V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Animals and Their Systems

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
301	Reproductive Performance of Animals	20%		9%	
302	Nutrient Utilization in Animals	23%		25%	
303	Genetic Improvement of Animals	6%		4%	
304	Animal Genome	2%		1%	
305	Animal Physiological Processes	0%		7%	
306	Environmental Stress in Animals	4%		0%	
307	Animal Management Systems	6%		7%	
308	Improved Animal Products (Before Harvest)	9%		6%	
311	Animal Diseases	4%		34%	
312	External Parasites and Pests of Animals	6%		0%	
313	Internal Parasites in Animals	3%		3%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	1%		0%	
315	Animal Welfare/Well-Being and Protection	16%		4%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	11.3	0.0	27.5	0.0
Actual Paid	17.3	0.0	47.3	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
292746	0	628226	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
292746	0	628226	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Quantified Nutrient Supply for Lactating Cows
- Developed Vaccine Technologies
- Researched Methodologies to Increase Reproductive Performance in Animals
- Conducted Research that Leads to Muscle Growth Augmentation
- Determined the Effects of Co-product Based Lamb Finishing Diets
- Conducted Sheep Production Workshops
- Coordinated Value-Based Marketing System for Cow-calf Operations
- Developed Beef Production Workshops
- Conducted Ranch Visits
- Conducted Farm Tours

2. Brief description of the target audience

- Puerto Rico Department of Labor and Human Resources
- Veterinarians
- Dairy Producers
- Producers of Ethanol Co-products
- Cattle Producers
- Swine Producers
- Muscle Biologists
- Livestock Nutritionists
- Sheep Industry
- Cow-calf Producers
- General Public

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	14228	1388626	3891	3119

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year:	2016
Actual:	2

Patents listed

1. Multiepitope fusion antigens and vaccines and their use in treatment of enterotoxigenic diarrhea
2. Orf virus based platform for vaccine delivery

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	24	31	55

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Percentage of all Hatch Research Projects in Animals and Their Systems

Year	Actual
2016	26

Output #2

Output Measure

- Publish and Disseminate Results of Nutritional Studies in Sheep Diets
  Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Number of Learning Activities for Sheep Producers or Consumers
  Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Demonstrate Value-Based Marketing to Cow-calf Producers

Year	Actual
2016	1

Output #5

Output Measure

- Create Learning Opportunities in the Beef Industry

Year	Actual
2016	18

Output #6

Output Measure

- Number of Publications Posted on iGrow Website

Year	Actual
2016	14

Output #7

Output Measure

- Number of Articles Posted on iGrow Website

Year	Actual
2016	186

Output #8

Output Measure

- Number of Podcasts Posted on iGrow Website

Year	Actual
2016	6

Output #9

Output Measure

- Number of Radio Programs Posted on iGrow Website

Year	Actual
2016	111

Output #10

Output Measure

- Conduct Learning Events to Enhance the Dairy Industry

Year	Actual
2016	32

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of Animals and Their Systems Hatch Research Projects
2	Enable Further Research to Explore Diet Formulation Strategies for Feeding Ruminant Livestock
3	Number of Individuals Participating in Sheep Production Learning Activities
4	Number of Cow-calf Operations Participating in the Calf Value Discovery Program
5	Number of Individuals Participating in Beef Production Learning Activities
6	Sustain and Enhance Growth in Dairy Production

Outcome #1

1. Outcome Measures

Number of Animals and Their Systems Hatch Research Projects

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	31

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Production costs are the determining factor in livestock producer profitability. High feed costs, poor reproductive performance, and disease are primary concerns for producers and scientists.

What has been done
Within the College of Agricultural and Biological Sciences, there are 31 Hatch projects that are categorized in the Planned Program of Animals and Their Systems. The research activities in this program are primarily supported by our Department of Animal Science, Department of Dairy and Food Science, and our Department of Veterinary and Biomedical Sciences. Projects include but are not limited to research studies to improve health and performance in dairy cattle, epidermis repair of food animals, pre-harvest management of beef cattle, co-product feeds for sheep, milk production management for dairy cattle, vaccines for viral diseases, and reproductive efficiency in cattle.

Results
Through research, we continue to build a scientific knowledge base to improve and understand production efficiency and product enhancement, and to prevent and detect animal and human diseases. Examples include:
Early detection of subclinical diseases in dairy cows, enhance the innate immune system and speed repair of livestock wounds, growth-promoting implants in nursing calves, lamb finishing diets of soy hulls, DDG and treated corn stover, methods of controlling estrus and ovulation in cattle, heifer growth performance on reduced fat distillers dried grains, swine and bovine influenza viruses, and feeding strategies to optimize piglet quality and sow longevity. In addition, graduate students gain valuable knowledge and skills while collaborating on research projects.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
304	Animal Genome
305	Animal Physiological Processes
306	Environmental Stress in Animals
307	Animal Management Systems
308	Improved Animal Products (Before Harvest)
311	Animal Diseases
313	Internal Parasites in Animals
315	Animal Welfare/Well-Being and Protection

Outcome #2

1. Outcome Measures

Enable Further Research to Explore Diet Formulation Strategies for Feeding Ruminant Livestock

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Number of Individuals Participating in Sheep Production Learning Activities

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Number of Cow-calf Operations Participating in the Calf Value Discovery Program

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	9

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The success of a cow-calf operation can come down to the marketing strategy employed by the producer. Retained ownership is a program that allows producers the opportunity to start with as few as five of their own calves and pool them with other calves to see how they perform in a feedlot. Retained ownership can provide the greatest opportunity to realize the true value of cattle, but it can also have increased economic risks.

What has been done
SDSU Extension coordinated the Calf Value Discovery Program, a retained ownership program in which 9 cow-calf operations participated with 160 calves. The calves were vaccinated, dewormed, individually identified, and weighed. They were consigned to a local feed yard where they were fed in a single pen, visually evaluated and sold in semi-load lots.

Results
The Calf Value Discover program provides feedback to producers on feeding performance and carcass characteristics of calves. The data provides a benchmark for comparison with cattle from other operations and it also provides useful guidelines for making selection and marketing decisions in the future. Several producers are using the data to influence their breeding program and some producers are using the data to market their calves for a higher price.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection

Outcome #5

1. Outcome Measures

Number of Individuals Participating in Beef Production Learning Activities

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1406

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Beef producers face many risks in the industry, but there are many programs that can help them stay or become more competitive. An increased use of reproductive technologies results in genetically superior sires that result in calves with higher economic value. Managing heifer development is also critical for longevity and profitability.

What has been done
SDSU Extension specialists conducted numerous programs, presentations, and webinars on cattle reproduction and heifer development. Participants learned proper handling techniques of semen and artificial insemination, but the focus was on cowherd management including estrous synchronization, the pros and cons of new technology, cattle handling, nutrition interactions with reproduction, as well as herd health and genetic selection.

Results
The participants that attended the SDSU Extension sponsored artificial insemination schools gained a more in-depth knowledge of bovine reproduction and can now better manage their cowherds, which improves reproductive efficiency. They also now have the ability to artificially inseminate and to successfully set up an estrous synchronization protocol. Fifteen beef cattle veterinarians also attended a workshop and now have the ability to do liver biopsies to determine the mineral status of cattle. With more knowledge of nutrition, health, genetics, calving, and advanced reproductive technologies, beef producers will be better equipped to feed the growing world population.

4. Associated Knowledge Areas

KA Code	Knowledge Area

307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection

Outcome #6

1. Outcome Measures

Sustain and Enhance Growth in Dairy Production

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1514

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
As identified by stakeholders, the present issues and needs of the dairy industry in this region are focused on three areas: 1) Market Assessment and Accessibility, 2) Social License to Grow - public perception, and 3) Dairy Development - availability of labor, succession planning and natural resources.

What has been done
With its many partners and collaborators, SDSU Extension was involved in numerous events to present research based information to the dairy industry and the general public. Farm tours, workshops, expos, demonstrations, and festivals are all part of the outreach efforts to share information and knowledge about the dairy industry. The events were carried out to provide unbiased information, increase profitability, optimize resource management, and enhance learning communities and build partnerships.

Results
Approximately 1,514 participants at 32 events increased their knowledge of the dairy industry. The topics included cattle handling, synchronization, genetics and genomics to increase milk and herd performance, managing employees, vaccinations, nutrient management, and best management processes. During farm tours, participants had the opportunity to see a newly constructed hoop barn and different types of calf housing and milk feeding units at four farm locations. Especially valuable at the farm tours was the participants ability to network with other producers and dairy industry personnel. An additional 1,700 people participated in a 3-day event that was an excellent opportunity for the public to learn about dairy production. The event

included a tour of the SDSU Dairy Processing Plant, a Dairy Fest Carnival, and a tour of a modern dairy farm where participants were able to see what cows eat, how they are fed, and how they are milked. The efforts of SDSU Extension enhance the sustainability of the dairy industry in South Dakota and strengthen the rural economy through improved profitability.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Appropriations changes
- Other (In-complete construction of the SDSU cow/calf research and education facility)

Brief Explanation

• The research infrastructure had not been completed at the facility, which prevented completion of the objective for research of fertility in growing bulls

• Availability of funding redirected a project's original focus on managing genotypes for best carcass outcomes

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Calf Value Discovery Program

On average, feeding costs were $340.49 per animal, while total costs were $472.17 per animal. This equates to a total cost of gain of $67/100 lb. When carcasses were sold on a grid marketing basis, price ranged from $1,300.47 to 2,221.63. When including the value of the feeder calf, there was a $692.33 per animal range in return from a loss of $393.40 to a profit of $298.93. However, on average total profit was $23.63 per animal.

Artificial Insemination School

80 Participants
100% Satisfaction with Training
100% Certified in Bovine Artificial Insemination
Size of cow herd
20% - < 50 head
18% - 50-100 head
25% - 100-200 head
37% - > 200 head
Type of Cattle Operation
25% - Seedstock

64%- Commercial
10%- Club Calf
1%- Dairy
Age of Participants
35%- < 25
57%- 25 - 50
8%- > 50
Length of time in the cattle business (in years)
23%- < 5years
33%- 5 - 10 years
23%- 10 - 20 years
21%- > 20 years
Also, participants identified which segments of the operation/cowherd expected to have the greatest impact on the success of AI programs:
Health
Nutrition
Timing of Insemination
Semen Quality
Synchronization Protocols
Technician Efficiency
Facilities
If advice was needed, participants were most likely to ask:
Veterinarian
SDSU Extension Field Specialist
Neighbor who has AI experience
Semen Dealer
Feed Salesman

Liver Biopsy Wet Lab Workshop
15 Participants

On a scale of 1 to 5, with 1 being poor and 5 being excellent, the presentations were rated as follows:
Determining Mineral Status-4.1
Interpretation of Results-4.1
Liver Biopsy Demonstration-5
Liver Biopsy Practice-5

As a result of participating in the workshop, here are some of the veterinarian's plans.
Advertise liver biopsy service
Do liver biopsy to determine copper levels in high sulfate areas
Emphasize importance of mineral analysis/testing
Take liver biopsies when I have a problem with reproduction and on sick calves.
Use liver biopsy to help determine mineral status of cattle and advise clients of proper supplementation

Of the 15 veterinarians who participated, 1/3 expected what they learned in the class to benefit their business greater than $1000, 1/3 said it would be greater than $500.

Key Items of Evaluation