. Roberts, Research Physiologist at Fort Keogh, received the 2nd Place award for Applied Papers at the Western Section of the American Society of Animal Science annual meetings in Fort Collins on June 17, 2009. The Western Section of the American Society of Animal Science recognizes Excellence in Applied Animal Science Research under the criteria of 1) Applicability to current production systems, 2) Potential for economic return on investment, and 3) New and innovative approaches to existing production systems. Accordingly, 2nd Place was awarded to A.J. Roberts, E.E. Grings, M.D. MacNeil, R.C. Waterman, L. Alexander, and T.W. Geary, USDA-ARS Fort Keogh Livestock and Range Research Laboratory, Miles City, MT, for the paper titled: Implications of Going Against the Dogma of Feed Them to Breed Them.

Dr. Andrew J. Roberts
Reproductive Physiologist

NEW EMPLOYEE

Brad Eik will join the staff at Fort Keogh as the Assistant to the Superintendent of Outside Operations at the end of October. Brad comes to us from Ashley, North Dakota, where he has been working for the Natural Resources Conservation Service. Originally from Joliet, Montana, Brad received his BA in Natural Resources Management from Dickinson State University where he also played football.

Brad Eik
Assistant to the Superintendent

RETIREMENT

Sandi Lockie, Administrative Associate for the Montana Agricultural Experiment Station at Fort Keogh, retired June 30, 2009. Sandi kept the animal records for the last 20 years and was very involved in the Line 1 program. Though Sandi has officially retired, she will continue to work on a part-time basis to make sure all the cattle records are kept up-to-date.

Sandi Lockie
Administrative Associate

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We're on the web!
http://www.ars.usda.gov/npa/ftkeogh

Public Seminars

Fort Keogh's Tech Room 2 p.m.

November 9: Kip Panter, Research Leader, Poisonous Plant Research Laboratory, Logan Utah, Overview of work at the Poisonous Plant Research Laboratory (including an update on work with pine needles). Ben Green, Scientist, Poisonous Plant Research Laboratory, Logan Utah, "Larkspur physiology and research objectives using Line 1 steers."

December 7: Matt Rinella, Research Rangeland Management Specialist, Fort Keogh Livestock and Range Research Laboratory, Miles City, Montana "Effect of Stocking Date on Grazing Intensity in Over-Grazed Mountain Meadows."

January 11: Kurt Reinhart, Research Ecologist, Fort Keogh Livestock and Range Research Laboratory, Miles City, Montana "Benefits of promoting grassland diversity."

February 8: Larry Brence, Eastern Region Department Head, Montana State University Extension Service located at Fort Keogh "Role of Extension in an electronic age."