

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Global Food Security and Hunger-Agricultural, Biological, and Natural Resources Engineering

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
102	Soil, Plant, Water, Nutrient Relationships	20%		0%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	10%		0%	
306	Environmental Stress in Animals	5%		0%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	5%		0%	
401	Structures, Facilities, and General Purpose Farm Supplies	0%		19%	
402	Engineering Systems and Equipment	50%		60%	
403	Waste Disposal, Recycling, and Reuse	10%		11%	
404	Instrumentation and Control Systems	0%		1%	
405	Drainage and Irrigation Systems and Facilities	0%		9%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	5.5	0.0	5.0	0.0
Actual Paid	7.5	0.0	1.6	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
192590	0	1813	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
192590	0	1716	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	448036	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research and outreach must not only adapt to engineering changes, but must improve efficiency under these new conditions provide by resource innovation.

2. Brief description of the target audience

Stakeholders and customers of research and Extension programs represent a broad section of audiences, including agricultural producers and consumers.

3. How was eXtension used?

The resources provided through eXtension were used to supplement and enhance our public learning experiences provided by MSU Extension agents and specialists. eXtension was also used as a resource in state-based planning processes. Overall, 230 MSU employees are eXtension users. Further, MSU Extension has 71 employees that serve on one or more of the 66 Communities of Practice (COPs); MSU Extension employees are members of 39 COPs. 10 MSU Extension employees serve as a leader for a COP, leading 7 COPs. 5 MSU Extension personnel are members of the Beef Cattle COP. 3 MSU Extension personnel are members of the Freshwater Aquaculture COP. 1 MSU Extension employee is a member of the Livestock and Poultry Environmental Learning Centers COP. 2 MSU Extension personnel are members of the Marine Aquaculture COP. 1 MSU Extension employee is a member of the Wood Energy COP. 4 MSU Extension personnel are members of the Community, Local, and Regional Food Systems COP. 1 MSU Extension employee is a member of the Youth Agriculture COP.

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	15752	13429	0	0

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

Patent Applications Submitted

Year: 2014

Actual: 2

Patents listed

- 1.Fiber separation from grain products including corn flour and DDGS using electrostatic method
- 2.Shock-wave mitigating bio-inspired football helmet design

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	2	20	22

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of people attending workshops, short courses, etc.

Year	Actual
2014	4864

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of producers adopting new practices, technologies, strategies, or systems due to research/extension recommendations.
2	Number of producers adopting new technologies, strategies, or systems.
3	Number of producers increasing production levels.
4	Number of producers decreasing production inputs/expenses.
5	Number of producers improving their environmental stewardship.

Outcome #1

1. Outcome Measures

Number of producers adopting new practices, technologies, strategies, or systems due to research/extension recommendations.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	487

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Many cattle producers leave attainable returns unrealized by lack of sufficient genetic improvement in their herds. Artificial insemination is a proven means of rapidly improving the genetics of a cattle herd, but specialized training is required to implement this technology. Successful adoption of artificial insemination requires intensive management and specialized training in the technique. There are limited training opportunities to learn artificial insemination management and techniques in the United States.

What has been done

A Cattle Artificial Insemination School was developed by Extension to provide a cost-efficient program to educate producers on reproductive management, familiarize producers with artificial insemination tools, and provide hands-on artificial insemination experience. The curriculum is updated at least twice annually to provide the most current information to participants. Both beef and dairy cattle breeders are serviced through this school.

Results

The Cattle Artificial Insemination School has gained national attention attracting participants from 20 states to date. Participant feedback indicates notable artificial insemination adoption as a result of this school. The net returns from artificial insemination use in Mississippi cattle herds due to program participation is estimated at \$876,250 per year across the 701 breeders who have already completed the program. Each year the program's annual economic impact grows by approximately \$93,750 as another 75 Mississippi cattle breeders implement artificial insemination as a result this program. Additional monetary benefits of the program are also realized from improved implementation of nutritional, health, and reproductive best management practices

emphasized through this school.

4. Associated Knowledge Areas

KA Code	Knowledge Area
306	Environmental Stress in Animals
402	Engineering Systems and Equipment

Outcome #2

1. Outcome Measures

Number of producers adopting new technologies, strategies, or systems.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	486

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Hay production across the state is still a large enterprise for winter feeding recommendations. The hay production yields in Mississippi range from 2.5 to 3.5 tons per acre. Those are 40% below the potential yields. Based on nutritive values, over 70% of the forage produced does not meet the nutrient requirements for a dry cow. The cost of hay production in Mississippi averages \$85 per acre.

What has been done

New approaches have been taken to implement management practices that will require less hay production and better quality hay. Adoption of new technologies such as portable Near Infra-red Systems (NIRS) has allowed advised producers on management practices that reduce the amount of hay needed, improve forage quality and improve nitrogen applications.

Results

Taking a field real time approach has allowed producers to obtain most of the hay needed in the first two cuts of hay. This has reduced the acres need for hay production by 54%, the amount of

fertilizer needed by 38% and improve nutritive value by 47%. Because of these approaches this has also reduced feed supplementation by 83%. Implementation of these combined strategies has created an economic impact of \$8.4 million to the Mississippi hay industry.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
402	Engineering Systems and Equipment
404	Instrumentation and Control Systems

Outcome #3

1. Outcome Measures

Number of producers increasing production levels.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	405

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Mississippi Band of Choctaw Indians tribally based high school's Occupational Training Center (OTC) constructed a new 5,000-square foot greenhouse for training special needs students. The OTC staff of three high school teachers had no prior experience operating a greenhouse or a modern fertilizer injector system. The staff had been using the injector system improperly and burned foliage of nearly half the seedlings produced in the new structure.

What has been done

The OTC staff asked Extension to train the school personnel in the proper use of the greenhouse's basic daily operating procedures and in the correct use of the liquid fertilizer injector. A day-long training was set up and instructed by an Extension specialist and the local

FRTEP agent to address these issues. All greenhouse personnel attended the workshop and received classroom and hands-on instruction in the greenhouse located at the OTC.

Results

Since the greenhouse training conducted by Extension in February 2014, the OTC staff has reduced the loss of more than 90% of the plant seedlings due to overfertilization by improper use of the greenhouse injector system. The OTC staff report an annual savings of approximately \$1,750 in soluble fertilizer cost, as well. The staff also reports that all OTC students receive a higher level of instruction by greenhouse staff due to expertise gained by working with Extension. The Tribe's FRTEP agent is now a regular guest instructor, spending more than 80 hours annually with tribal youth in the OTC greenhouse facility.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
401	Structures, Facilities, and General Purpose Farm Supplies
402	Engineering Systems and Equipment

Outcome #4

1. Outcome Measures

Number of producers decreasing production inputs/expenses.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	373

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Each year there are over 200 entries in the Mississippi Soybean Variety Trials. The average life of a soybean variety is about 3-4 years. Therefore, it is necessary to evaluate the new varieties, breeding lines, etc. for resistance to the major soybean diseases. This information is made

available to producers to assist them in selecting a variety.

What has been done

The entries in the variety trials and others to be evaluated are planted in replicated plots or in greenhouse and growth chamber studies. The entries are inoculated in separate trials with the various pathogens. The resistance to each disease is rated. The results are published in the Mississippi State Soybean Variety bulletin, online, and in other areas.

Results

The findings from the Mississippi State Soybean Variety Trials assist the producer in selecting disease resistant varieties. This allows losses due to disease to be minimized and also reduces the need for additional applications of expensive fungicides. Both of these outcomes allow for a great reduction in the expenses that soybean producers must undertake when growing their crops.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
402	Engineering Systems and Equipment
404	Instrumentation and Control Systems

Outcome #5

1. Outcome Measures

Number of producers improving their environmental stewardship.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	389

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Cutting propagation is the most widely used method for multiplying many nursery and floriculture crops. Shortages and costs of pine bark and peat moss, two common components of nursery and greenhouse growing media, have led to investigation of alternative, sustainable materials for crop production. Wood-based substrates have been identified as acceptable components in growing media for established nursery and greenhouse crops, but this material has not been evaluated for use in propagation media for rooting cuttings.

What has been done

A study was conducted over two years to evaluate processed whole loblolly pine trees (WPT; *Pinus taeda*) as a rooting substrate for stem cutting propagation of a range of ornamental crops. Substrates included processed whole pine tree, pine bark, and each mixed with equal parts (by volume) peat moss. Physical and chemical properties were determined for all substrates. Rooting percentage, total root length, total root volume, and total shoot length were evaluated for cuttings of eight herbaceous and woody ornamental crops rooted using commercial nursery practices.

Results

With an increasing number of commercial nurseries in the southeastern U.S. currently using (or considering use of) processed, whole pine tree as a renewable resource for plant production, this study demonstrated that whole pine tree media alone or combined with peat moss can be used for cutting propagation. Renewable materials are needed to replace supplies of pine bark, which has become more costly and difficult to obtain for nursery production, as pine bark is now being used as a fuel source. In this study, rooting percentages was similar among the different rooting media within each species. The addition of peat moss to whole pine tree material resulted in greater root length for most species. Shoot growth was most vigorous using pine bark and peat moss media.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
405	Drainage and Irrigation Systems and Facilities

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Government Regulations
- Competing Programmatic Challenges

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

MSU Extension agents and specialists, as well as MAFES faculty, used a variety of recommended methods to gather needed information. Specific strategies were initiated and utilized for collecting evaluation information to determine program outputs and outcomes (see impact statements for examples). In FY 2014, MSU Extension agents and specialists were required to submit four quarterly reports (January, April, July, and September). This quarterly report collects information about the number of contacts, types of contacts, and number of programs conducted in each Planned Program Area. In addition, two narrative Accomplishment Reports are required from each MSU Extension employee each year. Finally, a specific request for impact statements from MSU Extension and MAFES faculty and staff is also made. The evaluation results shared through our impact statements are a combination of this quantitative and qualitative data.

Late in the 2014 program year, we introduced a Standardized Extension Evaluation Survey. The Standardized Extension Evaluation Survey was designed for use in any MSU Extension Service program, workshop, or event with adults. The survey assesses program process, participant satisfaction, knowledge and/or skill change, and behavioral intentions. It provides a ready-made evaluation for agents and specialists to use and will allow us to aggregate data across the state. A small number of agents and specialists have utilized the survey to date, but we hope use will increase over time.

Key Items of Evaluation