V(A). Planned Program (Summary)

Program # 3
1. Name of the Planned Program
Animal Systems
☑ Reporting on this Program

V(B). Program Knowledge Area(s)
1. Program Knowledge Areas and Percentage

<table>
<thead>
<tr>
<th>KA Code</th>
<th>Knowledge Area</th>
<th>%1862 Extension</th>
<th>%1890 Extension</th>
<th>%1862 Research</th>
<th>%1890 Research</th>
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<tr>
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<td>15%</td>
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Total: 100% 100% 100% 100%

V(C). Planned Program (Inputs)
1. Actual amount of FTE/SYs expended this Program

<table>
<thead>
<tr>
<th>Year: 2017</th>
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<tbody>
<tr>
<td></td>
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<td>1890</td>
</tr>
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<td></td>
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Report Date 06/18/2018
2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

<table>
<thead>
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<th></th>
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<td>644486</td>
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V(D). Planned Program (Activity)

1. Brief description of the Activity

Livestock sales in Tennessee total over $1 billion annually. Tennessee has 3.5 million acres of forages, 2.1 million head of beef cattle, 210,000 horses and 102,000 goats. Total economic impact of the livestock sector is $5 billion annually in the state. To remain viable in a competitive marketplace, livestock and forage producers must improve their management efficiency, sustainability and productivity. Tennesseans need education in maintaining or improving production efficiency, marketing, product quality and food safety.

In FY 2017, the Master Beef Producer Program was led by a team of University of Tennessee Extension specialists and agents, with the support and involvement of representatives of state agencies, businesses and organizations that have an interest in the state's cattle industry. Master Beef Producer programs were taught by agents that had completed the comprehensive training curriculum. During this training, agents were exposed to each session of the program, and were provided on-screen presentations, speaker notes, evaluation instruments, and instructions about the most effective strategies for teaching this curriculum. Industry professionals, veterinarians, and other local industry leaders were included as a part of the teaching team. The Master Beef Producer Program:

1. Included a series of 12 educational sessions that focus on cow-calf production and issues facing the beef industry. These were conducted at various off-campus locations accessible to Tennessee beef producers. These sessions included hands-on demonstrations, mini-lectures, discussions, question and answer sessions, etc.

2. Enhanced the profitability and competitiveness of cow-calf operations by providing essential, technical information.

3. Provided participants with a beef production reference manual that covered in detail the educational information presented in the sessions.

4. Allowed producers to interact with trained facilitators and encouraged sharing of ideas with other producers.

Goats are an environmentally adaptive specie of livestock, extremely opportunistic and afford the
small limited resource landowner(s) an alternative enterprise. The goat provides food security, high quality protein (for human nutrition), biological land enhancement and many 'value-added' products to increase revenue generated on a holistically sustainable rural farm. With the decrease in planted tobacco acreage and income from this traditional crop, the production of goats becomes a natural alternative. Tennessee continues to rank second in meat goats in the U.S. The total number of meat goats in Tennessee on January 1, 2009 was 133,000 head, up 9,000 head from 2008. Milk goats totaled 5,800 head, unchanged from the previous year (TN Farm Facts, February 4, 2009). Meat goat numbers have been significantly increasing within the United States since the early 1990’s but goat meat consumption has surpassed available supply, based on ethnic group statistics. The importation of goat meat (30 pound carcass equivalent) surpassed export in 1994. There is no longer an export value for goat meat; the import value has tripled.

The Tennessee Browsing Academy was extensive four day hands-on training for producers, educators / government agency personnel interested in the biological and environmentally sound practices of vegetative management with small ruminants (specifically goats). This class was taught through lecture and applied practices as the participants learn new techniques.

The most outstanding example of successful outcomes encompassing the work of extension specialists, county extension agents, and clients was the Master Meat Goat Producer Program. This program reached producers, government agencies, meat goat organizations, and 4-H groups.

UT AgResearch conducts applied and basic research in animal health, nutrition, physiology, and genomics to address high priority problems of the livestock industries. We disseminate information gained from these studies to producers, veterinarians, and others associated with the animal industries through outreach programs and publications.

Surveillance of possible disease vectors is maintained by AgResearch throughout the insect season; suspected vectors are tested for appropriate viruses. Risk factor analysis test results are compared between sites where disease risk is high vs. those where disease risk is low. Mastitis susceptible and resistant dairy cows are used to identify potential genes, immune components, and other factors associated with and responsible for mastitis resistance. A series of trials uses pigs to test various feeding regimens and feed additives to determine effects on the number of antibiotic resistant foodborne pathogens occurring in those animals and their environment. Additional studies are detecting the prevalence of antibiotic resistant bacteria associated with cattle and surrounding environments. These studies should help determine strategies to limit such foodborne risks.

Other Activities:
Conduct research on the longitudinal survival and reproductive output of meat goat does.
Conduct research on nutritional requirements for Guinea fowl.
Perform genome mapping of important production qualities in Guinea fowl.
Conduct focus group meetings to collect information from producers and consumers.
Develop and administer surveys to selected producers and consumers.
Identify selected meat goat consumers/ethnic groups/communities.

2. Brief description of the target audience

Producers, veterinarians, and others associated with the animal industry were the target audience for this planned program. Tennessee cattle producers are primarily cow-calf operators, and all of the state’s cow-calf operators were in the target audience for this planned program.
Additional target audiences: Dairy and meat goat producers, the national meat goat industry, institutions of meat goat research, ruminant livestock producers, students, public officials, Guinea fowl and poultry industries, small farmers, scientific community.

3. How was eXtension used?

Tennessee Extension personnel were part of the following eXtension Communities of Practice that informed our work on this planned program:

- Beef Cattle
- Goats
- Horses
- Sheep

V(E). Planned Program (Outputs)

1. Standard output measures

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>Direct Contacts Adults</th>
<th>Indirect Contacts Adults</th>
<th>Direct Contacts Youth</th>
<th>Indirect Contacts Youth</th>
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</thead>
<tbody>
<tr>
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<td>950</td>
<td>18322</td>
<td>1000</td>
</tr>
</tbody>
</table>

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

- Patent Applications Submitted
  - Year: 2017
  - Actual: 1

- Patents listed

3. Publications (Standard General Output Measure)

- Number of Peer Reviewed Publications

<table>
<thead>
<tr>
<th>2017</th>
<th>Extension</th>
<th>Research</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual</td>
<td>17</td>
<td>63</td>
<td>80</td>
</tr>
</tbody>
</table>

V(F). State Defined Outputs

Output Target
Output #1

Output Measure
- Number of exhibits displayed to promote awareness of and participation in this planned program.

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>8877</td>
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</tbody>
</table>

Output #2

Output Measure
- Number of research-based publications distributed as part of this program.

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>638</td>
</tr>
</tbody>
</table>

Output #3

Output Measure
- Evaluate Alternative Heating Systems for Broiler Houses (Hawkins)
  Not reporting on this Output for this Annual Report

Output #4

Output Measure
- Improve Reproductive Efficiency in Cattle (Rispoli)
  Not reporting on this Output for this Annual Report

Output #5

Output Measure
- Promote Native Grasses in Forage Systems (Keyser)
  Not reporting on this Output for this Annual Report

Output #6

Output Measure
- Improve nutrient utilization in heat-stressed lactating dairy cows (Ruis)

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>1</td>
</tr>
</tbody>
</table>

Output #7

Output Measure
- Develop novel methods of measuring temperament in bulls (Kattesh)
Not reporting on this Output for this Annual Report
V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

<table>
<thead>
<tr>
<th>O. No.</th>
<th>OUTCOME NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Extension Economic Impact: The total economic impact of Extension animal systems programs. (The target is expressed in millions of dollars.)</td>
</tr>
<tr>
<td>2</td>
<td>Beef Production and Marketing: Number of beef producers who utilized improved sires, artificial insemination or other genetic improvement methods.</td>
</tr>
<tr>
<td>3</td>
<td>Beef Production and Marketing: Number of beef producers who improved marketing methods.</td>
</tr>
<tr>
<td>4</td>
<td>Beef Production and Marketing: Number of producers who improved forages for livestock by broadleaf weed control, planting clover, stockpiling fescue or planting warm-season grasses.</td>
</tr>
<tr>
<td>5</td>
<td>Beef Production and Marketing: The number of calves managed according to Beef Quality Assurance (BQA) guidelines.</td>
</tr>
<tr>
<td>6</td>
<td>Goat Production: Number of goat producers who have implemented practices related to genetic improvement, nutrition, health, reproduction and other information as a result of the Master Goat Program.</td>
</tr>
<tr>
<td>7</td>
<td>Develop Diagnostic Devices for Animal/Human Diseases (Eda)</td>
</tr>
<tr>
<td>8</td>
<td>Supplement Nutrients for Improved Reproduction (Mulliniks)</td>
</tr>
<tr>
<td>9</td>
<td>Research to provide new information on the benefit of a new sire breed option (Savannah) and creep feeding on improving the doe output and economic return for commercial meat goat enterprises. (Browning)</td>
</tr>
<tr>
<td>10</td>
<td>Efficiency of feed utilization in poultry through knowledge and implementation of optimum nutrient requirements, especially methionine and cysteine. (Nahashon)</td>
</tr>
<tr>
<td>11</td>
<td>Genetic resource information for future and rapid selection of well performing animals and those that can transmit superior economic traits to future generations. (Nahashon)</td>
</tr>
<tr>
<td>12</td>
<td>Discovery of modes of action of probiotics and new nutrient sensing pathways leading to establishment of precise nutrient requirements of poultry, especially chickens and guinea fowl. (Nahashon)</td>
</tr>
<tr>
<td>13</td>
<td>Research to enhance income for meat goat producers through increased consumer knowledge about goat meat and retailer knowledge of goat meat preferences. (Ekanem)</td>
</tr>
<tr>
<td>14</td>
<td>Enhanced producer knowledge of marketing information to expand goat meat sales to existing markets. (Ekanem)</td>
</tr>
<tr>
<td>15</td>
<td>Efficacy of fat deposition reduction in poultry through genotyping by sequencing approach for analysis of chicken genome. (Wang)</td>
</tr>
<tr>
<td>16</td>
<td>Research intestinal microbiota as alternatives to antibiotic growth promoters for food animals and to combat human obesity (Lin)</td>
</tr>
</tbody>
</table>
Address S. aureus as causative agent of mastitis (Dego)

Develop Non-Antibiotic Strategies for Dairy Cattle Mastitis (Almeida, Prado, Luther)

Conduct basic and applied research in innate immune interferons to develop novel antiviral therapeutics for the livestock industry. (Sang)

Increasing Returns for Tennessee Equine Owners through Extension Programs

Tennessee Extension Meat Quality, Safety and Marketing Educational Program

Master Dairy Producer Program Improves Producers' Knowledge of Milk Quality

Making Tennessee Forage Producers More Efficient and Profitable

Dairy Cow Time Budgeting (Krawczel)

Outcome #1

1. Outcome Measures

   Extension Economic Impact: The total economic impact of Extension animal systems programs. (The target is expressed in millions of dollars.)

2. Associated Institution Types

   ● 1862 Extension

3a. Outcome Type:

   Change in Condition Outcome Measure

3b. Quantitative Outcome

<table>
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<tr>
<th>Year</th>
<th>Actual</th>
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</thead>
<tbody>
<tr>
<td>2017</td>
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</table>

3c. Qualitative Outcome or Impact Statement

   Issue (Who cares and Why)
   Challenges facing the beef cattle industry in Tennessee range from the adoption of very basic management practices to complicated global market drivers that affect input costs. Nutritional, reproductive, genetic, and health management are the general areas that impact profitability.
What has been done

109 UT Extension Agents and Specialists spent 35,769 hours conducting educational programs that reached 202,802 direct contacts during 2017. Best management practices in beef cattle production were taught at 2,528 group meetings, 2,344 on-site visits and 4,708 walk-in consultations in the local county office. Reach and impact, as measured by direct contacts, remained stable compared to 2016 in all categories reported. Mail, telephone and electronic communications reached 103,308 contacts. These direct methods were reinforced by 3,299 social media posts, 6,337 newspaper articles, 6,683 radio programs and 13 television programs reaching an estimated 8.4 million indirect contacts. Volunteers invested 1,352 hours of their personal time to establish a total of 55,369 direct and indirect contacts.

Results

The total economic impact of UT Extension's beef cattle programming was estimated at more than $109.3 million in savings and additional revenue.

-3,892 beef producers sold 148,975 calves that were managed for improved marketing methods, according to practices promoted by UT Extension, to increase returns by $10,875,175.

-2,860 beef producers utilized 3,958 bulls (through natural service or artificial insemination) with greater genetic potential to produce 93,964 head of calves to increase returns by $4,698,200.

-1,986 beef producers implemented reproductive management by conducting breeding soundness exams on 14,931 bulls ($74,655,000 increased returns) and pregnancy diagnosis on 47,673 cows/heifers ($19,105,200 increased returns).

Adoption of modern technologies for reproductive management increased from that reported in the previous year. These practices have dramatic impact on the profitability of beef cattle production. Thus, County Agents focused on increasing adoption of those practices and that is evident in the dramatically positive financial impact reported here. In 2017, UT Extension programming for beef cattle production and management continued to enhance the lives and livelihood of Tennessee beef cattle producers.

4. Associated Knowledge Areas

<table>
<thead>
<tr>
<th>KA Code</th>
<th>Knowledge Area</th>
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</thead>
<tbody>
<tr>
<td>307</td>
<td>Animal Management Systems</td>
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</table>

Outcome #2

1. Outcome Measures

Beef Production and Marketing: Number of beef producers who utilized improved sires, artificial insemination or other genetic improvement methods.

2. Associated Institution Types
3a. Outcome Type:
Change in Action Outcome Measure

3b. Quantitative Outcome

<table>
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3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
What has been done
Results

4. Associated Knowledge Areas

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<tbody>
<tr>
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<td>Genetic Improvement of Animals</td>
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Outcome #3

1. Outcome Measures
Beef Production and Marketing: Number of beef producers who improved marketing methods.

2. Associated Institution Types

● 1862 Extension
● 1890 Extension

3a. Outcome Type:
Change in Action Outcome Measure

3b. Quantitative Outcome

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<th>Year</th>
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3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

<table>
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<th>KA Code</th>
<th>Knowledge Area</th>
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<tbody>
<tr>
<td>307</td>
<td>Animal Management Systems</td>
</tr>
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</table>

Outcome #4

1. Outcome Measures

Beef Production and Marketing: Number of producers who improved forages for livestock by broadleaf weed control, planting clover, stockpiling fescue or planting warm-season grasses.

2. Associated Institution Types

● 1862 Extension
● 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

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3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

<table>
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<td>Nutrient Utilization in Animals</td>
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</table>
307 Animal Management Systems

Outcome #5

1. Outcome Measures

   Beef Production and Marketing: The number of calves managed according to Beef Quality Assurance (BQA) guidelines.

2. Associated Institution Types

   ● 1862 Extension
   ● 1890 Extension

3a. Outcome Type:

   Change in Knowledge Outcome Measure

3b. Quantitative Outcome

<table>
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3c. Qualitative Outcome or Impact Statement

   Issue (Who cares and Why)
   What has been done
   Results

4. Associated Knowledge Areas

   KA Code   Knowledge Area
   307       Animal Management Systems

Outcome #6

1. Outcome Measures

   Goat Production: Number of goat producers who have implemented practices related to genetic improvement, nutrition, health, reproduction and other information as a result of the Master Goat Program.

2. Associated Institution Types
● 1890 Extension

3a. Outcome Type:
Change in Action Outcome Measure

3b. Quantitative Outcome

<table>
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3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

<table>
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<th>KA Code</th>
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<td>Reproductive Performance of Animals</td>
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<td>Nutrient Utilization in Animals</td>
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<td>Genetic Improvement of Animals</td>
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<td>307</td>
<td>Animal Management Systems</td>
</tr>
<tr>
<td>311</td>
<td>Animal Diseases</td>
</tr>
</tbody>
</table>

Outcome #7

1. Outcome Measures

Develop Diagnostic Devices for Animal/Human Diseases (Eda)

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

Supplement Nutrients for Improved Reproduction (Mulliniks)

Not Reporting on this Outcome Measure
Outcome #9

1. Outcome Measures

   Research to provide new information on the benefit of a new sire breed option (Savannah) and creep feeding on improving the doe output and economic return for commercial meat goat enterprises. (Browning)

2. Associated Institution Types

   ● 1890 Research

3a. Outcome Type:

   Change in Knowledge Outcome Measure

3b. Quantitative Outcome

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
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3c. Qualitative Outcome or Impact Statement

   Issue (Who cares and Why)
   Producers need to better assess the ability of breeds to contribute to efficient market kid production under limited inputs. Many producers have made poor breed choices that have led to non-sustainable operations. Creep-feeding in meat goat systems has often been recommended and implemented without sufficient research to support the recommendation.

   What has been done
   Savanna bucks have been compared to Kiko and Spanish bucks for preweaning progeny performance. Kids born were either creep-fed or not provided creep feed to assess growth and economic outcomes. Presentations and research updates were disseminated to at industry events and academic meetings.

   Results
   Research outcomes indicated that Savanna sires did not demonstrate an advantage over Kiko or Spanish sires for kid performance. Creep feeding enhanced kid growth, but did not necessarily enhance net economic return. Dissemination of results have allowed 700 new and experienced producers to gain a better understanding of the potential benefits of informed breed selection and creep-feeding for use in commercial meat goat herds.

4. Associated Knowledge Areas

   KA Code  Knowledge Area
   307      Animal Management Systems
Outcome #10

1. Outcome Measures

Efficiency of feed utilization in poultry through knowledge and implementation of optimum nutrient requirements, especially methionine and cysteine. (Nahashon)

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
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</table>

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Methionine and lysine are essential amino acids for growth performance of poultry; however, the requirement for the amino acids methionine, cysteine, and lysine for optimum growth performance of the guinea fowl is not known. Lack of optimal dietary amino acid profiles can hamper growth performance and increase cost of poultry production.

What has been done
The methionine, cysteine, and lysine requirement for optimum growth performance of the guinea fowl was evaluated.

Results
The requirement for methionine and cysteine for by the French guinea fowl was determined to be 0.45-0.50% and 0.35%, respectively. Pearl grey guinea fowl females and males demonstrated optimum growth performance when fed diets containing 1.16% and 0.98-1.22% lysine, respectively. It was determined that these diets should be fed in phases. Genetic resource information for future and rapid selection of well performing animals and those that can transmit superior economic traits to future generations.

4. Associated Knowledge Areas

<table>
<thead>
<tr>
<th>KA Code</th>
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<tbody>
<tr>
<td>302</td>
<td>Nutrient Utilization in Animals</td>
</tr>
<tr>
<td>303</td>
<td>Genetic Improvement of Animals</td>
</tr>
<tr>
<td>304</td>
<td>Animal Genome</td>
</tr>
</tbody>
</table>
Outcome #11

1. Outcome Measures

Genetic resource information for future and rapid selection of well performing animals and those that can transmit superior economic traits to future generations. (Nahashon)

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

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<thead>
<tr>
<th>Year</th>
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<tbody>
<tr>
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<td>9</td>
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</table>

3c. Qualitative Outcome or Impact Statement

**Issue (Who cares and Why)**
Genetic resource information to aid marker assisted selection for traits of economic importance, such as feed efficiency, and to aid poultry improvement, such as the guinea fowl, is limited. Understanding the nutrient requirements and generating additional genetic resource information to aid breeding will significantly aid poultry production and profitability, especially by small scale farmers willing to raise the bird for commercial purposes.

**What has been done**
Guinea fowl sequences of the bursa, spleen and bone marrow were generated through de novo sequencing and assembled.

**Results**
Discovery of modes of action of probiotics and new nutrient sensing pathways leading to establishment of precise nutrient requirements of poultry, especially chickens and guinea fowl. A total of 114.18 GB of bases were generated and 9 assemblies were realized. These sequences will be utilized in generating immune markers for comparative mapping, future selection and genetic improvement of the avian species. 1000 genes were annotated. Transcriptome analysis of differentially expressed genes in the bursa of the guinea fowl yielded 902 differentially expressed contigs, 64 biological pathways with 35 showing activation and 5 showing suppression. It was also revealed that even at 8 weeks of age, the bursa plays an active role in disease resistance in guinea fowl.

4. Associated Knowledge Areas

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<th>KA Code</th>
<th>Knowledge Area</th>
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</table>

Report Date 06/18/2018
Nutrient Utilization in Animals
Genetic Improvement of Animals
Animal Genome

Outcome #12

1. Outcome Measures

Discovery of modes of action of probiotics and new nutrient sensing pathways leading to establishment of precise nutrient requirements of poultry, especially chickens and guinea fowl. (Nahashon)

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

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<tbody>
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</table>

3c. Qualitative Outcome or Impact Statement

**Issue (Who cares and Why)**
The gastrointestinal tract is an enormous surface inhabited by a complex and diverse community of microorganisms known as the intestinal microflora. Some of these microorganisms have been characterized while others have not, yet they might bear beneficial effects on bird performance by enhancing health and nutrient utilization.

**What has been done**
The 16s rDNA library of chicken and guinea fowl gastrointestinal microbials was constructed, enriched and sequenced, and analyzed.

**Results**
The microbial profile of chicken and guinea fowl revealed diverse probiotic bacteria whose distribution was correlated with performance characteristics in attempt to improve poultry growth and production performance. Microbial profiles of chicken and guinea fowl revealed phylogenetic diversity of these avian species consisting of almost 150 families. Chicken microbial profiles showed abundance of microbial species compared to guinea fowl. Phylum actinobacteria was more abundant in chickens than guinea fowl.

4. Associated Knowledge Areas

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<th>KA Code</th>
<th>Knowledge Area</th>
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</table>
Outcome #13

1. Outcome Measures

Research to enhance income for meat goat producers through increased consumer knowledge about goat meat and retailer knowledge of goat meat preferences. (Ekanem)

2. Associated Institution Types

● 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

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<tr>
<th>Year</th>
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</table>

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Goat producers need to meet consumer demand for nutritious alternatives to red meat. Producers need the connections with consumers to satisfy demand for goat meat. Retailers seek opportunities to gain new knowledge about goat meat. Students and researchers desire to learn about goat meat marketing research.

What has been done
Team engaged target audiences in training, focus groups, conferences, expo, field days, meetings, interactive dialogue, seminars, surveys, symposiums, tours and related educational outreach.

Results
More than one-half of study participants (males, aged 51 to 80 years), sold goats at auction markets. Eighty-seven percent of the female producers used the internet in their operations. Results showed that sale of goat meat online increased. About 20 percent of the producers who used the internet to conduct business now sell goats and goat meat online. Almost 42% of participants increased goat meat sale online since they started advertising and marketing goat meat online. Others used online to advertise products, communicate with other farmers, identify competitors, locate auction markets, obtain data on prices, purchase inputs, and maintain inventory.
4. Associated Knowledge Areas

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<tbody>
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<td>603</td>
<td>Market Economics</td>
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</tbody>
</table>

Outcome #14

1. Outcome Measures

Enhanced producer knowledge of marketing information to expand goat meat sales to existing markets. (Ekanem)

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

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<th>Year</th>
<th>Actual</th>
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3c. Qualitative Outcome or Impact Statement

**Issue (Who cares and Why)**

Market information is a critical factor for both producers and consumers. Good and timely information about the market and trends in the preferences of consumers allow the producers to track price changes and adjust production decisions accordingly.

**What has been done**

Project provided producer/consumer education on healthy attributes of goat meat to enhance market connections. Marketing survey, seminars, symposium, visits, meetings, exhibitions, and presentations were used in addressing the nutritional value and benefits of consuming goat meat. Knowledge of such benefits enhances the market value and price paid by consumers for goat meat.

**Results**

71% of non-white consumed goat meat; whites showed increasing interest in consuming more goat meat. 29% of the consumers indicated that goat meat has now become a part of their regular diet. Consumers were willing to travel long distances and pay top dollars for goat meat from local and hometown producers. About 35% developed good connections; they knew where to purchase goat meat when they need it, especially during holidays. This increased sales for local producers of goat meat. Pre- and post-activity evaluations were used to track progress and modify project.
4. Associated Knowledge Areas

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<th>Knowledge Area</th>
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<tr>
<td>603</td>
<td>Market Economics</td>
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</tbody>
</table>

**Outcome #15**

1. **Outcome Measures**

   Efficacy of fat deposition reduction in poultry through genotyping by sequencing approach for analysis of chicken genome. (Wang)

2. **Associated Institution Types**
   - 1890 Research

3a. **Outcome Type:**

   Change in Knowledge Outcome Measure

3b. **Quantitative Outcome**

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<tr>
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</table>

3c. **Qualitative Outcome or Impact Statement**

   Issue (Who cares and Why)

   What has been done

   Results

4. **Associated Knowledge Areas**

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<tr>
<th>KA Code</th>
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<tbody>
<tr>
<td>304</td>
<td>Animal Genome</td>
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</table>

**Outcome #16**

1. **Outcome Measures**

   Research intestinal microbiota as alternatives to antibiotic growth promoters for food animals and to combat human obesity (Lin)

   Not Reporting on this Outcome Measure
Outcome #17

1. Outcome Measures

   Address S. aureus as causative agent of mastitis (Dego)

2. Associated Institution Types

   ● 1862 Research

3a. Outcome Type:

   Change in Action Outcome Measure

3b. Quantitative Outcome

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<tr>
<th>Year</th>
<th>Actual</th>
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<td>2017</td>
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</table>

3c. Qualitative Outcome or Impact Statement

   Issue (Who cares and Why)
   Frequent administration of antimicrobials to healthy cows as dry cow therapy for prophylactic control of mastitis as well as for treatment of cases of mastitis resulted in increased prevalence of antimicrobial resistant bacteria in dairy farms. Antimicrobial resistant bacteria or resistance gene/s may transfer directly or indirectly from contaminated dairy products to human.

   What has been done
   We evaluated antimicrobial resistance patterns of S. aureus isolates from cases of bovine mastitis, evaluated antimicrobial resistance patterns of major mastitis pathogens in Southeastern part of US, and determined occurrence of antimicrobial resistant bacteria and resistance genes in bulk tank milk and dairy environmental (soil, feces and farm floor) samples

   Results
   We developed effective antimicrobial resistance mitigation measures in dairy cattle production system.

4. Associated Knowledge Areas

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<th>Knowledge Area</th>
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<tr>
<td>306</td>
<td>Environmental Stress in Animals</td>
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<tr>
<td>311</td>
<td>Animal Diseases</td>
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</tbody>
</table>
Outcome #18

1. Outcome Measures

Develop Non-Antibiotic Strategies for Dairy Cattle Mastitis (Almeida, Prado, Luther)

Not Reporting on this Outcome Measure

Outcome #19

1. Outcome Measures

Conduct basic and applied research in innate immune interferons to develop novel antiviral therapeutics for the livestock industry. (Sang)

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

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3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The research will examine a group of antiviral molecules that play a defense role in all livestock species and potentially to develop into an effective measure against viral diseases. In addition, the general public should be concerned due to the zoonotic fact of most viral diseases existing in livestock animals, such as flu and Zika.

What has been done
We have determined phylogenic relationships of animal type I and type III innate immune interferons across the genome assemblies of 155 vertebrate species. Compared to humans and mice, which have around 17-20 IFN functional genes, bovine and porcine IFN loci contain about 60 IFN functional genes belonging to nine unconventional IFN subtypes. Based on this molecular identification and phylogenic analyses, we are well-posited in functional characterization of these unconventional IFNs in livestock.

Results
We have cross-species determined the molecular composition of interferon gene families in major livestock species including pigs, cattle and chickens. We further reveal novel molecular features
(including double intramolecular Fab domains and novel IFN subtypes) and more than three hundred IFN homologs which are belong to unconventional subtypes other than well-studied typical subtypes of IFN-alpha and IFN-beta. A functional study using porcine interferons as examples is complete. Major results have been disseminated in several journal publications and reported in scientific conferences and symposia.

4. Associated Knowledge Areas

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<td>Animal Diseases</td>
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</table>

Outcome #20

1. Outcome Measures

Increasing Returns for Tennessee Equine Owners through Extension Programs

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

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<tr>
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<td>2017</td>
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3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The equine industry has an impressive economic and agricultural impact to the State of Tennessee. Currently, the equine industry contributes $21 million to Tennessee’s economy annually, and the state is home to over 112,000 horses, ponies, mules donkeys and burros. With over 41,000 equine operations accounting for nearly 30% of Tennessee’s agricultural acreage, UT Equine Extension programs are essential to sustainable agriculture in the State.

What has been done
An integrated, multi-disciplinary extension and applied research program is currently being revitalized to develop and disseminate information regarding equine management, nutrition, economics, environmental impact and health. In 2017, county meetings, field days, on-farm/on-site visits, news articles, publications, personal contacts and an educational website were used to promote adoption of recommended equine management practices. Additionally, the Tennessee Master Horse Program continued this year, providing an unbiased science-based statewide
educational program for equine owners, business operators and enthusiasts alike.

**Results**
The combined economic impact of Extension programs for Tennessee equine owners $518,000.00 in 2017. Individual savings based on management practices are listed below.

- 76 equine owners feed 185 equids according to recommended nutritional requirements and management practices, such as adjusting rations based on body condition score and using forage testing to make feeding adjustments, saving $54,000.00 annually.
- 69 equine owners follow recommended health practices (including deworming, vaccination, hoof, and dental preventative care) on 202 equids, saving $464,000.00 annually.

4. **Associated Knowledge Areas**

<table>
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<th>KA Code</th>
<th>Knowledge Area</th>
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<tbody>
<tr>
<td>307</td>
<td>Animal Management Systems</td>
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</table>

**Outcome #21**

1. **Outcome Measures**

Tennessee Extension Meat Quality, Safety and Marketing Educational Program

2. **Associated Institution Types**

- 1862 Extension
- 1890 Extension

3a. **Outcome Type:**

Change in Knowledge Outcome Measure

3b. **Quantitative Outcome**

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3c. **Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**
Tennessee livestock producers and meat processors must deliver safe, high quality products to consumers.

**What has been done**
Extension personnel have designed and participated in educational programs to assist livestock producers, meat processors and consumers to utilize and prepare safe, high quality meat products. Also, information on meat marketing alternatives has been developed. Information has been disseminated via public programs, media outlets and individual consultation.

**Results**
- Over 350 beef producers and agents learned marketing and processing information through "The End Product" workshop for the Advanced Master Beef Program, grass-fed beef carcass traits, and other beef-related programs.
- Approximately 200 sheep and goat producers gained knowledge of lamb/goat quality assurance and lamb/goat carcass traits and fabrication
- 35 consumers participated in a two Home Meat Processing Workshops to increase knowledge and skills related to meat processing, quality, and safety.

4. Associated Knowledge Areas

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<tr>
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<td>307</td>
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<td>Market Economics</td>
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**Outcome #22**

1. **Outcome Measures**

   Master Dairy Producer Program Improves Producers' Knowledge of Milk Quality

2. **Associated Institution Types**

   ● 1862 Extension

3a. **Outcome Type:**

   Change in Knowledge Outcome Measure

3b. **Quantitative Outcome**

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<th>Year</th>
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3c. **Qualitative Outcome or Impact Statement**

   **Issue (Who cares and Why)**
   Dairy production in Tennessee faces one of the primary issues of dairy production across the nation, which is loss of dairy farms. This is a critical issue as it was previously estimated that for each dollar of profit a dairy farm generates an additional $5-7 dollars are generated within the local economy. With an average of roughly 100 cows, a typical Tennessee dairy farm will
contribute over a million dollars to the surrounding economy. Some of the main challenges to our farms and their survivability are milk quality, efficiency of production, and cost of production. Grazing and calf management may provide opportunities to address some of this.

**What has been done**
During 2017, various group meetings, farm visits, directed mail and email, and phone calls were used to reach the state's dairy producers with research-based education. Our major educational effort was the Master Dairy Producer Program.

**Results**
- More than 100 dairy producers gained knowledge of mastitis, nutrition, and housing from their involvement in the Master Dairy Producer Program. These farm factors contribute directly to the overall productivity of Tennessee's dairy farms.
- 57 producers have gained knowledge on measures of milk quality indicators (including somatic cell count, preliminary incubation count, standard plate counts, lab pasteurized counts, etc.)
- 57 producers have learned the relationship between somatic cell counts and milk production.

4. Associated Knowledge Areas

<table>
<thead>
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<td><strong>Animal Management Systems</strong></td>
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**Outcome #23**

1. **Outcome Measures**

Making Tennessee Forage Producers More Efficient and Profitable

2. **Associated Institution Types**

- 1862 Extension

3a. **Outcome Type:**

Change in Condition Outcome Measure

3b. **Quantitative Outcome**

<table>
<thead>
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<th>Year</th>
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</table>

3c. **Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

More efficient forage production will contribute to improved profitability for Tennessee forage.
producers.

What has been done
UT Extension conducted forage educational programs reaching over 28,000 direct contacts during 2017. Stockpiling tall fescue and weed control, as well as adding clovers to grass pastures and utilizing warm-season forages were primary educational topics covered. These were taught through approximately 300 group meetings and over 984 on-site visits. These direct contacts were supported by over 100 newspaper articles and 37 radio and TV programs.

Results
On-farm interviews and surveys were used to evaluate these programs. Impacts were:
- Producers planted 39,519 acres with clover for an increased production valued at $988,000.
- Producers planted 28,741 acres with warm-season grasses for an added value of $575,000.
- Producers fed 61,242 cattle with improved hay feed practices, saving $1.5 million.
- Producers stockpiled 17,769 acres of tall fescue, reducing feeding cost by $853,000.

4. Associated Knowledge Areas

<table>
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<tr>
<td>307</td>
<td>Animal Management Systems</td>
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</table>

Outcome #24

1. Outcome Measures

Dairy Cow Time Budgeting (Krawczel)

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

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<thead>
<tr>
<th>Year</th>
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3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The ability of lactating dairy cows to meet their time budgeting needs is critical to their health and productivity. Despite the recognition that cows have amounts of lying time that they attempt to obtain in confinement systems, this aspect of management has not been evaluated with pasture-based herds.

**What has been done**
The lying behaviors of organic dairy cows either managed with a low input approach that maximized forage intake or a high input approach that maximized milk yield were investigated.

**Results**
Cows under low input management spent less time lying per day and engaged in lying in a more diurnal pattern. Cows under high input management spent more time lying and engaged in lying patterns that were driven by management practices such as milking and feeding.

4. Associated Knowledge Areas

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<tr>
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<tbody>
<tr>
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<td>Animal Management Systems</td>
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<tr>
<td>315</td>
<td>Animal Welfare/Well-Being and Protection</td>
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</tbody>
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V(H). Planned Program (External Factors)

**External factors which affected outcomes**
- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

**Brief Explanation**
The financial impact of Extension animal systems programming fluctuates from year-to-year depending on several factors including commodity prices, public policy, input costs, and land value. Extension animal systems programs continue to enhance the lives and livelihoods of Tennessee farmers.

V(I). Planned Program (Evaluation Studies)

**Evaluation Results**
New microorganisms were revealed from the gastrointestinal tract of chicken and guinea fowl. These microorganisms will be evaluated for probiotics potential and as alternatives to antibiotics in broiler production.
New recommended dietary concentrations of methionine, cysteine and lysine are being
utilized and are lower than those previously used by feeding turkey rations to guinea fowl.

Optimizing Animal Production - Extension agents emphasized quality assurance, reproductive
management, nutrition, and marketing with Tennessee beef producers, with an economic impact of
$109 million. Tennessee horse owners depend on UT Extension's research-based programs for
horse health and nutrition. UT Extension taught rotational grazing to increase forage production,
vaccinations, dental care, and correct deworming practices. These practices helped 121 horse
owners, owning more than 1,000 horses, to save a combined $605,000.

Key Items of Evaluation

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