

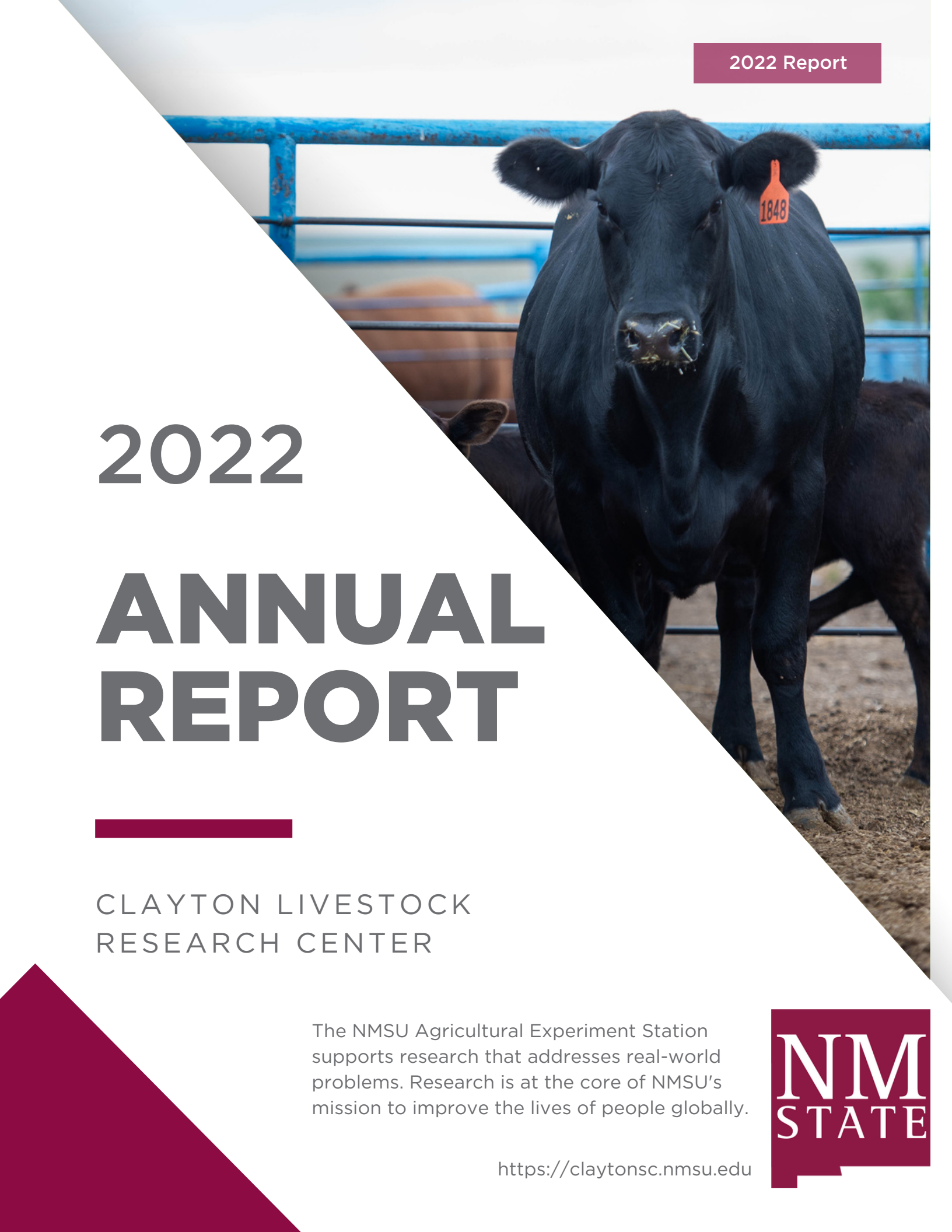
2022 ANNUAL REPORT

CLAYTON LIVESTOCK
RESEARCH CENTER

The NMSU Agricultural Experiment Station supports research that addresses real-world problems. Research is at the core of NMSU's mission to improve the lives of people globally.

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Notice to Users of this Report

This report has been prepared to aid Science Center staff in analyzing the results of various research projects from the past year and to record data for future reference. These are not formal Agricultural Experiment Station Report research results. The reader is cautioned against drawing conclusions or making recommendations as a result of the data in this report. In many instances, data represents only one of several years' results that will ultimately constitute the final formal report. Although staff members have made every effort to check the accuracy of the data presented, this report was not prepared as a formal release.

None of the data are authorized for release or publication without the written prior approval of the New Mexico Agricultural Experiment Station.

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Agricultural Science Center Locations Map

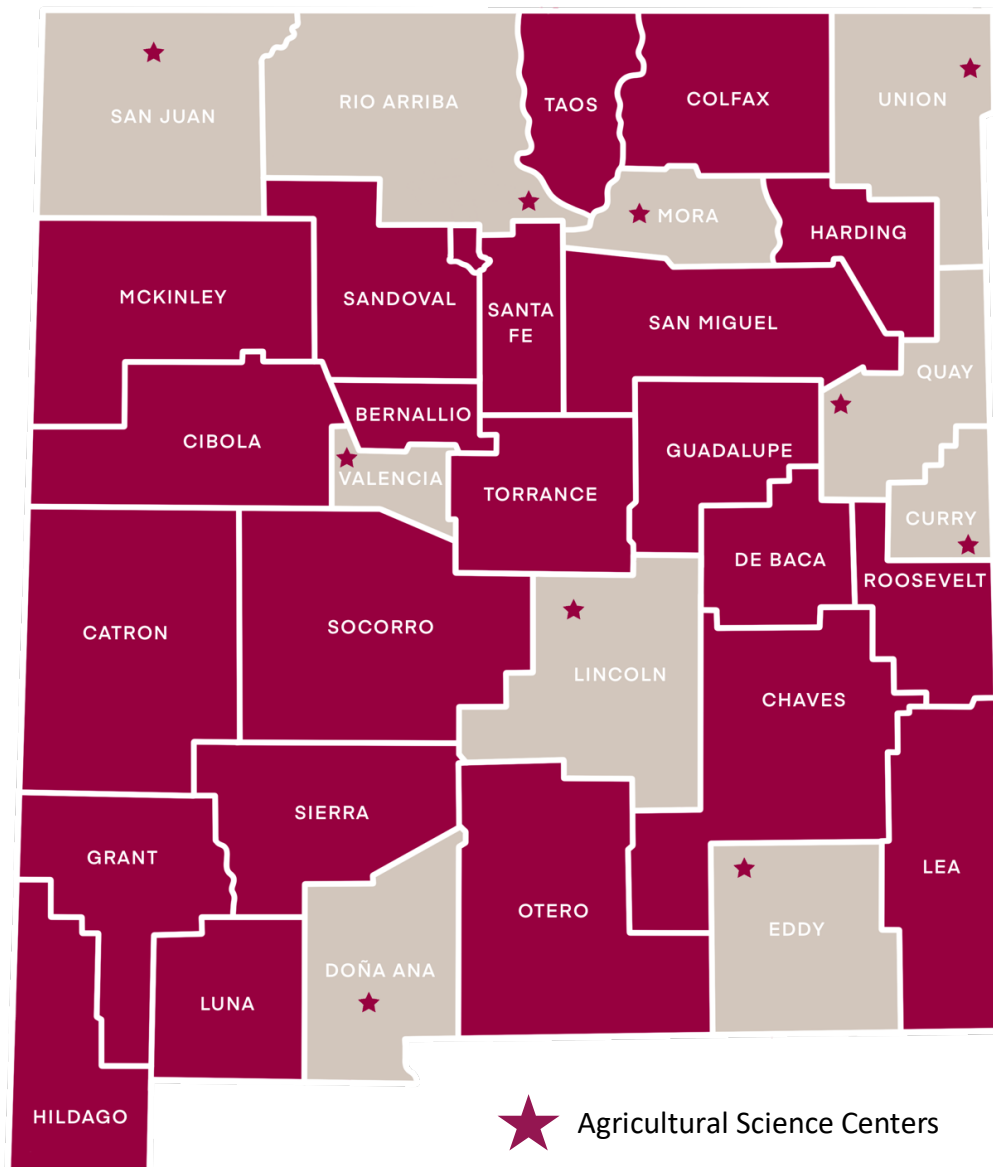


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Executive Summary

Research at the Clayton Livestock Research Center (CLRC) took a heavy hit during the Covid pandemic, with an interrupted supply chain and volatile grain and cattle markets. However, 2022 saw the yard full or nearly full year-round with both receiving and finishing cattle research projects, as well as, the Sustainable Southwest Beef Project investigating the Criollo cattle during the stocker, receiving, and finishing phase.

I would like to extend a thank you to Dr. Glenn Duff for his leadership of the CLRC over the last several years and acknowledge and congratulate him for his time and service to the American Society of Animal Science as the immediate Past-President, and a member of the Board of Directors, as well as, serving on the ASAS Foundation Board of Trustee, and the ASAS Accreditation Council. Many times these are thankless volunteer services of real importance that do not get the acknowledgment they deserve. Glenn's tireless service to the advancement of the ASAS was noticed and he was selected for the Distinguished Service Award of the Western Section American Society of Animal Science this past year.

I would also like to give a shout-out to one of CLRC's graduate students, Kenzie Smithyman, she won First Place M.S. Poster competition at the National ASAS Meeting in Oklahoma City, as well as, Runner Up in Graduate Student Competition at the Plains Nutrition Council Conference in San Antonio. Congratulations to both Glenn and Kenzie on a job well done with a great representation of the CLRC and NMSU!

While research is again in full swing, it has not precluded the design and initiation of the feed mill modernization plans funded through the FY22 Legislative Session and a remodel of the interior of the processing barn with both having a June 2023 completion target date. The modernization of the feed mill will include a new roof, repairs to the main structure, and complete electrical re-wire and computerization of the milling operations. These upgrades will bring the mill to current standards in the milling process and make operations safer, as well as, more precise in providing research nutrition for cattle on trial. Remodeling the processing barn will complement the recently upgraded cattle handling facility and will provide a more comfortable and efficient space with new medicine and equipment storage area, restrooms, and an enclosed common area to take a break from the weather elements, as well as, give more flexibility for outreach and student education with more convenient experiential, chute-side educational activities.

In addition to remodeling activities, the CLRC has increased research opportunities with the addition of multiple C-Lock Inc. products. Nine SmartFeed units have been added to three pens and are state-of-the-art, digital, individual animal recording feeding bunks. Additionally, those three pens now have SmartWeigh systems that gather body weight measures every time an individual animal goes to the water trough. Last, CLRC will soon be able to measure differences in greenhouse gas emissions from cattle as they investigate diets, supplements, and genetics, as well as, unlimited possibilities that will arise in the future through the addition of two GreenFeed systems.

These new additions and upgraded facilities will be an enhanced opportunity for the two new faculty additions to be stationed at the CLRC and searches for both are currently in the application process. These two new positions will complement current research through strengthened beef cattle nutritional research and the addition of microbiome expertise. As you can see, these are exciting times for CLRC. We intend to highlight current research and showcase the improved facilities, new equipment, and enhanced capabilities of the research center this fall at our field day in mid-September.

Research Projects

Evaluation of access and consumption of a supplemental water source for newly received feedlot calves for rehydration and repletion of trace minerals – Investigators: Vinícius Nunes de Gouvêa (PI), Glenn C. Duff (co-PI)

Effects of dietary fat and roughage level on intake, growth performance and immune function of highly stressed, newly received feedlot calves – Investigators: Vinícius Nunes de Gouvêa (PI), Glenn C. Duff (co-PI)

Effects of roughage level and bunk management on growth performance, nutrient digestibility, and ruminal metabolism of finishing beef cattle – Investigators: Vinícius Nunes de Gouvêa (PI), Glenn C. Duff (co-PI)

Comparison of Raramuri Criollo vs. Brangus cows and effects on Chihuahuan vegetation and soils – Investigators: Glenn C. Duff (PI), Santiago A. Utsumi (co-PI), Rick E. Estell (co-PI)

Evaluation of vaginal temperature and DART score in newly received heifers - Investigators: Glenn C. Duff (PI)

Evaluation of the timing of colonization and source of *Mannheimia haemolytica* in newborn beef calves - Investigators: Glenn C. Duff (PI)

Evaluation of access and consumption of a supplemental water source for newly received feedlot calves for rehydration and repletion of trace minerals

Investigators: Vinícius Nunes de Gouvêa (PI)(vinicius.gouvea@ag.tamu.edu) Glenn C. Duff (co-PI) (glennd@nmsu.edu)

Project Overview: Oral hydration therapy has been used to improve the performance and health of newly received feedlot calves; however, little is known regarding water intake following arrival at the feedlot. Our objective was to evaluate the water intake of newly received feedlot calves provided a supplemental water source or a novel nutritional rehydration solution during the initial 3 days following arrival. Our preliminary results indicate that providing a supplemental source of water during the initial 3 d after arrival increased total water intake and may facilitate rehydration in stressed calves following transit.

Meeting the Needs of New Mexico: A majority of New Mexico calves eventually end up in feedlots. After transportation, where cattle don't have access to water, results in dehydration which may impact the health of cattle. Providing supplemental water tanks in the feedlot impacts water intake which may help with the health of calves. Ranchers could provide supplemental water tanks before shipping that cattle may be familiar with and if provided after receiving will increase water intake.

Impact: The health of cattle continues to be an issue facing the cattle industry and approaches well over a billion dollars annually. One factor that may influence health includes hydration status and when cattle are withheld from feed and water, these factors may further complicate the issue. Providing supplemental water tanks may impact the consumption of water. Our results suggest that water intake will be enhanced by providing supplemental water tanks to newly received cattle. We hypothesized that the animals may be more familiar with the supplemental tanks and thus water intake was enhanced.

Funding Acknowledgement: Zinpro Corporation, CLRC Operational Funding

Effects of dietary fat and roughage level on intake, growth performance, and immune function of highly stressed, newly received feedlot calves

Investigators: Vinícius Nunes de Gouvêa (PI) (vinicius.gouvea@ag.tamu.edu) Glenn C. Duff (co-PI) (glennd@nmsu.edu)

Project Overview: Since energy is the first limiting element for newly arrived feedlot cattle and activation of the immune system is an energy-dependent process, increasing the fat content in receiving diets could overcome the negative effects of low energy intake and improve immune function. Feeding 30% roughage diets or adding 3.5% of yellow grease as supplemental fat increased feed efficiency during the feedlot receiving period. Adding 3.5% yellow grease (DM basis) as supplemental fat had some impact on morbidity rate, and roughage level did not affect the number of antimicrobial treatments for bovine respiratory disease, despite the numerical increase in the percentage of retreatments.

Meeting the Needs of New Mexico: Producers that retain ownership of cattle may visit with their cooperating feedlot to discuss including yellow grease in the diet of newly received calves. Feed efficiency will be improved which should result in improved returns without significantly impacting the health of their animals.

Impact: The performance of newly received cattle is generally decreased because of low feed intake after arrival. Providing more energy will not only improve performance but will also improve the immune status of newly received cattle. Improving feed efficiency and immune status will positively affect the beef industry. Our results suggest that feed efficiency was positively impacted without statistically impacting treatment for respiratory disease.

Funding Acknowledgement: CLRC Operational Funding

Effects of roughage level and bunk management on growth performance, nutrient digestibility, and ruminal metabolism of finishing beef cattle

Investigators: Vinícius Nunes de Gouvêa (PI) (vinicius.gouvea@ag.tamu.edu) Glenn C. Duff (co-PI) (glennd@nmsu.edu)

Project Overview: Combining a low roughage inclusion level with varying bunk management systems in the feedlot may alleviate the instances of digestive upset in finishing beef cattle. This study evaluated if greater roughage inclusion could improve ruminal fermentation characteristics and reduce the risks of subacute acidosis (a common problem in the feedlot industry due to concentrating concentrations in the diet) in varying bunk management systems, especially if animals are restricted to feed for some hours before next feeding. Slick bunk management is a common practice in which feed is consumed prior to the next day's feed allotment. However, this bunk management approach may impact ruminal fermentation.

Meeting the Needs of New Mexico: Producers retaining ownership of cattle could be impacted by the feeding programs. Although hard to evaluate, subclinical acidosis may impact the overall performance of cattle. Knowledge gained from this project will help feedlot nutritionists on the impacts of feeding practices on fermentation characteristics.

Impact: A majority of cattle in the United States are finished in feedlots before harvest. Most feedlots have consulting nutritionists to manage feeding practices. One such practice is feeding cattle with a "slick" bunk management whereby cattle are fed slightly less than at ad libitum intakes. This management practice has been shown to increase the overall intake of the animals. However, knowledge about the impacts of such programs on rumen fermentation is lacking. In addition, knowledge about the impacts of roughage concentrations in the diet as related to bunk management may help to improve cattle management. Our data suggest that there isn't a great influence on rumen fermentation when cattle are slightly restricted in intake.

Funding Acknowledgement: Texas Cattle Feeders Association (TCFA) and CLRC Operational Funding

Comparison of Raramuri Criollo vs. Brangus cows and effects on Chihuahuan vegetation and soils

Investigators: Glenn C. Duff (PI) (glennd@nmsu.edu), Santiago A. Utsumi (co-PI) (sutsumi@nmsu.edu), Rick E. Estell (co-PI) (rick.estell@usda.gov)

Project Overview: Ranching supports the livelihood of rural populations along the US-Mexico border in the desert Southwest. Changing climate is posing new challenges to ranchers across the region. At the Chihuahuan Desert Rangeland Research Center, we have found that in southern New Mexico, summers are getting hotter, rainfall is becoming more variable, and the onset of summer rains is happening later in the year. Over the past 50 years grass production at our research site declined by 38%. New strategies are needed to meet these unprecedented challenges.

Meeting the Needs of New Mexico: A growing number of ranchers on both sides of the US-Mexico border are beginning to raise desert hardy cattle breeds that can cope with more variable forage conditions and hotter temperatures. One such breed is the Raramuri Criollo from the Copper Canyon in Chihuahua, Mexico. This cattle biotype, which descends from cattle introduced by Spanish Conquistadors approx. 500 years ago, has been maintained with minimal crossbreeding by the Tarahumara people in the Sierras of the same name. It is believed that these cattle are better able to cope with a hotter and more variable environment while inflicting a lower environmental footprint on desert rangelands. However, up until now, the environmental footprint of these smaller and lighter cows has not been determined. Our study will compare the impact of Raramuri Criollo vs. (larger) Brangus cows on Chihuahuan Desert rangeland. We plan to monitor desert vegetation and soils as well as animal behavior, production, and well-being.

Impact: Evaluating alternative cattle breeds, particularly heritage cattle may impact decision-making by ranchers in the desert southwest on the type of cattle that are raised. With ever-increasing climate variability, traditional animal breeds may need to be defined. However, the impacts of such breeds on vegetation and impact on soils is yet to be determined. We are evaluating the impacts of a heritage animal biotype (Raramuri Criollo) on the grazing behavior of cattle in the semi-arid region of the southwest. In addition to impacts on vegetation and soils, we are evaluating the impacts of crossbreeding the heritage breed with traditional beef breeds including Angus, Red Angus, or Brangus on feedlot performance and carcass characteristics.

Collaborating Agricultural Science Centers: Chihuahuan Desert Rangeland Research Center

Funding Acknowledgement: USDA-NIFA-AFRI, USDA-LTAR

Evaluation of vaginal temperature and DART score in newly received heifers

Investigators: Glenn C. Duff (PI) glennnd@nmsu.edu

Project Overview: Cattle are evaluated constantly for morbidity with visual methods. Generally, any animal that is displaying symptoms of depression, anorexia, respiratory distress, and if they have a rectal temperature of greater than 104 degrees F is considered morbid and are administered antibiotics. However, data from observation at packing plants for lung legions indicate that the industry may not be catching all animals with respiratory disease. The relationship of the visual score with body temperature is lacking. We evaluated vaginal temperature in heifers and will correlate the with visual scores obtained by 3 trained individuals.

Meeting the Needs of New Mexico: Data from packing plants indicate that some animals may have had the respiratory disease at some point during their lifetime prior to slaughter. Whether this is at the feedlot or the ranch is unknown. The ability to identify morbid animals as it related to body temperature may improve overall management of cattle both at the ranch and also once the cattle are received at the feedlot.

Impact: Diagnosis of bovine respiratory disease is an art form at best. Limited data are available on the relationship between visual observations and other measures of respiratory disease. Better diagnosis will improve the performance of newly arrived beef cattle. In addition, there is evidence that cattle that have never been treated for respiratory disease have lung legions at slaughter. Improving diagnosis either at the ranch or in the feedlot should help to alleviate this problem and the associated impact on performance and carcass characteristics Ultimately it will improve the judicious use to antibiotics.

Funding Acknowledgement: CLRC Operational Funding

Evaluation of the timing of colonization and source of *Mannheimia haemolytica* in newborn beef calves

Investigators: Glenn C. Duff (PI) (glennnd@nmsu.edu)

Project Overview: *Mannheimia haemolytica* is an organism normally present in the respiratory tract of cattle. When cattle are stressed either as the result of normal marketing conditions or as the result of viral insults, *M. haemolytica* can proliferate and travel to the lungs where it can cause bacterial pneumonia. This condition is commonly referred to as shipping fever. It is unknown when the animals are colonized or what the source of colonization is. This series of experiments are evaluating the timing and also the source of the organism. We are sampling calves along with their dams for the determination of colonization.

Meeting the Needs of New Mexico: The beef industry is significant in New Mexico and in the United States most cattle end up in the feedlot. The bovine respiratory disease continues to be a problem at the ranch or at receiving in the feedlot. It is unknown when calves are colonized with the primary organism that causes respiratory disease. Understanding colonization may lead to more effective vaccination programs for cattle.

Impact: With bovine respiratory disease affecting the beef industry management of newly received cattle and understanding the mechanisms responsible for the disease is vital. One organism that causes bovine respiratory disease is *Mannheimia haemolytica*. This organism is normally present in the nasal passages of cattle. If the animal is stressed, the organism can proliferate and travel to the lungs. Understanding when and how the organism is colonized may lead to more effective vaccination programs for cattle and lessen the impact of respiratory disease on the industry.

Funding Acknowledgement: CLRC Operational Funding

Grants and Contracts

- Novel Strategies to Increase Sustainability of Beef Production Systems in the Western United States, \$8,937,554 Ongoing Year 4
- Texas Cattle Feeders \$6,500 completed
- Zinpro Corporation \$20,000 completed

Research Publications

2021

- Brooks, J.M., Randall, J.J. and Duff, G.C., 2021. Effects of preconditioning on the nasopharyngeal microbiota of beef calves grazing winter wheat. *Translational Animal Science*, 5(Supplement_S1), pp.S11-S15.
- Brooks, J.M., Randall, J., Steiner, R., Briggs, R. and Duff, G.C., 2021. PSXVI-28 Late-Breaking: Effects of Preconditioning (Value Added Programs) on the Health, Performance, *Mannheimia haemolytica*, and *Pasteurella multocida* in Cattle Received on Winter Wheat Pasture. *Journal of Animal Science*, 99(Supplement_3), pp.382-383.
- Campbell, D.L., Gouvêa, V.N., Smithyman, M.M., Batistel, F., Cooke, R.F. and Duff, G.C., 2021. Effects of supplementation with a bioactive phyto-compound on intake, growth performance, and health of newly received feedlot calves. *Translational Animal Science*, 5(Supplement_S1), pp.S16-S19.
- Gouvêa, V.N., Duff, G.C., Sowers, C.A. and Barnes, M.L., 2021. Effects of supplemental phytomolecules on growth performance, carcass characteristics and liver abnormalities of finishing beef steers. *Journal of Applied Animal Research*, 49(1), pp.324-329.
- McIntosh, M.M., Estell, R., Cibils, A., Cox, A., Nyamuryekung'e, S., Duni, D., Duff, G.C., Spiegel, S., Brandani, C., Utsumi, S. and Gouvêa, V.N., 2021. PSX-A-6 Late-Breaking: Conventional vs Heritage cattle supplement intake, weight-gains and body condition scores on Chihuahuan desert pasture. *Journal of Animal Science*, 99(Supplement_3), pp.375-376. Collaborative with CDRRC and USDA-JER
- Smithyman, M.M., Gouvêa, V.N., Campbell, D.L., Duff, G.C. and Branine, M.E., 2021. PSI-11 Effects of a supplemental water source and trace-mineral based electrolyte drinking solution on intake and blood cell count of newly received feedlot calves. *Journal of Animal Science*, 99(Supplement_3), pp.282-283.
- Smithyman, M.M., Gouvêa, V.N., Oliveira, M.O., Giacomelli, H.J.M., Campbell, D.L., Batistel, F., Cooke, R.F. and Duff, G.C., 2021. Effects of supplemental fat and roughage level on intake, growth performance, and health of newly received feedlot calves. *Translational Animal Science*, 5(Supplement_S1), pp.S25-S29.

2022

- Birkenstock, B., Figueroa-Zamudio, J.J., Soto-Navarro, S.A., Duff, G.C., Gouvea, V.N., Marks-Nelson, E., Yates, D.T., Akter, A., Smythe, B.G., Smith, K.E. and Löest, C.A., 2022. PSI-1 Effects of Pre-Transit Diets and Road Transportation on Plasma, Salivary Cortisol, and Rumen Environment of Beef Heifers. *Journal of Animal Science*, 100(Supplement_4), pp.20-21.

- Galyean, M.L., Duff, G.C. and Rivera, J.D., 2022. Galyean Appreciation Club Review: revisiting nutrition and health of newly received cattle—what have we learned in the last 15 years?. *Journal of animal science*, 100(4), p.skac067.
- Lauriault, L.M., Marsalis, M.A., Cox, S.H. and Duff, G.C., 2022. Seasonal Mass, Performance under Grazing, and Animal Preference for Irrigated Winter Cereal Forages under Continuous Stocking in a Semiarid, Subtropical Region. *Grasses*, 1(1), pp.1-11. Collaborative with REKASCT, CRLRC, and ASC-Los Lunas
- Lauriault, L.M., Schmitz, L.H., Cox, S.H., Duff, G.C. and Scholljegerdes, E.J., 2022. A Comparison of Native Grass and Triticale Pastures during Late Winter for Growing Cattle in Semiarid, Subtropical Regions. *Agronomy*, 12(3), p.545. Collaborative with REKASCT and CRLRC.
- Nyamuryekung'e, S., Duff, G.C., Estell, R., Utsumi, S., Funk, M., Cibils, A., Cox, A., Gong, Q., Cao, H., Spiegel, S. and Gouvêa, V., 2022. PSXIII-7 Field Testing of Lora-wan Sensors for Real-Time Tracking and Biosensing of Brangus and Raramuri Criollo Cattle Grazing a Small Pasture. *Journal of Animal Science*, 100(Supplement_3), pp.203-203. Collaborative with CDRRC and USDA-JER
- Smithyman, M.M., Gouvêa, V., Campbell, D.L., Duff, G.C., Loest, C.A. and Branine, M.E., 2022. PSI-17 Effects of a Supplemental Water Source and Trace-Mineral Based Electrolyte Drinking Solution on Intake and Blood Cell Count of Newly Received Feedlot Calves. *Journal of Animal Science*, 100(Supplement_3), pp.231-231.

Cooperators and Collaborators

Individuals

Mr. Leonard Laurialt, Superintendent, Tucumcari Agricultural Science Center
Dr. Kevin Lombard, Superintendent, Farmington Agricultural Science Center
Dr. Andres Cibils, Professor, Animal and Range Sciences, NMSU, Las Cruces
Dr. Clint Loest, Professor, Animal and Range Sciences, NMSU, Las Cruces
Dr. Sergio Soto-Navarro, Professor, Animal and Range Sciences, NMSU, Las Cruces
Dr. John Richeson, Associate Professor, West Texas A & M University
Dr. Brent Auverman, Resident Director, Texas Agri-Life, Amarillo
Dr. Jackie Rudd, Professor, Texas Agri-Life, Amarillo
Dr. Sara Capik, Assistant Professor, West Texas A & M University
Dr. Fernando Batistel, Utah State University
Dr. Mark Branine, Zinpro

Institutions

New Mexico State University, Las Cruces
Agricultural Science Center Tucumcari
Agricultural Science Center Farmington
Jornada Experimental Range USDA Las Cruces
West Texas A & M University
Texas A & M University
Utah State University
Texas Cattle Feeders Association (TCFA)

Industry

Zinpro
Cargill
Merck Animal Health
Biomin

Outreach Activities

- Staff at the CRLRC also raise and market show goats for state and regional youth. These purpose-bred animals are raised solely for youth stock showers to provide them with an affordable high-quality animal to start their show career.
- Personnel from CRLRC sponsored and manned a booth at the National Cattlemen's Beef Association annual meeting and NM Joint Stockman's. Likewise, Superintendent and Ranch manager held integral roles at the NM Wool Show and Eastern NM State Fair
- United States Beef Academy. Program sponsored by NMSU Department of Animal and Range Sciences, NMSU Cooperative Extension, Zoetis, Purina, Zinpro, IMI Global, Texas A&M, and the University of Tennessee. Directed by Drs. John Wenzel, Eric Scholljegerdes, Adam Summers, Craig Gifford, Marcy Ward, and Shad Cox. Project is held at the Corona Range and Livestock Research Center. 25 Attendees. May 15 through 21, 2022.
- Technology for Ranch Management. Program sponsored by Cooperative Extension, Sustainable Southwest Beef, and Corona Range and Livestock Research Center. Directed by Dr. Craig Gifford. 30 Attendees. October 21, 2022
- Sheep and Goat reproductive technologies. Program sponsored by the Department of Animal and Range Sciences, ReproLogix, and Corona Range and Livestock Research Center. Directed by Dr. Adam Summers and Shad Cox. 15 Attendees. November 17, 2022.

Advisory Committee

- Michael Atkinson (USFS representative): Union
- Ben Creighton: Union
- Bruce Davis: Colfax
- Bill Brokman: Union
- Curtis Kelling: Union
- Red Miller: Union
- Hilman Swagerty: Union Representing NMSU
- Boe Lopez: Colfax
- Leigh Ann Marez: Guadalupe

Personnel

- Dr. Glenn Duff, Professor/Scientist
- CiCi Sowers, Farm/Ranch Manager
- Mike Barnes, Farm/Ranch Manager
- Devon Dillon, Farm/Ranch Supervisor
- Shad Cox, Interim Superintendent