APPENDIX D
SAES-422
Format for Multistate Research Activity Accomplishments Report

Project/Activity Number: S-1086

Project/Activity Title: Genetic Aspects of Beef Cow Adaptation to Diverse U.S. Production Environments.

Period Covered: October 1, 2025 – September 30, 2026

Date of This Report: June 19, 2026

Annual Meeting Date(s): May 20, 2026

Participants: James Matthews, Rhonda Vann, Megan Rolf, Andy Herring, Bob Godfrey, and Brian Rude.

Brief summary of minutes of annual meeting:

The S1086 annual meeting was held online on May 20, 2026; The zoom link was as follows: https://msstateextension.zoom.us/j/91020676935?pwd=eYEnD7fEB4Vxvg13HoKLihTqcHlafK.1. All attendees introduced themselves and then we proceeded with the NIFA report from Dr. Bob Godfrey. Dr. Godfrey indicated that he would be retiring in 120 days. Dr. Godfrey indicated to be sure and pay attention to the new executive orders; as there were lots of new terms and conditions. There are lots of new rules about what can and cannot be done. At this time there is not a date released for the AFRI-NOFO. He also reminded everyone to be sure to sign up for NIFO notifications. Also, for questions about NOFO phone calls may work best because they can do more with a phone call than an email in many cases. Also, he provided the following links:
https: www.whitehouse.gov/presidential-actions/executive-orders/
https://www.usda.gov/directives/sm-1078-021
https://www.usda.gov/ree/reorganization

Dr. James Matthews gave his report and indicated that the report was due 60 days from this annual meeting. Everyone agreed to a deadline on July 6, 2026 for submitting their information for the annual report. We indicated that a reminder would be sent out on July 1, 2026. We discussed setting up a google doc for everyone to enter their information into the document to streamline the reporting process. Dr. Matthews also indicated the importance of Impact Statements and to remember that connectivity and collaborations was very important.

The venue for this year's meeting was supposed to be in Texas but due to the limited number of people able to attend in person the venue was postponed until 2027. Dr. Andy Herring and Dr. David Riley extended the invitation to come to Texas for next year's annual meeting in Texas. The group elected for next year's meeting to be on May 18 -20, 2027 and was motioned by Megan Rolf and seconded by Andy Herring. In addition, due to the limited number of attendees Dr. Matthews asked if willing for the Chair and Chair-elect to remain for one more year. At this time the Chair is Rhonda Vann; Chair-elect is Micheal Gonda; and Secretary is Emily Baker; motioned by Brian Rude and seconded by Andy Herring. Motion carried no nay votes.

Minutes from secretary and this includes reports from nomination and resolution committees)

Accomplishments: This section focuses on intended activities, outputs, and short-term outcomes. Committees should build information built around the activity's milestones, as identified in the original proposal. Please indicate significant evidence of linkages both internal to the project/committee and to external peer groups, stakeholders, clientele, and other multistate activities. The report should also reflect on the items that stakeholders want to know, or want to see. The committee should describe plans for the coming year in no more than one or two short paragraphs. If the committee is filing an annual report, the accomplishments will cover only the current year of the project; for termination reports, list accomplishments from the entire span of the project.

Objective 1: To evaluate adaptation of beef cattle to local production and environmental challenges.

South Dakota State University Agricultural Experiment Station
Efforts are underway to assess cow feed efficiency on pasture. Unlike feed efficiency of post-weaning calves in a feedlot or drylot setting, cow feed efficiency on pasture has received less attention from the scientific community. To assess cow feed efficiency on pasture, we will deploy GreenFeed units that measure enteric carbon dioxide and methane emissions. These emissions are correlated with cow feed efficiency.

Kansas State University
We have deployed GreenFeed units to measure gas fluxes and estimate forage intake on grazing beef cows in the flint hills. We have analyzed number of spot samples needed for accurate sampling and are beginning work to generate preliminary heritability estimates as well as develop methodology for handling incomplete records, which are quite common in grazing cows where data is collected in extensive environments.

University of Missouri
We are using 3D images of cattle to measure surface area and volume. According to the "surface law" of animal metabolism, the basal metabolic rate of animals is influenced by their surface area. We have generated repeated records of surface area for hundreds of animals and are using this information to measure heritabilities and genetic correlations.

Oklahoma State University
Efforts are underway to characterize patterns of genomic homozygosity and heterozygosity in Brahman cattle raised in tropical production systems. Using genotypes from 5,468 Brahman cattle, we are identifying runs of homozygosity (ROH) and heterozygosity-rich regions (HRR) to better understand genomic inbreeding, population history, and regions of the genome associated with adaptation. Results to date indicate that Brahman cattle combine moderate levels of genomic inbreeding with widespread regions of elevated heterozygosity. Functional analyses of ROH and HRR islands have identified genes and pathways related to olfactory signaling, energy metabolism, oxygen transport, and muscle-related processes, suggesting that these genomic regions may contribute to adaptation and biological function in tropical environments. This information may also help inform breeding and management strategies in U.S. beef systems, particularly in subtropical and heat-stressed environments where adaptation and resilience are increasingly important.

A second study focuses on the genetic and environmental factors affecting pregnancy loss in Nellore cattle. Using more than 305,000 breeding records from 667 sires across 271 farms in Brazil, we are evaluating sire-related differences in pregnancy loss and estimating genetic parameters for this trait. Results to date indicate that pregnancy loss is largely influenced by environmental and management factors, but meaningful differences among sires are also present. Younger females, particularly precocious heifers, showed the highest pregnancy loss rates, and comparisons among sire groups suggest that the use of superior sires could reduce pregnancy loss in high-risk females. These findings may also provide useful insight for U.S. beef cattle systems by highlighting opportunities to improve reproductive efficiency through a combination of genetic selection and targeted management of more vulnerable female groups.

Mississippi State University

Hair shedding scores were taken on 2025 spring and fall calving cows as well as their calves after weaning. Growth data were collected from weaning until yearling on all fall born calves.

Objective 2: Estimate heterosis in Brahman-*Bos taurus* crosses.

Texas A&M

1. Third year of Artificial Insemination completed.
2. Two years of calves born in the project.
3. First year of project heifers born in 2025 are being exposed to calving ease Angus bulls.
4. Tables 1 and 2 summarize data to date.

Table 1. Texas: Simple means and statistics (kg) for calves born in 2025.

	Birth weight					Weaning weight					Yearling weight				
Calf		**Mea**			**Ma**		**Mea**					**Mea**			
Breed	**N**	**n**	**SD**	**Min**	**x**	**N**	**n**	**SD**	**Min**	**Max**	**N**	**n**	**SD**	**Min**	**Max**
A	26	32.3	5.24	20.9	43.5	23	217.4	37.57	130.2	284.9	20	359.4	92.45	245.8	573.8
B	19	32.5	5.07	24.5	43.5	18	219.3	29.14	172.8	264.0	18	334.4	69.03	253.1	458.1
AB	13	33.8	4.06	25.4	41.7	12	262.6	33.25	192.8	307.5	12	427.9	79.18	288.5	557.9
BA	16	45.0	7.44	29.9	59.9	15	282.6	44.12	202.3	372.9	14	453.7	93.61	301.2	628.2
¾ A ¼ B	43	32.1	6.33	20.9	50.8	41	277.1	49.07	193.7	379.2	40	414.6	92.61	247.7	601.0
¾ B ¼ A	35	38.9	6.77	21.8	52.6	35	267.2	33.23	210.5	353.8	35	383.6	57.99	297.6	528.4

Table 2. Texas: Simple means and statistics (kg) for calves born in 2026.

Calf Breed	N	Mean	SD	Min	Max
A	41	32.8	5.82	18.1	48.1
B	16	32.7	5.36	25.4	41.7
AB	21	32.6	4.45	23.6	39.0
BA	11	48.3	10.50	35.4	67.1
3/4A1/4B	67	31.7	4.97	18.1	44.0
3/4B1/4A	41	40.3	5.78	28.1	52.2

Objective 3: Estimate economically relevant traits as deviations from Angus across a United States North-South and East-West continuum.

Kansas State University

We have been working on developing genetic evaluations of male fertility related traits. We have made substantial progress in the Angus dataset, and are beginning work in Simmental.

Oklahoma State University

A third study was recently published investigating the genetic associations between pregnancy loss and economically important traits in Nellore cattle. Using records from 23,507 heifers, including 17,052 genotyped animals from a large Brazilian breeding program, the study evaluated the genetic relationships between pregnancy loss and reproductive, growth, carcass, and feed efficiency traits. Results showed that pregnancy loss has low heritability, but it is favorably associated with reproductive precocity traits such as probability of early calving and age at first calving, suggesting that indirect selection may be more effective than direct selection for reducing pregnancy loss. In contrast, associations with growth and carcass traits were generally weak, while selection for improved feed efficiency may have less favorable relationships with pregnancy maintenance. These findings may help inform U.S. beef production systems by identifying reproductive indicators that can be used alongside economically relevant traits to compare and evaluate Bos indicus–influenced cattle. Additional economically important traits are currently being investigated to support these comparisons further.

Texas A&M

1. Began joint work with East Foundation, San Antonio, TX. Low pass sequence obtained from approximately 1500 heifers across two years.
2. Table 3 shows projected breed composition based upon vendor analyses.
3. The traits obtained in the extensively managed system include weights after weaning and pregnancy rate. The first cohort was born in 2024 and exposed to bulls for the first time in 2025.

4. The original vision was to incorporate data from multiple similar herds using prominent breeds as linkages in U.S. beef production.

Table 3. Texas: Unadjusted statistics of breed proportion (%) of East Foundation heifers

Breed	Mean	Min	Max
Brahman	19.8	2.9	44.6
Angus	46.9	0.0	84.5
Shorthorn	13.3	0.0	38.8
Hereford	11.1	0.0	36
Gelbvieh	8.1	0.0	16.7
Holstein	6.6	0.0	6.6
Simmental	6.1	0.0	15.7
Limousin	4.7	0.0	4.6
Jersey	3.8	0.0	3.2
Maine-Anjou	3.6	0.0	16.4
Braunvieh	2.5	0.0	7.8
Charolais	2.1	0.0	25.7

Table 4. Unadjusted statistics for 10-month-old weight of East Foundation heifers

		10-Month-Old Weight (kg)				Pregnancy Rate	
Breed Type	**N**	**Mean**	**SD**	**Min**	**Max**	**Mean**	**SD**
Red Angus cross	625	254.7	26.77	205.4	385.0	0.86	0.35
Santa Gertrudis cross	123	259.5	26.77	190.9	325.5	0.89	0.31

Short-term Outcomes:

Objective 1: To evaluate adaptation of beef cattle to local production and environmental challenges.

University of Missouri
Dotun Olaoye under the supervision of Jared Decker, produced a research Hair Shedding EPD for the Red Angus Association of America. Hair shedding is a direct measure of an animal's ability to sense and respond to cues from the environment. This effort is assisting the Red Angus Association of America to adopt genomic predictions of hair shedding. Olaoye is a USDA-FFAR Fellow supported by matching funds from Angus Genetics Inc and the Red Angus Association of America.

Objective 2: Estimate heterosis in Brahman-*Bos taurus* crosses.

Objective 3: Estimate economically relevant traits as deviations from Angus across a United States North-South and East-West continuum.

Outputs:

Objective 1: To evaluate adaptation of beef cattle to local production and environmental challenges.

Objective 2: Estimate heterosis in Brahman-*Bos taurus* crosses.

Objective 3: Estimate economically relevant traits as deviations from Angus across a United States North-South and East-West continuum.

Activities:

Objective 1: To evaluate adaptation of beef cattle to local production and environmental challenges.

South Dakota State University Agricultural Experiment Station
(PI M Gonda) has collected methane and carbon dioxide phenotypes on 1,494 cows on pasture in three herds in Western South Dakota. Collaborating ranches raise black Angus cattle. We focused on black Angus cattle because this breed has the most registrations in the USA and in South Dakota. Animals in this study will range from 3-16 years of age and the ranches all practice rotational grazing during the summer grazing season. These ranches represent typical grazing livestock production systems in the NGP. Plant species composition of the ranches is typical Northern mixed-grass prairie (Samson et al., 1996). The vegetation is dominated by cool- and warm-season perennial grasses, including needle grasses (e.g., green needlegrass *Nassella viridula* [Trin.], porcupinegrass *Hesperostipa spartea* [Trin. & Barkworth], needle-and-thread *Hesperostipa comata* [Trin. & Rupr.], and wheatgrasses. Wheatgrasses include western wheatgrass *Pascopyrum smithii* [Rydb.] Á. Löve, slender wheatgrass *Elymus trachycaulus* [Link] Gould ex Shinners, and bearded wheatgrass *Triticum caninum* [L.] (USDA-FS, 2023). Farther east, nearing the tall-grass prairie, warm-season grasses such as big bluestem *Andropogon gerardii* [Vitman], little bluestem *Schizachyrium scoparium* [Michx.] Nash, and sideoats grama *Bouteloua curtipendula* [Michx.] Torr. are more prevalent

(USDA-FS, 2023). Ranches within this study are clayey or loamy ecological sites and represent major land resource areas (MLRA) of 63B, 53B, and 102D.

All animals used in this study were fitted with electronic identification ear (RFID) tags that can be interrogated by the GreenFeed system used to measure enteric methane and carbon dioxide emissions. GreenFeed units were deployed with grazing beef cows and calves for the duration of the grazing season. Each GreenFeed unit was filled with a "Sweet Feed" pellet, which is a mix of grains and molasses, to entice animals to utilize the GreenFeed unit. When cows ate this pellet from the GreenFeed units, the units record enteric methane and carbon dioxide emissions.

An ear notch tissue sample has been collected on all cows, and the DNA has been isolated from ~75% of these tissue samples. A total of 384 DNA samples has been sequenced (average 0.5X sequencing coverage) to identify genetic variants that will be later assessed for their association with phenotype.

Mississippi State University

Fall calving 2025 Angus cows were bred to A.I. sires with extreme hair shedding EPDs for the fourth breeding season. Data were collected for pooling for the duration of the S-1086 regional project for objective 1. Fall born 2024 Angus bulls (n=19) and heifers (n=15) were evaluated for growth and hair shedding from May to July.

Objective 2: Estimate heterosis in Brahman-*Bos taurus* crosses.

University of Missouri

We are researching the genetics of heifer puberty and fertility, including in Brahman-*Bos taurus* crosses. As part of this research, we have identified genotype-by-breed interactions, indicative of epistasis. Heterosis is due to nonlinear interactions, such as dominance and epistasis.

Objective 3: Estimate economically relevant traits as deviations from Angus across a United States North-South and East-West continuum.

Milestones:

Objective 1: To evaluate adaptation of beef cattle to local production and environmental challenges.

Objective 2: Estimate heterosis in Brahman-*Bos taurus* crosses.

Objective 3: Estimate economically relevant traits as deviations from Angus across a United States North-South and East-West continuum.

Impacts:

Objective 1: To evaluate adaptation of beef cattle to local production and environmental challenges.

South Dakota State University Agricultural Experiment Station
We are assessing an indicator trait for cow feed efficiency. The goal is to improve understanding of genetic variation affecting cow feed efficiency on pasture towards the development of a genetic selection tool. Presently, beef producers have access to tools allowing selection for feed efficiency in beef calves in a feedlot or drylot setting but not cows on pasture.

Machine learning systems can be used with multiple image systems to delineate dark vs. light, and various pigmentation with high accuracy.

An appropriate winter coat scoring system for ½ Brahman or greater should be based on quantity of coat, rather than shedding pattern.

Mississippi State University
Matings will continue to be made to produce animals with extremes in hair shedding phenotypes. This will allow for populations to be created and evaluated for production traits and their association to hair shedding.

Objective 2: Estimate heterosis in Brahman-*Bos taurus* crosses.

Objective 3: Estimate economically relevant traits as deviations from Angus across a United States North-South and East-West continuum.

Publications:

Objective 1: To evaluate adaptation of beef cattle to local production and environmental challenges.

Abrams, A.N., L.A. Kuehn, J.W. Keele, M.G. Gonda, and T.G. McDaneld. 2025. Evaluation of nasal microbial communities of beef calves during pre-weaning outbreak of bovine respiratory disease. Animals 15(19): 2914. https://doi.org/10.3390/ani15192914

Gonzalez-Hernandez, J.L., M.G. Gonda, F. Boehm, R. Kaushik, P. Urso, J. Martin, and P. Naduvathu. 2026. Bison genomics at scale: 95.7 Mb auN assembly reveals a 90% fixed functional genome. Advances in Genome Biology and Technology Agricultural Meeting, Phoenix, AZ.

Keppers, H.A. and M.G. Gonda. 2025. Lethal White Foal Syndrome: A review. Canadian Journal of Animal Science 105: 1-8.

Lammers, S.E., Z.K. Smith, J.K. Grubbs, K.R. Underwood, C.E. Bakker, M.G. Gonda, J.L. Gonzalez Hernandez, K.C. Olson, and A. D. Blair. 2026. Programming Carcass Composition Through Gestational Nutrition. Reciprocal Meats Conference, Amarillo, TX.

Viskupič, F., R. Daly, D. Wiltse, and M.G. Gonda. 2026. The relationship between personal COVID-19 vaccination decisions and cattle vaccination practices: Evidence from a survey of South Dakota beef producers. PLoS ONE 21(5): e0349234. https://doi.org/10.1371/journal.pone.0349234

Shaffer, WR, JAH Moreno, NM Bello, R Noland, CM Ahlberg, K Bruno, CR Krehbiel, MS Calvo-Lorenzo, CJ Richards, SE Place, U DeSilva, LA Kuehn, RL Weaber, JM Bormann, and **MM Rolf.** 2025. Beef cattle phenotypic plasticity and stability of dry matter intake and respiration rate across varying levels of temperature humidity index. Journal of Animal Science 103, 2025, skaf115. https://doi.org/10.1093/jas/skaf115.

Nogueira E, Torres Junior RAA, Ferreira LCL, Cordeiro DAG, Pedro FO, Carvalho I, Martins JCA, Siqueira F, Prata AR, Menezes GR, Otto PI, Sutovsky P, Moraes JGN, Amorim ST. Genetic and Environmental Factors Affecting Pregnancy Loss in Nellore Cattle: Insights from a Large-Scale Brazilian Field Database. Journal of Animal Science, 2026. https://doi.org/10.1093/jas/skag176

Engle, B.N., C.A. Gill, J.E. Sawyer, D.G. Riley, J.O. Sanders, and A.D. Herring. 2026. Influence of first calving date on stayability and productivity in Bos indicus-Bos taurus crossbred cows. Transl. Anim. Sci. 10:txag051. Influence of first calving date on stayability and productivity in Bos indicus-Bos taurus crossbred cows

Riley, David, Andy Herring, Clare Gill, Penny Riggs, and Jim Sanders. 2025. Cattle breeding & genomics projects at TAMU. Proc. 71st Annual Texas A&M Beef Cattle Short Course. Pages 230 to 239.

Ali, I., H. Yu, J. Wang, T. Smith, R.C. Vann, J.G. Powell, J.W. Thorne, E. van Marle-Köster, L.W. Bauer, M.M. Rouquette, D.G. Riley, and L.L. Hanna. 2025. Using two-dimensional facial images of Hereford crossbred cattle as a source of computable trait for facial patterns: from images to biological trait. J. Anim. Sci. 103(Suppl. 2):2(Abstr.). https://doi.org/10.1093/jas/skaf170.002

Melby, C.S., D.G. Riley, C.R. Dahlen, K.C. Swanson, K.A. Ringwall, and L.L. Hanna. 2025. Systematic effects influencing hair shedding in Admixed beef heifers in the Northern Great Plains. J. Anim. Sci. 103(Suppl. 2):2(Abstr.). https://doi.org/10.1093/jas/skaf170.004

Objective 2: Estimate heterosis in Brahman-*Bos taurus* crosses.

Objective 3: Estimate economically relevant traits as deviations from Angus across a United States North-South and East-West continuum.

Bis FC, Silva Neto JB, Brunes LC, Pereira L, Espigolan R, Oliveira ECM, Pereira A, Ferraz JBS, Baldi F, Amorim ST. Genetic associations between pregnancy loss and

economically important traits in Nellore cattle. Journal of Animal Science, 2026. https://doi.org/10.1093/jas/skag130