

GSL Researcher

Fall 2019



INTRODUCTION

By **Travis Mulliniks**, Range Cattle Nutritionist

Greetings from the faculty, cowboys, staff, and students at and associated with Gudmundsen Sandhills Laboratory.

Welcome to the first edition of our GSL newsletter. Our goal with the newsletter is to be a bi-annual publication to give updates on activities, on-going and completed research, publications, forage forecasting, and awards coming from GSL. We will also have a technical note section to describe a science-based procedure utilized in projects, why it is important from a scientific-basis and why it is important for you as our stakeholders.

In the beef research side, we have quite a few projects ending this year and new projects starting. We are wrapping up the 2nd year of a 3-year study looking at energetics of young range cows during the breeding season. Our goal with this project is that it reveals mechanisms and drivers of metabolic flexibility in young beef cows that are more reproductively efficient. We also began a young cow supplementation project looking at strategies to increase reproductive efficiency. The calf crop this year in our March-calving herd will be the last crop in a 3-year late-gestation supplementation project looking at the impact of rumen-protected methionine supplementation on cow and progeny performance. Methionine has been suggested to be a limited amino acid for cows grazing forage-based diets. Previous research has shown rumen-protected methionine can increase protein utilization in low-quality forage diets.

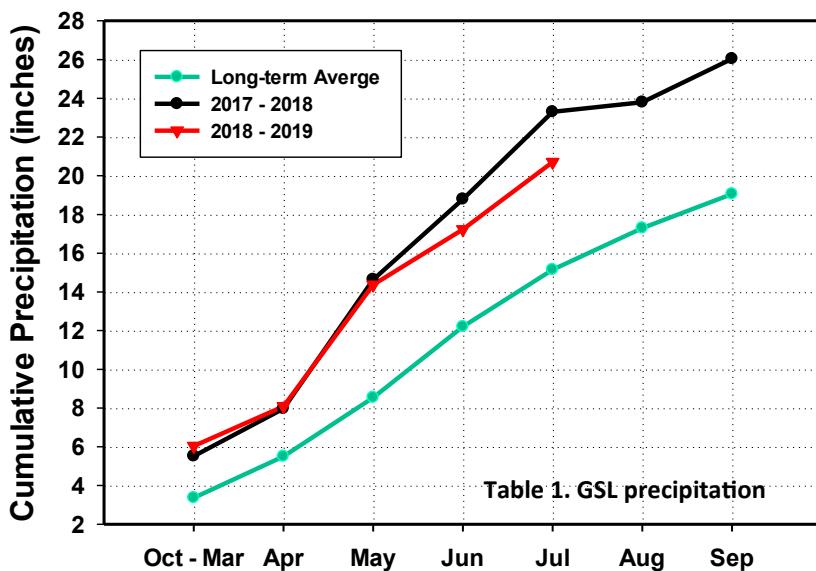
In rangeland research, **Mitch Stephenson's** lab has conducted year 3 of a study evaluating the effect of early-season burning on hay production and quality on Sandhills meadows. The objective of this study was to better understand the trade-offs of early-season burning and grazing on later-season hay production. They also began year 1 of a study evaluating how timing and intensity of grazing on meadow hay regrowth during the fall and winter influences subsequent year hay production. In addition, they are collecting long-term plant production data at GSL. This data has been collected since 2004 and with 15 years of data of which they have begun modeling how weather variables influence production of different functional groups. This information will assist in better understanding vegetation dynamics and potential trigger dates for drought management decisions.

We look forward to your thoughts and suggestions on what should be included in upcoming editions of the newsletter.

INSIDE THIS ISSUE

Introduction	1
Range & Pasture Update	2
Technical Note.....	3
Ranch Crew Spotlight.....	3
Students & Awards	4
Ranch Update.....	5
Highlighted Research.....	6
Open House Agenda.....	7
Publications.....	8





	Average	2017-2018	2018-2019	2018-2019 Cumulative
OCT to MAR	3.36	5.52	6.04	6.04
APR	2.14	2.45	2.05	8.09
MAY	3.04	6.67	6.28	14.37
JUN	3.66	4.15	2.86	17.23
JUL	2.95	4.51	3.48	20.71
AUG	2.15	0.50		
SEPT	1.76	2.24		

Figure 1. GSL forage year precipitation through 7-31-19.

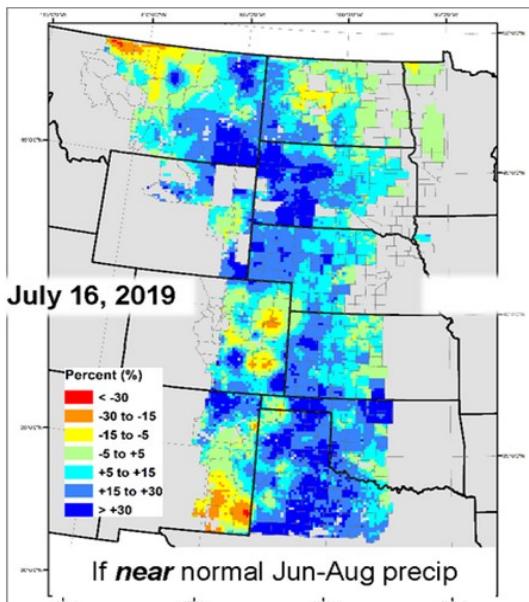


Figure 2. Grass-Cast grassland production forecast map released 7-16-19.

RANGE & PASTURE UPDATE



By **Jerry Volesky**,
Range Scientist

The 2019 growing season continues to be quite favorable. Cooler April and May temperatures did result in a delay of grass growth. At GSL, forage year (since last October) precipitation has been above the long term average and fairly similar to 2018 (Table 1, Figure 1). Although June precipitation at GSL was slightly below the average; total precipitation during the critical months of May, June, and July was above average.

Annual upland range production in the central Sandhills averages about 1,850 lb/acre. In 2018, production was 15% greater than average and that above average production will likely be the result for 2019. This is consistent with the Grassland Production Forecast (Grass-Cast), a model for the Central and Northern Great Plains, which include historical GSL production data (Figure 2). Additional information on Grass-Cast can be found at: <http://grasscast.agsci.colostate.edu/>

By August, the vast majority of growth for both cool-and warm-season grasses has already occurred. Additional rainfall in August will generally not promote additional growth, but rather, help maintain those plants in “green” mature state of the warm-season grasses. Late August and September rainfall will stimulate growth of cool-season grasses into the fall.

TECHNICAL NOTE: ACETATE TOLERANCE TEST



By **Tasha King** and **Joslyn Beard**, PhD Students

Sometimes research procedures and production-based research don't seem to go hand-in-hand. This summer one of the research protocols we used was an acetate tolerance test. Many of you are nodding your head and saying, "Cool, but what is an acetate tolerance test? And how does it affect me?"

What is an acetate tolerance test?

To conduct an acetate tolerance test, we insert a catheter into the jugular of a cow. A 20% acetic acid solution is then infused through the catheter at 2.75 mL/lb of cow body weight (BW). Blood samples are then taken from the jugular catheter at -1, 0, 1, 3, 5, 7, 10, 15, 30, 60, and 90 minutes relative to infusion. Blood samples are analyzed for acetate concentration level. Blood samples at -1 and 0 tell us the cow's normal acetate concentration. Blood draws taken at the various time points after infusion determines the rate acetate is leaving the bloodstream. Samples are analyzed to measure acetate concentration at various time points, which are entered into a calculation to see the rate acetate concentration decreases over time after infusion.

What does this tell us?

Acetate clearance rate can indicate oxidative metabolism, the process of converting food energy to energy utilized by the body. Therefore, a faster clearance rate represents a diet that is more balanced with nutrients (acetate to propionate or amino acids).

Cattle consuming forage-based diets produce a greater concentration of acetate to propionate. Acetate and propionate are volatile fatty acids (VFAs) produced by microorganisms in the rumen utilized by cattle as a source of energy. These VFAs are absorbed through the rumen wall to provide a large proportion of the cow's energy requirements. Propionate is the only VFA that contributes to glucose production, providing between 27 and 54% of a cow's glucose. Therefore, a shift in production to a greater concentration of acetate when consuming a forage-based diet, can affect how the cow synthesizes glucose.

How does this affect producers?

When acetate is abundant and glucose is insufficient, the efficiency of acetate utilization can decrease. Cows are either not getting enough energy from their diets or not utilizing the nutrients to the fullest potential. Supplementation strategies can facilitate this nutrient imbalance from the diet to improve cow grazing performance. For instance, this spring we conducted an acetate tolerance test on 3-year-old March calving cows receiving different supplementation treatments.

Results will allow us to evaluate how supplementing varying levels of glucose precursors affects efficiency. Previous studies reported an increase in acetate clearance rate with supplementation of protein and propionate in sheep consuming forage-based diets. This provides the opportunity to develop supplementation strategies that will improve efficiency in forage utilization.

Conducting acetate tolerance tests in cows in different production settings allows us to evaluate the efficiency of nutrient utilization in cow-calf systems. Specifically in forage diets, acetate tolerance tests can determine the efficacy of those animals grazing different quality of forages along with implemented supplementation strategies. With the cow contributing 60 to 70% of energy costs of cattle from gestation to slaughter, efficiency and supplementation strategies will continue to be an important research focus.



RANCH CREW SPOTLIGHT



Roger Carpenter was born and raised in Bassett, Nebraska on a cow-calf operation. He is currently taking classes through the University of Nebraska-Lincoln to finish his Bachelor's degree in animal science. Roger has worked on the ranch for 2 years. He enjoys getting to spend his time outdoors working with cattle, working on machinery and trying new things. Roger likes to spend his free time playing golf and spending time with his family and friends. He is looking forward to many more years at GSL.

AWARDS

Joslyn Beard, PhD student with **Travis Mulliniks** and **Dustin Yates**, won 1st place in the Applied Science Competition at the Western Section of the American Society of Animal Science Meeting with her paper entitled “The effect of dam age on heifer progeny performance and longevity”.

Tasha King, PhD student with **Travis Mulliniks** and **Jim MacDonal**d, won 2nd place in the Graduate Student 3 Minute Video talking about her research on the effect of harvest methods on corn residue quality at the Western Section of the American Society of Animal Science Meeting.

Joslyn Beard, PhD student with **Travis Mulliniks** and **Dustin Yates**, won 3rd place in the Graduate Student 3 Minute Video talking about her research on metabolic flexibility and fatty acid mobilization in range beef cows.

GRADUATE STUDENTS AT GSL



Joslyn Beard, PhD student, is working with Travis Mulliniks and Dustin Yates. Her PhD research investigates the mechanisms that define metabolic flexibility and energetics in young range cows during lactation. Joslyn is originally from Las Cruces, NM, and received her BS and MS degrees from New Mexico State University. She is also serving as an instructor at Nebraska College of Technical Agriculture.

Tasha King, PhD student, is working with Travis Mulliniks and Jim MacDonald. Her PhD research is focused on supplementation strategies to increase energy and amino acid utilization and reproduction in young range

cows. Tasha is originally from Bronson, Iowa, and received her BS degree from Northwest Missouri State University and MS degree from UNL. She is also serving as an instructor at Nebraska College of Technical Agriculture.

Tara Harms, MS Student, is working with Mitch Stephenson and Jerry Volesky. Her MS research is focused on management strategies to improve the grazing and hay use of Sandhills meadows. These management strategies involve early-season burning and grazing and grazing at different intensities in the fall and winter. Tara is originally from Dodge, Nebraska, and received her BS degree from UNL in Animal Science and Grazing Livestock Systems.

Rob Ziegler, MS student, is working with Travis Mulliniks and Jim MacDonald. His MS research focuses on management and supplementation strategies to increase cow/calf efficiency in the Sandhills. Rob is originally from Green Lane, Pennsylvania, and received his BS degree from the University of Wyoming. Rob also serves as an animal science student representative for the IANR graduate committee.

INTERNS AT GSL

We have had the opportunity to have **Hannah Watson** intern with the ranch crew this summer. Hannah is a junior in the Department of Animal Science with a specialty in Production Management and a minor in Beef Industry Scholars. Hannah graduated from McPherson County High School in Tryon, Nebraska in May of 2017, then started her BS degree at UNL in August of 2017.



RANCH UPDATE



By **John Nollette** and **Jacki Musgrave**

Like the rest of the state, we too felt the effects of cold temps and spring storms. Sub-zero temps in early March made for a challenging start to the March calving season. This, followed by major blizzards in March and April, took its toll on cow body condition. Compared to the average of the last 5 years, cows were 0.3 and heifers 0.2 BCS points lower. The cows looked rough coming out of this winter. Thankfully, through the hard work of the ranch crew, death losses were kept to a minimum through these chilling weather conditions. We are hoping that the stress on the calves through the spring won't result in an increase in summer pneumonia cases.

Tasha King, a PhD graduate student working with Travis Mulliniks, moved to GSL in March for an early lactation supplementation study. March calving three-year-olds were individually fed either a traditional distillers grain cube containing either Rumensin or calcium propionate. This study was looking at the impact of supplementation on energy utilization and reproduction. She will be back next spring to repeat these treatments one more year.

The cold wet spring left us ready for warmer, drier weather to arrive. Cool season grasses appeared to flourish but it delayed forage growth on the warm season dominated upland range. Diets collected for the June Ranch Practicum were lower than average in crude protein (11.1 vs. 12.5%). Similarly, we saw lower crude protein values in June last year when moisture was abundant. Warmer weather in late June and early July may have helped our upland range quality. Hay quantity may be good but quality may be lower. Luckily, we have been able to start bailing in early July on some of our drier meadows. Combining cows in lower body condition with lower quality forage looks like we might be looking at decreased pregnancy rates this fall.

Joslyn Beard, another of PhD student working with Mulliniks, returned this summer for her second of three years. She is working with May-calving two-year-olds on energy energetics, utilizing heart rate loggers and GPS collars to estimate energy expenditure.

We are using insecticide tags again this year for fly control. David Boxler is comparing three different tags to evaluate their efficacy. He is also continuing to monitor our pesticide resistance levels.

Tara Harms will be back again this fall and winter. She is looking at the impacts of meadow grazing at moderate and high stocking rates pre- and post-frost. She also has another study looking at burning as a meadow management tool.

Rob Ziegler, a MS graduate student working with Travis Mulliniks, will be moving out to GSL in September for a late gestation supplementation study. Rob is also analyzing long-term GSL cow size data to look at the optimal cow size for the Sandhills.

Overall, the hills are green and things look pretty good here at GSL. Hopefully we get to enjoy a mild fall before winter sets in again.



HIGHLIGHTED RESEARCH RESULTS

THE EFFECT OF DAM AGE ON HEIFER PROGENY PERFORMANCE AND LONGEVITY

Selection and development of heifers can have long-term impacts on production and profitability. Developing females to replace cull cows is costly and one of the most expensive management decisions for cow-calf producers. Several studies have examined methods to reduce heifer development costs without impairing reproductive function. Cow and calf performance data were collected from 2005 through 2017 at the University of Nebraska, Gudmundsen Sandhills Laboratory (GSL) near Whitman, NE. Cow and calf performance data were obtained from both March and May calving herds at GSL to determine the impact of dam age on subsequent heifer progeny performance and longevity. Cows ($n = 1,059$) utilized in this study were a Red Angus/Simmental composite and ranged from 2 to 11 yr of age. To determine the effect of dam age on subsequent heifer progeny's growth development and reproductive efficiency, cows were also classified by age groups as young (2 to 3 yr old), moderate (4 to 6 yr old), and old (≥ 7 yr old).

Heifer calves born to young cows had lighter ($P \leq 0.01$, Table 1) birth BW and 205-d than heifer calves born to moderate and old cows. Although pre-weaning BW differences occurred, heifer pre-breeding BW and at time of pregnancy determination were not different ($P \geq 0.17$) among dam age groups. Female progeny born to moderate and old cows had a greater ($P < 0.01$) percentage reach puberty prior to breeding compared with heifers born to young cows. However, dam age did not influence ($P = 0.15$) heifer progeny pregnancy rates. This could be attributed to post-weaning growth, as no BW differences were observed among the groups suggesting heifer post-weaning intake and plane of nutrition impacted reproduction success. In the subsequent calving season, there were no differences ($P = 0.28$) among age groups for percentage of heifers who calved within first 21 d of calving. However, average number of calf crops from progeny within dam age was different among all groups ($P < 0.01$), with heifer progeny from young dams having more calves (3.1 ± 0.7) than moderate (2.8 ± 0.7) and old (2.2 ± 0.8).

Results from this study suggest dam age will impact heifer progeny growth and reproductive performance. Heifer progeny from moderate and older dams tended to have increased performance up to first calving. However, heifer progeny from young dams had increased calf crops and productivity compared with their older counterparts. Depending on production goals, dam age may need to be considered for selecting replacement females with the goal of increased productivity and long-term profitability.

Table 1. Effect of dam age on heifer progeny growth and reproductive performance

	Dam Age ¹			SE	P-Value
	Young	Moderate	Old		
Heifer BW, lb					
Birth	70.4 ^a	74.8 ^b	72.6 ^b	0.9	< 0.01
205 d	436 ^a	453 ^b	451 ^b	7	0.01
Prebreeding	609	622	618	9	0.21
Pregnancy diagnosis	816	816	805	9	0.17
Puberty, %	51.55 ^a	69.64 ^b	74.06 ^b	9.7	< 0.01
Pregnancy, %	80.44	84.08	85.89	2.5	0.15
Calved in first 21 d, %	73.34	77.88	78.94	3.0	0.28
Calf Crop ² , n	3.1	2.8	2.2	0.7	< 0.01

^{a,b}Means with different superscripts differ $P \leq 0.05$.

¹Dam age at calving: Young (2 to 3 yr of age), Moderate (4 to 6 yr), Old (≥ 7 yr)

²Number of calf crops produced with dam age groups.

GUDMUNDSEN SANDHILLS LABORATORY

GSL is a research ranch located in the heart of the Nebraska Sandhills. It is comprised of 11,600 acres of upland native range and 1,200 acres of subirrigated meadow. It was gifted to the University of Nebraska Foundation in 1978.

Since Gudmundsen's inception, research and educational programs have become more ecologically diverse and team oriented. Joint projects with animal, range, soil, veterinary, economics, entomology, geology, hydrology, forestry and wildlife have increased our understanding of the Sandhill's ecosystem. This has resulted in advances in range livestock nutrition, beef cattle reproduction, grazing systems, range-land ecology, low cost cattle management, groundwater issues, and wildlife management.

RECENT PUBLICATIONS

Beard, J. K., J. A. Musgrave, R. N. Funston, and J. T. Mulliniks. 2019. The effect of cow udder score on cow/calf performance in the Nebraska Sandhills. *Translational Animal Science*. 3:14-19.

Broadhead, D., J. T. Mulliniks, R. N. Funston. 2019. Developmental Programming in a Beef Production System. In *Vet Clinics: Food Animal Practice*. R. N. Funston and J. T. Mulliniks (Ed.), *Developmental Programming in a Beef Production System*.

Cantrell, B., H. Lachance, B. Murdoch, J. Sjoquist, R. Funston, R. Weaber, and S. McKay, 2019. Global DNA methylation in the limbic system of cattle. *Epigenomes*. 3(8):1-7.

Yu, J., M. Vandevere, J.D. Volesky, and K. Harmoney. 2019. Estimating the Basis Risk of Rainfall Index Insurance for Pasture, Rangeland and Forage. *Journal of Agricultural and Resource Economics*. 44:179-193. ISSN 1068-5502

CONTACT US

Ranch: 308-544-6430 or visit
www.gsl.unl.edu

Travis Mulliniks: 308-696-6707 or
travis.mulliniks@unl.edu

Jacki Musgrave: 308-544-6515 or
jacki.musgrave@unl.edu

Rick Funston: 308-696-6703 or
rfunston2@unl.edu

Mitch Stephenson: 308-632-1230 or
mstephenson3@unl.edu

Jerry Volesky: 308-696-6710 or
jvolesky1@unl.edu



The University of Nebraska does not discriminate based on race, color, ethnicity, national origin, sex, pregnancy, sexual orientation, gender identity, religion, disability, age, genetic information, veteran status, marital status, and/or political affiliation in its programs, activities, or employment.