

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Animal Production and Protection

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	2%		15%	
302	Nutrient Utilization in Animals	5%		13%	
303	Genetic Improvement of Animals	4%		10%	
304	Animal Genome	3%		10%	
305	Animal Physiological Processes	0%		10%	
307	Animal Management Systems	45%		13%	
308	Improved Animal Products (Before Harvest)	0%		1%	
311	Animal Diseases	25%		15%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	1%		2%	
315	Animal Welfare/Well-Being and Protection	1%		11%	
605	Natural Resource and Environmental Economics	4%		0%	
806	Youth Development	10%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	9.1	0.0	7.0	0.0
Actual Paid Professional	15.1	0.0	10.0	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
712713	0	1127714	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
712713	0	1029669	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	4584783	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research programs to:

- Understand the processes that control/influence reproduction at the molecular and genetic level.
- Develop and test new cropping, grazing and feeding strategies for food animals.
- Develop and evaluate management/training strategies for race horses to reduce injuries.
- Add to the understanding of various food animal genomes by improving and integrating genetic maps.
- Understanding of the genetic and molecular processes that control/influence the immune system in food animals to create new disease detection and tracking technologies.
 - Develop and evaluate new tools and strategies to detect, prevent and control emerging and reemerging livestock and poultry diseases.
 - Understanding of the environmental fate and biological effects of vaccines, steroids and other drugs fed to animals.

Extension activities to:

- Assist beef producers with implementing the mandatory electronic identification system and demonstrate methods to use the system to sharpen management skills.
 - Provide livestock producers with knowledge and skills to develop and maintain herd-health systems.
 - Provide animal industry with up-to-date animal health information.
 - Improve farm-specific environmental stewardship related to manure management, including developing whole-farm nutrient management plans, manure value, land use and neighbor relations.

2. Brief description of the target audience

Michigan animal producers, agriculture and natural resources industry representatives, animal pharmaceutical industry, animal welfare organizations, state agency representatives, state and local elected officials and the interested public.

3. How was eXtension used?

eXtension was one of the major components in 2012 for multi-state and integrated activities. Members and contributors consisted of both AgBioResearch and Extension staff (119 people contributed in 2012). The public website had 68,139 site visits (a 28% increase) and 151,906 pageviews (a 15% increase) in 2012. The Ask an Expert component had 2,072 questions answered for Michigan residents with 252 questions answered by other state experts and Michigan answering 261 questions from other states.

Ask an Expert statistics were analyzed for our program areas and found for Animal Production and Protection there were 11 staff paid by formula funds (4 fte). A few examples were:

Question: Does the bull determine the length of gestation in a cow or is the cows age and whether or not the bull is calving ease determine the gestation

Answer: Gestation length varies by age of dam, breed, and sex of the calf. Gestation length ranges from 279 to 287 days. For most breeds, 283 days is common. Cows carrying bull calves tend to have a slightly longer gestation compared to cows carrying heifer calves. First-calf females tend to have a shorter gestation than mature cows, but that may be due to their being bred to calving-ease bulls, and they may be calving easier because they sire calves that are *in utero* for a shorter length of time. Browse related Faqs by tag: beef cattle, gestation Thank you for using eXtension's Ask an Expert function.

Question: How many acres does a 1 cow need for eating?

Answer: 5 acres

Question: I have a 6 yr old QH Gelding. Showing all the signs of ulcers and excess gas. We are treating with the GastroGard, what would be the best hay and grain for this animal. Research of the low carb/sugar leave me lost.

Answer: The best diet for all horse, and especially those with ulcers is a forage based diet (hay and pasture). If addition calories are needed, use a complete feed or a fat supplement.

Question: What is wrong with chickens thats legs are out in front of them and they can't stand?

Answer: There could be a disease issue, a nutrition issue, or perhaps a management issue. However, I don't have enough information to provide guidance on one of these areas. Please provide some additional information on type of chicken, age, feeding program, management program, and anything else you want to share.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1326	2652	15154	30308

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

Patent Applications Submitted

Year: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	1	44	45

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of research programs on animal production and protection.

Year	Actual
2012	40

Output #2

Output Measure

- Number of adult participants trained in animal management systems.

Year	Actual
2012	663

Output #3

Output Measure

- Number of youth participants trained in animal management systems.

Year	Actual
2012	15154

Output #4

Output Measure

- Number of adult participants trained in animal diseases.
Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of adult participants with increased knowledge about animal management systems.
2	Number of youth participants with increased knowledge about animal management systems.
3	Number of adult participants with increased knowledge of animal diseases.
4	Number of research programs to understand the processes that control/influence reproduction at the molecular and genetic level.
5	Number of research programs to add to the understanding of various food animal genomes by improving and integrating genetic maps.
6	Number of research programs to develop and evaluate new tools and strategies to detect, prevent and control emerging and reemerging livestock and poultry diseases.
7	Number of research programs to understand the environmental fate and biological effects of vaccines, steroids and other substances fed to animals.
8	Number of research programs to develop and evaluate management/training strategies for horses to reduce injuries.
9	Number of research programs to add to the understanding of animal behavior and welfare.
10	Number of research programs to test new cropping, grazing and feeding strategies for food animals.

Outcome #1

1. Outcome Measures

Number of adult participants with increased knowledge about animal management systems.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

One example is for beef producers to help them increase profitability while improving quality of the animal and protecting the environment.

What has been done

MSUE conducted a four-part webinar series called "Opportunities in Beef Production & Marketing"

Results

Thirty five individuals participated in one or more of the webinars in the four-part series held in February and March 2012. An online survey was sent to all participants at the conclusion of the series with two follow-up reminders to those who had not completed the survey. Response rate was 55 percent (n=19).

Participants reported that they planned to use much of the information presented in the series. Ten of the thirteen topics covered in the series received high marks with 90 ? 100 percent of participants reporting that they would use the information in their business or farm operation. Current Cost of Beef Production and Identifying Market Potential & Consumer Demand Trends appeared to be the most useful segments with 100 percent of respondents reporting they planned to use the information from these webinar segments.

A behavior check list assessing potential changes that participants may make in their operations in the next nine months showed that producers are planning significant change. Sixty-one percent plan to expand their existing beef herds and 22 percent plan to begin raising beef that are not currently raising beef. Eleven percent reported they plan to change their production method for producing beef and 17 percent plan to change the type of genetics they are using. Thirty percent

reported they plan to expand direct marketing efforts and 11 percent plan to begin direct marketing.

Twenty eight percent plan to begin marketing a differentiated beef product (ex. grass fed, organic or no added hormones) and 17 percent plan to expand marketing of a differentiated beef product. Eleven percent plan to develop a branded meat product. Half of the respondents reported they plan to write a business plan and 22 percent plan to update their existing business plan.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
311	Animal Diseases

Outcome #2

1. Outcome Measures

Number of youth participants with increased knowledge about animal management systems.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	12123

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

It is critical youth learn about animal management, life skills, and to examine if this is an area that they may wish to pursue a career.

What has been done

One example is where MSUE conducted a 4-H Horse camp where the objectives of the horse camp were to help youth:

- learn horsemanship skills
- increase knowledge and interest in the area of equine science
- increase knowledge of equine project related careers
- learn important life skills such as teamwork, critical thinking, problem solving, decision making

Results

Thirty-nine youth completed evaluation surveys. Results found:

- 83% increased their knowledge in horse science
- 66% increased communication skills
- 75% increased skills in horse management practices
- 70% increased decision making skills in areas that involve their horse project area.
- 78% increased problem solving skills that involve their horse project area
- 75% increased critical thinking skills in areas that involve their horse project area
- 86% feel more knowledgeable about career opportunities related to the equine project area.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
311	Animal Diseases
806	Youth Development

Outcome #3

1. Outcome Measures

Number of adult participants with increased knowledge of animal diseases.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Number of research programs to understand the processes that control/influence reproduction at the molecular and genetic level.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Unless you are a strict vegetarian or lactose intolerant, chances are that dairy and beef products make up half of your diet. According to the U.S. Department of Agriculture, almost 40 percent of the average American diet is dairy, and beef makes up 10 percent. This makes these products an integral part of our lifestyle and our economy, this sustained productivity and animal health are critical issues to the cattle industry

What has been done

Research to: understand the impact of animal agriculture on the modern society; develop new methods to improve fertility and reproductive efficiency in livestock; investigate potential effects of exposure to environmental contaminants in humans and animals, with an emphasis on reproductive performance; develop a local/regional pasture-based beef production system encompassing the entire beef production chain; and to assess the impact of Ovsynch on conception rates of lactating dairy cows.

Results

Research on why fertility increases in lactating cows when progesterone is enhanced during the growth of the ovulatory follicle found that it might be possible to significantly lower fertility in heifers by lowering progesterone during growth of the ovulatory follicle.

Research to improve conception rates among dairy cows at a Michigan dairy operation experiencing a 10 to 20 percent first service conception rate found that the application of the newly developed G-6-G protocol increased first service days to 100 days for cows and 120 days for first-calf heifers (vs. 65 to 70 days after calving), and that the conception rate for these cows increased to about 60 percent.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
303	Genetic Improvement of Animals
304	Animal Genome
305	Animal Physiological Processes
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals

Outcome #5

1. Outcome Measures

Number of research programs to add to the understanding of various food animal genomes by improving and integrating genetic maps.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	7

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Genetic maps are an integral part of several statistical models that are commonly used to find disease genes. A better understanding of these maps will allow for the development of increasingly accurate models that will provide researchers and producers with reliable estimates in a practical amount of time and will greatly enhance disease prevention and treatment efforts.

What has been done

Research to: develop methods for producers and consultants to evaluate dairy herd performance and assess trends for herd life and culling rates; develop a new set of tools and reagents to study autologous cell therapy using a new large animal model; and to develop and adapt statistical and computational methods to link phenotypic variation to genomic variation.

Results

DNA and phenotype records from a resource population of Duroc sires and Pietrain dams (pigs), along with DNA and phenotypes from a Landrace x Yorkshire population that had been exposed to a halothane challenge test were used to evaluate corticotropin-releasing hormone receptor 2 (CRHR2) as a potential candidate gene affecting stress response, carcass merit and meat quality traits. Several meat quality traits, including pH and drip loss exhibited a significant association with the CRHR2 genotype.

Significant strides have been made in the identification of next generation probiotics for the treatment of bone health and obesity. First, a recombinering technology in *L. reuteri* and *L. lactis* was developed, enabling researchers to perform powerful genetic assays to identify key probiotic features in these organisms. Second, researchers have demonstrated that *L. reuteri* 6475 has a positive effect on bone health in three different models of osteoporosis in mice. Third, scientists have isolated and cataloged more than 2000 intestinal bacterial isolates from healthy human volunteers to be screened for beneficial properties in obesity, type II diabetes and antibiotic-associated diarrhea.

4. Associated Knowledge Areas

KA Code	Knowledge Area
304	Animal Genome

305 Animal Physiological Processes

Outcome #6

1. Outcome Measures

Number of research programs to develop and evaluate new tools and strategies to detect, prevent and control emerging and reemerging livestock and poultry diseases.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Animal disease in the United States could seriously damage the livestock and poultry industries. For example, eradication of avian influenza in the United States following an outbreak in the mid-1980's resulted in the destruction of 17 million birds and cost taxpayers nearly \$65 million. The collective effort and vigilance of researchers, livestock producers, veterinarians and state and local government officials is needed to ensure adequate disease surveillance and to provide the needed resources to prevent, respond and/or eliminate disease outbreaks.

What has been done

Research to: develop new interventions to reduce antimicrobial resistance when treating animals with antimicrobial drugs and to develop a new non-antibiotic treatment for mastitis in dairy cows; determine the contribution of T2SS to biofilm formation in gram-negative human and plant pathogens' better understand parasitic and mutualistic interactions in a bacteria-nematode insect association; collect and screen for bacterial strains with antagonistic properties for food borne pathogens and test their efficacy; and improve immune recognition in order to protect against or eliminate viruses and diseases such as Johne's disease.

Results

A cooperative effort involving the United States and Canada, with support from the USDA and MSU AgBioResearch scientists, offered training sessions and worked with producers in educating employees about mastitis. This has led to a better understanding of milking procedures and a reduction in mastitis through prevention and non-antibiotic treatments. Michigan is consistently one of the top states in mastitis control and production of quality milk.

A Johnes Disease lesion scoring system for cattle has been developed, which will greatly assist scientists studying tissues from infected animals.

2012 marks the sixth year of the Michigan Upper Peninsula Bovine Viral Diarrhea Virus (BVDV) Project. To date, over 60 percent of the Upper Peninsula cattle farms are enrolled in the project. The data collected and research findings coming from this project are not only benefiting producers by reducing economic losses associated with BVDV morbidity and mortality, but consumers are benefiting because of reduced disease incidence, which has both food safety and quality implications. Recent studies have reported out on the potential for detecting BVDV virus by PCR skin samples taken from calves following vaccination with a modified-live BVDV vaccine and the potential association of persistent infection with BVDV on colonization and shedding of shiga-toxin producing E. coli.

4. Associated Knowledge Areas

KA Code	Knowledge Area
303	Genetic Improvement of Animals
305	Animal Physiological Processes
308	Improved Animal Products (Before Harvest)
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection

Outcome #7

1. Outcome Measures

Number of research programs to understand the environmental fate and biological effects of vaccines, steroids and other substances fed to animals.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Michiganders are an exceptionally vulnerable population due to their chronic exposure to complex mixtures of endocrine disruptors, which include legacy environmental contaminants (e.g., dioxin, PCBs, DDT) within the Great Lakes basin. A comprehensive molecular and physiological

understanding of the interactions that may occur is critical to human health. Also, vaccines, steroids, antibiotics and other substances are added to animal feed to improve growth rates by controlling parasitic and bacterial diseases. With the recent major expansion in concentrated animal feedlot operations, the potential risks from these operations must be assessed.

What has been done

Research to: achieve a better understanding of the impact of animal agriculture on society by integrating the risks and benefits related to economics, environmental protection and human health; develop multistage hierarchical models to facilitate greater efficiency of inference in general mixed model microarray experiments; and to identify the environmental transformations undergone by animal feed additives and determine their environmental fate.

Results

Outreach efforts to promote better stewardship on antibiotic use on dairy farms in the past year included several workshops on mastitis bacteriology for dairy producers and veterinary practices to help these stakeholders make better therapeutic decisions, and several presentations made to veterinary practitioner and dairy producer groups to highlight the interaction between poor therapeutic decisions and residues in meat and milk.

Research evaluating the effects of feeding farm-raised mink diets containing PCB-contaminated fish from the Upper Hudson River (New York) on adult reproductive performance and kit growth and mortality found that a daily diet composed of less than 10 percent Hudson River fish could provide a dietary concentration of PCBs that resulted in 20 percent kit mortality.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
311	Animal Diseases
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
315	Animal Welfare/Well-Being and Protection

Outcome #8

1. Outcome Measures

Number of research programs to develop and evaluate management/training strategies for horses to reduce injuries.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Due to improvements in nutrition, management and health care, horses are living longer, more useful lives. It's not uncommon to find horses and ponies living well into their 20s and 30s. Although genetics play a determining role in longevity, providing proper care and nutrition plays a key role in horses' health, performance and overall well-being.

What has been done

Research to: investigate ways to manipulate bone density and strength through mechanical loading to help prevent injuries to performance horses and increase the longevity of livestock; identify ways to manipulate the equine diet to optimize skeletal health and improve the overall welfare of horses; and to define the role that EHV-5 plays in the development of spontaneous equine multinodular pulmonary fibrosis.

Results

Information provided through talks and popular press publications provided new material on how to properly feed growing horses, how to feed equine athletes, feeding horses in hot weather, and feeding for soundness. Information was also provided to the science and veterinary communities on topics such as gastric ulcers, whether the incorporation of phytase into equine diets can reduce phosphorus excretion into the environment, and using horses as a model to explore a link between insulin resistance and iron overload disorder in browsing rhinos.

4. Associated Knowledge Areas

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

Outcome #9

1. Outcome Measures

Number of research programs to add to the understanding of animal behavior and welfare.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Our society has placed increased emphasis on the welfare of research and exhibit animals. U.S. law now requires attending to exercise requirements for dogs and the psychological well-being of non-human primates. Animal welfare without knowledge is impossible. Animal behavior researchers look at the behavior and well-being of animals in lab and field. Good animal welfare requires solid science that informs and directs policies and practices related to disease prevention and veterinary treatment, appropriate shelter, management, nutrition, humane handling and humane slaughter.

What has been done

Research to: maintain and improve skeletal health in livestock and companion animals; identify management practices and environmental conditions, particularly for young animals, that allow expression of positive natural behaviors while improving animal welfare in the context of environmentally sustainable production systems; and to examine ethical issues in agriculture.

Results

A wireless body-mounted sensor system to describe behavior, space use and resources use in non-caged laying hens has been developed. Outputs associated with this system include the development of standardized science-based criteria for assessing the well-being of non-caged chickens and an automated monitoring system to be used commercially to monitor the well-being of livestock.

4. Associated Knowledge Areas

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

Outcome #10

1. Outcome Measures

Number of research programs to test new cropping, grazing and feeding strategies for food animals.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	11

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

As production costs rise, environmental concerns increase and consumer expectations become higher, those involved in the agrifood industry are looking for ways to maximize reproductive and performance efficiencies in a way that is economically and environmentally sustainable, and that protects human and animal health.

What has been done

Research to: develop a local/regional pasture-based beef production system encompassing the entire beef production chain; investigate strategies to maximize milk production output and ecosystem functions in grazing dairy systems; mitigate the environmental footprint of animal systems; develop a local/regional pasture-based beef production system encompassing the entire beef production chain; investigate strategies to maximize production output (milk) and ecosystem functions (processes and services) in grazing systems managed under various scenarios for the optimization of automatic milking and pasture systems; better understand the mineral needs of the pig; and to evaluate the effectiveness of mannan oligosaccharides on egg production, egg weight and bird livability of laying hens.

Results

Research to increase the efficiency of protein production and the quality of meat and milk in ruminants through nutritional methods has resulted in the development of a database to quantify relationships among factors that affect dairy feed efficiency. The database is currently being used to determine if there is an optimal level of milk production to maximize feed efficiency. There is currently data from about 5,000 Holstein cows from the United States and Europe, with a goal of collecting data from 8,000 cows.

Research investigating the effects of water iron concentration, valence and source on the drinking water preference of lactating cows found that, upon first exposure to drinking water, lactating dairy cows tolerate concentrations of iron up to 4mg/L without reducing water intake. However, water intake was reduced with 8 mg/L. Preference was not dependent upon iron valence or iron source in the studies. This information will aid in the understanding of potentially negative impacts of some poorer quality natural or polluted waters often relegated to livestock. Being able to effectively treat waters for consumption by cattle while maintaining normal health and production will be crucial to help preserve, or at least conserve, more pristine waters.

Research on how nutrition affects reproduction and feed efficiency found that once cows reach the optimum body condition score for calving, they should be fed less grain and more digestible

fiber to direct more energy to milk. Understanding how to feed cows during early and late stages of lactation also affects the efficiency of milk production, a critical consideration for dairy operations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
307	Animal Management Systems
308	Improved Animal Products (Before Harvest)

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

The ongoing economic challenges being faced by Michigan -- including the recent federal funding sequestration process -- continue to affect this planned program area. Consequences have included delaying the award of new financial assistance obligations, reducing levels of continued funding, and renegotiating or reducing the current scope of assistance through formula funds or block grants. Although overall research FTEs only decreased by one - from 65 to 64 FTEs this past year - we are down from 77.1 FTEs just two years ago. Attrition, faculty departures and reduced faculty hires also continue to have an impact on program outcomes.

The extreme weather conditions during last year's growing season also delayed or greatly diminished some of the research projects being conducted at our various research centers both on- and off-campus, particularly related to plant research around animal feed and food crops.

We also opted in this year's reporting to revert back to our original 6 planned program areas for ease of reporting and better integration of research and Extension efforts. This has, once again, resulted in skewed results from numbers for this year's projected outcomes. This should be rectified after this year's reporting cycle.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

As Hatch dollars are base funding for faculty member salaries, there is a built-in evaluation mechanism through annual reviews of overall performance, research productivity

and the leveraging of additional research dollars. In addition, many of the research projects have an evaluative element that is required by state and federal-level funding sources that provides documentation related to project assumptions, goals and outcomes. This information is used to determine the overall success of research initiatives; their contribution to providing practical, real-world solutions and resources to address challenges and problems; and whether continuation funding and/or new dollars are appropriate and necessary as funds are available.

That said, the most notable qualitative impacts realized in this program were:

An evaluation of a newly developed protocol, G-6-G, to improve conception rates among dairy cows at a Michigan dairy operation experiencing a 10 to 20 percent first service conception rate found that the use of the protocol increased first service days to 100 days for cows and 120 days for first-calf heifers (vs. 65 to 70 days after calving), and that the conception rate for these cows increased to about 60 percent.

- An evaluation of advances in the identification of next generation probiotics for the treatment of bone health and obesity documented the development a recombinering technology in *L. reuteri* and *L. lactis* that enables researchers to perform powerful genetic assays to identify key probiotic features in these organisms, and that *L. reuteri* 6475 has a positive effect on bone health in three different models of osteoporosis in mice. Scientists have isolated and catalogued more than 2000 intestinal bacterial isolates from healthy human volunteers to be screened for beneficial properties in obesity, type II diabetes and antibiotic-associated diarrhea.
 - A 2012 evaluation of the Michigan Upper Peninsula Bovine Viral Diarrhea Project documented that over 60 percent of the Upper Peninsular cattle farms are now enrolled in the project
 - Research evaluating the effects of feeding farm-raised mink diets containing PCB-contaminated fish from the Upper Hudson River (New York) on adult reproductive performance and kit growth and mortality found that a daily diet composed of less than 10 percent Hudson River fish could provide a dietary concentration of PCBs that resulted in 20 percent kit mortality.

Examples Of MSUE Evaluation Results Not Previously Reported For This Area:

Adoption of feeding technology results in reduced ammonia emissions from swine grow/finish facilities

Issue (who cares and why)?

Reduced emissions from livestock operations can have a tremendous impact on both the environment and costs.

What has been done?

MSUE conducted training for swine farmers on changing their feeding strategies to reduce ammonia emissions.

Results/Impact?

Evaluation has found that Michigan swine farmers have adopted feeding strategies that reduced ammonia emissions from swine grow/finish facilities. A MSU researcher reported a 21% reduction in average daily ammonia emissions when grow/finish pigs were fed diets formulated using three synthetic amino acids, (lysine, methionine and threonine) compared to pigs provided diets formulated using lysine, only. Average daily ammonia emissions were reported at 37,136 mg/pig when pigs were fed the lysine diet versus 29,123 mg/pig when pigs were fed diets containing three synthetic amino acids, an average daily reduction of 8,013 mg ammonia on a per head basis.

USDA reports 2,000,000 hogs are marketed from Michigan farms annually. Because farms turn-over their inventory about 2.6 times each year, Michigan's inventory of pigs in the grow-finish phase of production was estimated at 795,000 head. Nutritionists formulating diets for Michigan swine farms estimate that 80%, 636,000 head, of the pigs are currently fed diets formulated with at least three synthetic amino acids compared to just 6 years ago when most farms fed diets containing lysine, only. Based on the state's inventory of grow/finish hogs and the ammonia emission reduction reported by Powers, in Michigan the adoption of this feeding strategy has resulted in an annual reduction of 2,047 tons of ammonia emissions.

Key Items of Evaluation

Key research items from evaluations include:

- A newly developed protocol to improve conception rates among dairy cows resulted in increasing first service days from 65 to 100 and increasing conception rates from 10/20 percent to about 60 percent.
- A recombinering technology in *L. reuteri* and *L. lactis* was developed that enables researchers to perform powerful genetic assays to identify key probiotic features in these organisms. A key finding along these lines is that *L. reuteri* 6475 has a positive effect on bone health in three different models of osteoporosis in mice.
- A Johnes Disease lesion scoring system for cattle has been developed, which will greatly assist scientists studying tissues from infected animals.
- More than 60 percent of Michigan Upper Peninsula cattle farms are now enrolled int the Michigan Upper Peninsula Bovine Viral Diarrhea Project, greatly increasing the ability of producers and veterinarians to reduce and control this economically costly disease.

Results from MSUE Institute Workteams relevant to this area:

Agriculture and Agribusiness Institute

- 1,002 new farms adopting practices to improve quality
- 246 new farms adopting tools or technology to improve quality
- \$3,631,822 Dollars gained

Children and Youth Institute

- 60,616 youth trained in animal science

- 10,960 youth educated in biological science
- 14,225 youth educated in Ag in Classroom