

FY 2020 Annual Report of Accomplishments and Results

South Dakota
South Dakota State University Extension
South Dakota State University Agricultural Experiment Station

I. Report Overview

The NIFA reviewer will refer to the executive summary submitted in your FY 2020 Plan of Work located in the Institutional Profile. Use this space to provide updates if needed.

1. Executive Summary (Optional)

Our activities in 2020 best reflect our critical issues laid out in our 2021 Plan of Work.

No updates.

II. Merit and Scientific Peer Review Processes

The NIFA reviewer will refer to your 2020 Plan of Work. Use this space to provide updates as needed or activities that you would like to bring to NIFA's attention.

Process	Updates ONLY
1. The <u>Merit Review Process</u>	No updates.
2. The <u>Scientific Peer Review Process</u>	No updates.

III. Stakeholder Input

The NIFA reviewer will refer to your 2020 Plan of Work. Use this space to provide updates as needed or activities that you would like to bring to NIFA's attention.

Stakeholder Input Aspects	Updates ONLY
1. Actions taken to seek stakeholder input that encouraged their participation with a brief explanation	No updates.
2. Methods to identify individuals and groups and brief explanation.	No updates.
3. Methods for collecting stakeholder input and brief explanation.	No updates.
4. A Statement of how the input will be considered and brief explanation of what you learned from your stakeholders.	No updates.

IV. Critical Issues Table of Contents

No.	Critical Issues in order of appearance in Table V. Activities and Accomplishments
1.	Families, Youth, and Communities
2.	Food Systems, Nutrition, Health, and Well-Being
3.	Regenerative Agronomic Systems
4.	Regenerative Livestock Systems
5.	Natural Resources and Environmental Systems
6.	
7.	

V. Activities and Accomplishments

Please provide information for activities that represent the best work of your institution(s). In your outcome or impact statement, please include the following elements (in any order): 1) the issue and its significance (e.g. who cares and why); 2) a brief description of key activities undertaken to achieve the goals and objectives; 3) changes in knowledge, behavior, or condition resulting from the project or program’s activities; 4) who benefited and how. Please weave supporting data into the narrative.

No.	Project or Program Title	Outcome/Impact Statement	Critical Issue Name or No.
1.	SDSU Research: Impact Analyses and Decision Strategies for Agricultural Research Increases Understanding of Economics	What is the situation? Stakeholders in the food and agribusiness sector are facing challenges such as plateauing of yields, climate change, declining availability and quality of natural resources, and shifting consumer demand. To address these challenges, research and development (R&D) investments, resulting in innovations and technology developments, are essential. Although there will be differences in the focus of public and private R&D investments, there could be spill-over effects of R&D investments from public and private sectors. The impact of R&D investments could be manifested in	Families, Youth, and Communities / #1

		<p>many ways, including increase in crop productivity and increase in input use efficiency.</p> <p>What is the issue? Who cares and why? The overall impact of R&D investments depends on the adoption and diffusion of target technologies by producers. Estimating benefits of R&D investments is required for the continuation and prioritization of R&D investments. R&D investments can result in an increased understanding of economics and R&D investments, innovation, and adoption of technologies in agriculture, as well as information that will be useful for investors and producers that will help them in their investment and adoption decisions.</p> <p>This study focuses on the following two objectives within this reporting period:</p> <ol style="list-style-type: none"> 1) Analyze the adoption and diffusion of new agriculture technologies, assess agronomic, economic, and institutional barriers to adoption, and evaluate policies to overcome such barriers. 2) Examine possible future demand for technology as influenced by changes in population, climate and other environmental factors in addition to estimating the potential benefits of prospective technological developments. <p>What has been done? Data was collected through various formats including relevant published reports and online data sources, producer surveys and consumer surveys. Two graduate students were engaged in survey research, applied econometric analysis, and policy analysis.</p>	
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		<p>Results reported from this project during the reporting period:</p> <ol style="list-style-type: none"> 1) A nationally represented consumer survey was completed that examined consumer perceptions and willingness to pay for gene-edited crops relative to genetically modified crops and conventional crops. <ol style="list-style-type: none"> a. Almost 90% of the survey respondents have heard of genetically modified (GM) crops, while only 43% have heard of gene-edited foods. b. About 48% of the sample consumed GM foods during the previous three months of the survey. c. The study showed that current consumers of GM foods are more likely to consume gene-edited foods (~50%). d. The study showed that consumers prefer conventional foods (non-GM and non-gene-edited) and providing information on technology increases consumers' willingness to pay for gene-edited foods. e. Consumers prefer gene-edited technology from universities and small domestic start-ups compared to those from multi-nationals. f. Preliminary results from the survey were presented at the 2020 Western Agricultural Economics Meeting (virtual conference). 	
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<p>2.</p>	<p>SDSU Extension:</p> <p>4-H Summer Adventure Series Provides South Dakota Youth With Safe Educational Opportunities</p>	<p>What is the situation?</p> <p>In March 2020, the coronavirus pandemic caused all face-to-face youth programs to come to a screeching halt generating much uncertainty about what educational summer opportunities would be available to South Dakota youth. Families across the state were potentially looking at a summer without activities like out of school time (OST) programs, day camps, overnight camps, sports, or 4-H events. Additionally, OST programs were scrambling to identify if they had a location to have their summer programs or if they would be virtual, and if they had enough staff to make the needed adjustments to operate safely.</p> <p>What is the issue? Who cares and why?</p> <p>To address the situation, SD 4-H had to pivot and find a new way to reach youth as well as aid our OST partners. This pivot resulted in the SD Summer Adventure series, an 11-week virtual program that covered topics like gardening, Lakota star knowledge, performing arts, and doing laundry.</p> <p>What has been done?</p> <p>Through a variety of live zoom sessions, interactive videos, hands-on youth contests, and weekly family challenges; youth learned about their communities, their environment, their food, and so much more through the SD Summer Adventure series.</p> <p>The Summer Adventure series not only created educational opportunities for youth, but it also allowed the youth to connect with other youth, 4-H professionals, and other SD professionals throughout the summer. Participation varied from week to week, but it averaged (63) youth per week.</p> <p>Results reported from this project include:</p> <p>Some of the most popular topics included Dirt vs. Soil (394 youth), Container Gardens (315), Community Service (178), Explore the Space</p>	<p>Families, Youth, and Communities / #1</p>
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		<p>(163), and Basketball Skills (157). Youth especially enjoyed the challenge competitions sprinkled throughout the summer.</p> <p>This program provided over 1,300 youth of all ages opportunities to connect virtually with others and safely try new activities with their families.</p>	
<p>3.</p>	<p>SDSU Research:</p> <p>Engineering Technologies for Novel Applications in Dairy Manufacturing</p>	<p>What is the situation?</p> <p>Dairy products have been a key component of a healthy diet and a source of many nutrients. The dairy manufacturing employs advanced processing technologies to deliver a variety of products and ingredients. New trends in consumers' life style have redefined the desired attributes of processed foods they would like to have. Assurance of microbial safety is no longer sufficient; instead modern American consumers are looking for product formulated with healthy ingredients, free of additives, fresh-like characteristics, and natural flavor. However, the design and development of ingredients and products formulated with such characteristics and without compromising the safety of the product is a major challenge from a technological point of view. Most of the desired compounds differ from the product matrix in terms of solubility, melting point, and chemical compatibility. Such compounds must first be converted into a stable phase using additives and high input of mechanical energy.</p> <p>What is the issue? Who cares and why?</p> <p>Searching for solutions to address the continuous market changes, engineers and scientists have been evaluating various technological approaches that involve the use of advanced thermal technologies (microwave, radiofrequency and Ohmic heating) and non-thermal technologies (high pressure processing, pulsed electric fields, ultrasound,</p>	<p>Food Systems, Nutrition, Health, and Well-Being / #2</p>

		<p>supercritical fluid technology) to potentially meet rising consumer expectations. Intelligent combinations of different emerging technologies have shown some promises for improving the manufacturing protocols, and enhancing overall quality and nutritional content. The challenge is that the effects of different emerging technologies on milk and its constituents are largely unknown and specific key components is still incomplete.</p> <p>What has been done?</p> <p>The overall goal of the research program is to generate scientific understanding of the behavior of dairy systems and their individual components during manufacturing.</p> <p>Two (2) objectives within this goal during this reporting period include:</p> <ol style="list-style-type: none"> 1) To investigate the efficacy of combined pressure-temperature on safety and selected quality parameters of dairy beverages. 2) To evaluate the role of pressure on emulsion stability within a wide range of processing conditions. <p>Strategies to reduce the impact of thermal processing and effectively inactivate microorganisms was studied. An example sited is hydrodynamic cavitation (HC). It is an emerging technology for continuous processing of liquid foods. HC consists of a stationary external cylinder and a high-speed rotating inner cylinder, micro-bubbles are formed within the liquid and subsequently collapse. This releases waves of energy that instantaneously elevate the fluid temperature.</p>	
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		<p>The research also studied stabilizers which play an essential role in the manufacturing of ice cream. The research used hydrodynamic cavitation (HC) to reduce the concentration of stabilizers in ice cream mix.</p> <p>Results reported from this project include:</p> <ul style="list-style-type: none"> • The project improved the researcher’s understanding of process engineering aspects of hydrodynamic cavitation, including velocity and temperature profiles, cavitation number, and residence time distribution. • Outcomes of the study present opportunities to utilize cavitation to assist thermal treatment to inactive thermoduric sporeformers with a single pass. • Information generated in this study may help to develop strategies to formulate and manufacture ice cream with reduced concentration of stabilizers. • The research program provided the opportunity to foster the next generation of dairy industry leaders by exposing graduate students to cutting-edge research. Two (2) students worked full-time on the project; a Ph.D. student and a M.S. student. They obtained skills in public speaking, writing manuscripts, process engineering, process design, and critical thinking. 	
<p>4.</p>	<p>SDSU Extension: SDSU Outreach Adapts Educational Outreach to Continue Food Preservation Training</p>	<p>What is the situation? Home food preservation education has been implemented through the Extension system for more than 100 years and has evolved over through the years. Recent rising food costs have persuaded many people to plant gardens. Consumers who use untested or outdated home food preservation techniques or recipes put the health of families at risk. With</p>	<p>Food Systems, Nutrition, Health, and Well-Being / #2</p>

		<p>the knowledge of what foodborne illnesses can occur, it is important to use proper procedures and tested recipes to prepare safe preserved foods.</p> <p>What is the issue? Who cares and why? Home food preservation is a way to preserve the freshness of homegrown or locally purchased foods. Methods include canning, freezing and drying. Whether you have excess produce from your garden, or you simply want to preserve your own jam, South Dakota State University (SDSU) Extension provides established and trusted research-based food preservation information. Without factoring in the labor costs, home food preservation can save money compared to commercially preserved foods.</p> <p>What has been done? During the 2020 fiscal year, South Dakota State University Nutrition Field Specialists adapted outreach methodology to continue providing food preservation training to constituents during the pandemic. The following efforts were implemented:</p> <ol style="list-style-type: none"> 1) In lieu of in-person food preservation workshops, a 9-session Food Preservation @ Home series was offered. In total, (181) registered for the series, with (713) views and counting on YouTube. 2) An educational effort to distribute credible, safe food preservation practices included publishing (8) videos to the South Dakota State University YouTube channel in July 2020 as follows: <ol style="list-style-type: none"> a. Troubleshooting James & Jellies: 28 views b. How to Use a Water Bath Canner: 132 views c. How to Use a Pressure Canner: 354 views d. How to Can Green Beans: 45 views e. How to Freeze Produce: 32 views 	
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		<ul style="list-style-type: none"> f. Common Questions About Canning Tomatoes: 111 views g. Types of Canners: 36 views h. Canning Equipment: 42 views <ul style="list-style-type: none"> 3) SDSU Extension Nutrition Field Specialists presented the Basics of Food Preservation at Dakotafest. Dakotafest is an event that showcases agriculture-focused products, services and technologies from over 500 exhibitors. 4) Updated the SDSU Extension Food Preservation page (https://extension.sdstate.edu/food/preservation#) and five (5) food preservation content pages including the Master Food Volunteer Program. 5) Developed and issued one publication: A Guide to Drying (https://extension.sdstate.edu/guide-drying-foods). 6) Submitted seven (7) food preservation articles on SDSU Extension’s website (https://extension.sdstate.edu/food/preservation#). 7) The Master Food Preserver (MFP) Program was launched by SDSU Extension. <ul style="list-style-type: none"> a. Created and distributed a statewide survey to gather interest in the MFP program. Received (191) responses. b. Screened applicants and collected volunteer forms as appropriate. Received (35) applications. c. Finalized Master Food Preserver Guidebook. d. Communicated with and trained (12) MFP volunteers across the state. e. In the first couple of months of being trained, (3) volunteers committed to (28) volunteer hours while reaching (306) South Dakota residents. 	
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		<ul style="list-style-type: none"> f. Audited videos of MFP volunteers practicing food preservation practices. g. Assembled six (6) MFP volunteer canning kits. <p>Results reported from this project include:</p> <ol style="list-style-type: none"> 1) As a result of the 9-session Food Preservation @ Home series, a partnership with South Dakota Specialty Producers was created to provide a place for individuals to bulk order fresh produce to preserve (https://sdspecialtyproducers.org/producers/bulk-produce/). They also promoted SDSU Extension’s preservation resources. 2) The Food Preservation @Home training course was created to expand knowledge in safe food preservation practices on water bath canning, pressure canning, and freezing. <ul style="list-style-type: none"> a. August-September 2020 – 10 submissions of interest have been received from Massachusetts, Texas, Pennsylvania, Hawaii, California, North Dakota, and South Dakota. b. Two (2) SDSU Extension professionals are active members in the North Central Regional Food Preservation Collaboration Team. These two individuals distributed the multi-state evaluations in order to gather regional impacts of food preservation courses. 3) Testimonies regarding SDSU Extension’s food preservation educational series efforts include: <ul style="list-style-type: none"> a. <i>“Thank you! These have been great. I now look forward to my husband getting his first deer now that I know how easy it is to can meats!”</i> 	
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<p>5.</p>	<p>SDSU Research:</p> <p>Winter Wheat Breeding and Genetics to Improve Quality and Performance for South Dakota</p>	<p>What is the situation? Hard red winter wheat (HRW) was planted an average of 1.4 million acres per year in South Dakota over the last 20 years, ranging from 830,000 acres to 2,100,000 acres, making it an important crop in the region. Winter wheat not only provides 10-25% yield advantage over spring wheat, but also helps conserve soil moisture and improves soil health as it is fall-seeded into no-till fields and keeps the ground covered. The SDSU winter wheat breeding and improvement program develops and releases new improved winter wheat cultivars that help to sustain and expand winter wheat production in the state by overcoming production challenges and delivering superior end-use quality wheat for the food industry.</p> <p>What is the issue? Who cares and why? It is predicted that the world population will reach 9 billion by 2050. To meet the projected food demand, agriculture productivity needs to increase at a rate of 1.8% per year, compared to the current 1% per year. Furthermore, increased productivity is vital to the profitability of producers who have been stressed by many years of increased input costs. Winter wheat is primarily grown in the dryer parts of South Dakota, and therefore cultivars with drought tolerance and winter hardiness are critical, along with pathogen/pest resistance. Developing wheat varieties with superior end-use quality is essential to meet the requirements of the</p>	<p>Regenerative Agronomic Systems / #3</p>

		<p>milling and baking industry and ensure regular supplies of ingredients to the US and world food industry.</p> <p>What has been done?</p> <p>The overall goal of the SDSU winter wheat breeding program is to make winter wheat cultivars and germplasm available with desirable characteristics such as 1) agronomic adaptation and yield potential; 2) biotic (disease and insect) and abiotic (winter hardness, drought, heat) stress tolerant, 3) end-use quality characteristics, and 4) increased return to the producers of South Dakota and the region.</p> <p>Two (2) objectives within this goal during this reporting period include:</p> <ol style="list-style-type: none"> 1) Develop winter wheat varieties of germplasm with high yield potential, high test weight, environmental stress tolerance, durable resistance to diseases and better end-use quality through the use of conventional and modern breeding strategies including marker-assisted selection and genomic selection (GS). 2) Develop an improved understanding of important agronomic traits through the use of genome-wide association studies (GWAS) and genomic prediction to alleviate constraints for effective winter wheat production. <p>Results reported from this project during the reporting period:</p> <ul style="list-style-type: none"> • During 2020, 710 unique cross combinations were developed after careful selection of parents evaluated in South Dakota growing environments or lines having specific traits lacking in our materials. The breeding operation is cyclic, with 442 F2 populations developed from crosses made in the previous year. The results of 	
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		<p>the trials are available https://extension.sdstate.edu/sites/default/files/2020-08/S-0002-2020-01-WW-Regional_Summary.pdf</p> <ul style="list-style-type: none"> • HRW variety ‘Winner’ (released 2019) topped the state yield trials both in central and eastern South Dakota. Winner offers producers an approximately 3-bushel advantage when compared to ‘Redfield’ (released in 2013), grown on 17% acres in South Dakota. This increase in yield potential can result increased revenue of \$12 per acre for the producers when compared to Redfield, demonstrating the economic impact of SDSU variety development. • Several crosses and backcrosses were performed to transfer resistance to stripe rust, wheat streak mosaic virus, and stem rust in SD material. • Semi-dwarf winter wheat lines were identified (Agate, MT06103), and Winner) with longer coleoptile that could assist in the improved establishment of winter wheat under fall drought. • ‘Watkins accessions’ is resistant to Septoria nodorum blotch (SNB), tan spot, and FHB could be employed for breeding future wheat varieties with resistance to these diseases. • During 2020, (5) graduate students were trained in the SDSU winter wheat breeding program to become future breeders in the public and private industry. Each student worked on an independent project and participated in collaborative research projects sharing their findings through posters and talks at conferences and publications (manuscripts/articles). 	
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<p>6.</p>	<p>SDSU Extension:</p> <p>SDSU Integrated Pest Management Assists stakeholders in Making Informed Decisions</p>	<p>What is the situation?</p> <p>The South Dakota Integrated Pest Management (SDIPM) program emphasizes providing professional agronomists and land managers up-to-date IPM training, developing a regional resource for insect, plant disease and weed management guidelines to address pesticide resistance management, and developing alternative pest management strategies. Improved knowledge of pest biology, impacts of environmental factors, pest forecasts, and communication that includes available technology, landowners, and managers can prevent unacceptable levels of pest damage by economical means, while posing the least possible risk to people, property, resources, and the environment.</p> <p>What is the issue? Who cares and why?</p> <p>The SDIPM program encourages stakeholders to make informed decisions for pest management to reduce input costs and environmental impacts of pesticides through the reduction of unnecessary and inappropriate applications. The SDIPM program is implemented by SDSU Extension Specialists who provide education and information on the biology of pests, impacts of pesticides, environmental factors that influence pests, and pest forecasts. The project has three goals:</p> <ol style="list-style-type: none"> 1) The first goal is to develop applied research projects that will be used for demonstration and outreach programs in collaboration with SDSU Extension agronomy and agronomy-related specialists in South Dakota. 2) The second goal is to deliver IPM resources through the development and deployment of Extension programs for South Dakota stakeholders (i.e., residents, producers, consultants, and additional members of the agricultural community.) 	<p>Regenerative Agronomic Systems / #3</p>
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		<p>3) The third goal of this project is to prepare and publish electronic and hard copies of Extension materials that will provide accurate pest updates, pest information and pest forecasts.</p> <p>What has been done? The SDIPM program is a broad-based program addressing pest management needs identified through focus and advisory groups. Annual activities include updating and developing publications/factsheets, web pages (http://extension.sdstate.edu), digital video, and educational materials and displays. Deliverables are targeted for use at grower meetings in collaboration with Extension pest management personnel, and specialized trainings for agronomy professionals and agency personnel. Newly initiated projects include the development of a best management practices for corn, soybeans, and wheat. Training focuses on pest identification resources, pest monitoring and assessment, pesticide resistance management, and evaluating pest impact through use of economic thresholds. A Pest & Crop Newsletter is distributed statewide (https://extension.sdstate.edu/sdsu-extension-pest-crop-newsletter) by the SDIPM program.</p> <p>Results reported from this project include: Pest management guides, identification guides, fact sheets, and digital articles were worked on during the Covid-19 pandemic. Due to guidelines enforced by South Dakota State University, limited research efforts were allowed during 2020, which reduced the ability to conduct applied research projects for Extension purposes. During the next reporting period research efforts will be increased to make up for the lack of opportunities presented by 2020.</p>	
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<p>7.</p>	<p>SDSU Research:</p> <p>Non-Intrusive Assessment and Management of Endoparasites in Bison Herds</p>	<p>What is the situation?</p> <p>Commercial bison production is becoming a viable industry in the U.S. and South Dakota, with its neighboring states, produce more than half of all bison meat in the nation. Management systems used in bison production range from very low-input, strictly grazing approaches (which keep stocking rates and animal handling low, and a reliance on available natural resources high) to high-input systems similar to approaches used in high-input cattle production. Management of herds that are publically-owned (by Federal or State agencies or Tribal communities) tend to focus more on low-input approaches, while the profit incentive in commercial bison herds drive producers to increase stocking densities (even to feedlot conditions) and provide animals with supplemental feeds. By concentrating animals into smaller areas, the transmission of infectious diseases increases, along with the need to monitor herd health conditions and manage health problems. These health-related activities require the use of livestock squeeze chutes (LSCs) which enables individual animals to be separated from the herd, immobilized temporarily, so that diagnostic samples can be collected to assess health issues and provided with appropriate treatments. Even in domesticated livestock, these handling processes add significant stress to the individual animal and the herd, and create opportunities for injuries to some of the animals especially cow/calf herds when calves are young. Therefore, even commercial herd owners want to minimize the need to process their bison in LSCs and are looking for technologies to monitor animal health diagnostics and apply preventatives and treatments without handling the animals.</p>	<p>Regenerative Livestock Systems / #4</p>
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		<p>What is the issue? Who cares and why?</p> <p>Limiting the stress associated with the use of LSCs is particularly important to Native American communities that rely on their herds as a source of meat and cultural products, but do so in ways that respect the autonomy of each bison individual. However, Tribes are under increasing pressure to increase stocking rates in their herds in response to increasing demand for bison meat as a health choice to decrease risk factors for cardiovascular disease. The natural nomadic and migratory behavior of bison prior to the 1800s meant that they had very little exposure to the build-up of infectious disease agents that domesticated livestock experienced throughout human history, and to the selective pressures created by this exposure. A significant portion of these infectious agents consist of various gastrointestinal (GI) parasites that have infectious stages that contaminate pastures, are chronically present throughout all livestock herds, and cause clinical disease and subclinical production losses. Bison are susceptible to the same GI parasites that plague cattle, sheep, and goats.</p> <p>What has been done?</p> <p>The overall goal of the research project is to develop non-intrusive assessment and intervention tools to improve the evaluation and management of endoparasite health issues in bison herds, where routine processing of individual bison in livestock squeeze chutes is not available or desired.</p> <p>Two (2) objectives within this goal during this reporting period include:</p> <ol style="list-style-type: none"> 1) Assess usefulness of DNA fingerprinting tools to analyze fecal samples to correlate individual bison with specific GI parasite loads. 	
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		<p>2) Determine effectiveness of radio frequency identification tags in monitoring identification and location of bison, and use of free-choice anthelmintic products.</p> <p>For the first objective, sixty-one (61) bison were identified from a tribal herd that was willing to participate in this project. Each bison was given a unique ear tag, and hair samples were collected from each animal. When possible, fecal samples were also collected and stored in 100% ethanol. The hair samples have been sent to a university lab with experience in genetic analysis of bison using DNA microsatellites. The lab recently demonstrated that microsatellite analysis of fecal DNA does not correspond well to the data generated from hair samples.</p> <p>For the second objective, a free-choice anthelmintic product was evaluated without the ability to measure how long each bison remained in the proximity of an anthelmintic block. For this study, Safe-Guard® “Pressed” 20% Medicated Deworming Protein Block containing 750 mg/lb. fenbendazole was used as the free-choice anthelmintic product because an earlier study with the same herd showed that a non-medicated 20% (high) protein pressed mineral block (similar to the Safe-Guard® 20% protein medicated deworming block) reached a higher consumption rate more rapidly than an alternative high-molasses/low protein poured mineral (similar to the Safe-Guard® En-Pro-AI Molasses Medicated Deworming Block containing 750 mg/lb. fenbendazole).</p> <p>Results reported from this project include:</p> <ul style="list-style-type: none"> • In spite of the good progress made with developing nonintrusive monitoring and treatment tools for bison at the herd level, little 	
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		<p>progress has been made with strategies to monitor parasite levels at the individual bison level.</p> <ul style="list-style-type: none"> • Results from the free-choice study found that a 10-day treatment of bison with Safe-Guard® “Pressed” 20% Deworming Protein Blocks decreased trichostrongyle egg shedding by over 95%. These findings provide a proven treatment option for bison managers who do not want to process their animals through a squeeze chute. • Due to the Covid-19 pandemic, it has not been possible to personally disseminate findings with the various bison managers in the area region. • Socially-distanced meetings with a manager of a tribal herd, located close to the South Dakota State University campus, provided an opportunity to disseminate research findings. They also offered the manager to provide researchers with a much more appropriate perspective of cultural priorities associated with a tribal bison herd and how they influence the monitoring and management of health issues within the herd. • The Covid-19 pandemic inhibited the researcher’s ability to disseminate their findings to the science community (specifically livestock parasitologists) through regional and national meetings. 	
<p>8.</p>	<p>SDSU Extension: I-29 Moo University Collaboration Establishes Widespread Learning Community</p>	<p>What is the situation? The I-29 Moo University represents a collaboration of five states (SD, IA, MN, ND and NE) University Extension personnel and representatives from the dairy industry with complementary expertise and knowledge of dairy production and management in the region. The I-29 Moo University</p>	<p>Regenerative Livestock Systems / #4</p>

		<p>Collaboration includes dairy farms and processors located within the five states and is a major representation of the nation’s dairy industry. This area is large and producers within the states face similar challenges of fluctuating feed costs and milk prices, labor management public perception, and leadership, along with other issues related to sustaining family farms and their communities. Furthermore, limited educational resources and opportunities are available to these producers and the dairy industry as a whole.</p> <p>What is the issue? Who cares and why?</p> <ul style="list-style-type: none"> • Animal welfare, particularly in calves, is an area in dairy production that is at the forefront of industry-led dairy animal care programs. Producers want to know how they can maximize best management practices in the areas of pain management for budding calves; employee training and standard operating procedures; and options for rearing calves to improve welfare, performance, and public perception. • There are many emerging issues the dairy industry needs to be able to address on a timely basis, while simultaneously reaching a large number of producers at one time. One way to do this is through the utilization of webinars, especially during the Covid-19 pandemic. • With over a million cows in the states along the I-29 dairy corridor, the resulting bull calves represent part of the 21 percent of the total beef production in the United States. While traditionally discounted in the fed market, Holstein steers are more consistent than other breeds, and have the potential for quality and yield premiums when managed correctly. Coupled with the current 	
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		<p>trend in crossbreeding dairy cows to beef bulls, improving the value of dairy and crossbred calves has the potential for significant contributions to revenue for producers.</p> <p>What has been done? The I-29 Moo University collaborated with dairy producers to provide dairy field days, a winter workshop series, webinars, an online dairy beef short course, and a webpage.</p> <p>Results reported from this project include:</p> <ul style="list-style-type: none"> • <u>A Dairy Field Day</u> was held at Tri Cross Dairy in Viborg, South Dakota. Fifty-one (51) attendees toured the facilities, dairy owners shared their experiences with utilizing crossbreeding within the dairy to create a durable and productive cow herd, and a presenter from UM discussed the reasons why there is a growing interest in crossbreeding in dairy cattle globally. • <u>Winter workshops series</u> was held with a total of (116) individuals participating in the workshops in four states (SD, ISU, NE, IA). Presentations focused on four main areas of calf management. Following each of the three (3), thirty-minute presentations, producers participated in roundtable discussions where they discussed the presentations and what was working and not working in their operations, and how they might apply the information learned to their operations. Dairy producers milking over 19,475 cows were represented throughout the workshop series, representing a significant annual economic impact to the I-29 Corridor. 	
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		<ul style="list-style-type: none"> • Three (3) <u>I-29 Moo University Webinars</u> were held and open to the public. Topics included: <ul style="list-style-type: none"> a) Dealing with a Changing Climate in Agriculture: (28) individuals attended the webinar live and (148) viewed the archived recording. b) March Dairy Outlook and Federal Dairy Legislation Update: (427) individuals attended the webinar live and (459) viewed the archived recording. c) August Global Dairy Outlook: This webinar had a total of 829 views including participants from 17 different countries. (102) individuals attended the webinar live and (727) viewed the archived recording. • <u>An Online Dairy Beef Short Course</u> was previously planned as a face-to-face educational opportunity, but was offered as a webinar instead due to the cancellation of the Central Plains Dairy Expo due to the Covid-19 pandemic. The event was geared toward producers and industry involved in dairy beef production, but was open to the public. There were (185) short course participants, including (17) states and (2) countries. • <u>An I-29 Moo University Webpage</u> was developed to provide links to an I-29 Moo University newsletter and podcast and as an avenue for promoting resources such as upcoming events. The podcast averages (22) downloads each week, the newsletter has (442) subscribers, the webpage has (85) average page views per month. 	
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<p>9.</p>	<p>SDSU Research:</p> <p>Integrative Native Insect Biodiversity Discovery</p>	<p>What is the situation?</p> <p>The native terrestrial insects of the Northern Great Plains, remain poorly understood. This lack of information restricts competent studies on pest, potential pest, invasive species, and important native species. At this time, it is impossible to factually state numbers or provide specific identifications on most of the non-pest insects of the region due to the lack of inventory data, documentation, and taxonomic verification. In regard to native pollinators this information is in demand by natural resource agencies and institutions. It's essential that biodiversity and taxonomic studies of insect groups, particularly those of directed interest such as pollinators, groups with agriculturally important specifics such as click beetles, and those of specific environmental value be fully studied. This lack of information is especially acute with regard to native pollinators and insects associated with native plants in natural and manmade grasslands and prairies.</p> <p>What is the issue? Who cares and why?</p> <p>A mistaken notion in contemporary biology and agriculture is the belief that insect diversity and their interactions with plants are well known. Both aspects are factually incorrect, except for a few species associated with traditional crops. Planned work on this project will expand knowledge on click beetle (Coleoptera, elateridae) taxonomy and biodiversity, native pollinators in june-berry (Amelanchier alnifolia), and insects associated with cup plant (Silphium perfoliatum) as an oil seed crop, as well as pollinator support native legumes for soil and range improvement. Parasitic wasps on aphids affecting legumes and grains, especially soybean and intermediate wheatgrass as a perennial grain will be sought.</p>	<p>Natural Resources and Environmental Systems / #5</p>
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		<p>What has been done?</p> <p>The overall goal of this study is to acquire new knowledge of native insect biodiversity and plant associations, including native pollinator communities, parasitoids of native and introduced aphids, impacts of land use changes on native insect diversity, and associations of those species with novel biomass feedstock and conservation seed crops.</p> <p>Two (2) objectives within this goal during this reporting period include:</p> <ol style="list-style-type: none"> 1) Document native insect biological diversity across the Northern Great Plains, especially in the Black Hills, native remnant prairies, and selected anthropogenic sites. <ol style="list-style-type: none"> a. This project surveyed the native bee pollinators in and associated with Juneberry, a commercial fruit important to indigenous cultures. b. A survey of the federally threatened Dakota skipper confirmed that anthropogenic perturbations, especially landscape alterations and large-scale plant community changes (ill-timed and high intensity grazing and haying) negatively impact the insect population. 2) Determine and describe natural insect associates of native plant species under development as biomass feedstocks, e.g., cup plant and native legume seed predators and parasitoids. <ol style="list-style-type: none"> a. This objective focused on aphid parasitoid braconid wasps. We published on parasitoid diversity in soybean fields and demonstrated that native wasp diversity is present, but ignored by most pest managers. 	
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		<p>b. A novel modification to commonly used Malaise traps to survey aphid parasitoids was found successful to improve wasp capture.</p> <p>c. A major paper was published on the agronomic impacts of seed feeding by insects on purple prairie clover. The causative factors were discovered for low seed set and loss in this plant. They are bruchine beetles, weevils, and larvae of gall midges. Purple prairie clover is a native plant high in demand for conservation, biodiversity, wildlife sustainability, and the horticultural industry.</p> <p>Results reported from this project include:</p> <ul style="list-style-type: none"> • It was determined that native bumblebees are the primary insect pollinators of this early season plant, and that overall pollinator diversity, abundance and effectiveness is depressed due to habitat loss from landscape conversion to row crops and rural development. • Twenty-seven (27) species of bees were found to frequent Juneberry plantings, with 38.8% represented by the silky-striped sweat bee, <i>Agapostemon sericeus</i>. Nine species of bumblebee were found at our South Dakota sites with 49.5% of all bumblebees represented by only the tricolored bumblebee, <i>Bombus ternarius</i>. • Continued studies of insects feeding on seeds of native grasses and legumes has resulted in the discovery of new insect-plant modes of association and undescribed species of gall midge and eulophid wasp. • The butterfly appears to no longer occur on historically documented sites in northeastern South Dakota. 	
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<p>10.</p>	<p>SDSU Extension:</p> <p>SDSU Extension RREA Program Increases Producer Knowledge of Range Management Strategies</p>	<p>What is the situation?</p> <p>South Dakota ranks 2nd in the nation in the market value of cattle and calves, and 8th in the market value of sheep. These two components of the state's agricultural industry account over \$3.2 billion in sales, or over 30% of the state's total cash receipts (USDA National Agricultural Statistics Service, 2017). Rangelands and pasture lands are critical in ensuring the sustainability of the over 16,000 ranching operations across the state that depend on them for grazing. In addition, rangelands are invaluable to the general public, providing water, minerals, open spaces, opportunities for recreation, and a way to preserve American and western heritage. Grasslands of the Northern Great Plains, including South Dakota, have long been recognized as an ecosystem at high risk.</p> <p>What is the issue? Who cares and why?</p> <p>Conservation of this resource is best ensured through the prosperity of private land ranching. With approximately 22 million acres of South Dakota's rangeland under private ownership, it is critical that landowners and managers have a thorough understanding of best management</p>	<p>Natural Resources and Environmental Systems / #5</p>

		<p>practices in order to improve long-term rangeland health, utilization, and productivity. Important considerations in development of best management practices include analysis of range condition, knowledge of the ecology of range and pasture systems, and scientific principles guiding response of rangelands to various management strategies. The South Dakota State University RREA project works with state and federal agencies, and other partners such as the SD Grassland Coalition to provide educational programs and materials for landowners.</p> <p>What has been done?</p> <p>Despite Covid-19, South Dakota State University was able to offer several educational opportunities for the RREA program during FY2020. The overall objectives of the project are to increase producer knowledge of range management strategies and increase adoption of practices that will improve overall range condition and increase economic benefits from enterprises depending on the rangeland resource.</p> <ul style="list-style-type: none"> • The Grazing School was offered in 2020 and is designed for producers and anyone with an interest in learning how to best manage grasslands to benefit livestock. Area producers shared their expertise about various topics related to grazing techniques and grassland management. Participants heard presentations in the classroom and gained experience with hands-on activities in the field with pasture association activities with cattle. • Rangeland pasture tours for public and private land managers were conducted and included a tour for partners, a pasture walk focused on grassland birds, and the South Dakota Leopold Conservation Award Tour. • Nine (9) workshops were held for agency professionals and producers, covering the topics of grass management, grazing practices, holistic resource management, rethinking chemical inputs in pastures, and low stress animal handling. 	
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