V(A). Planned Program (Summary)

Program # 10

1. Name of the Planned Program

Food, Agricultural, and Biological Engineering Systems (OARDC Led)

☑ 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>
</tr>
</thead>
<tbody>
<tr>
<td>401</td>
<td>Structures, Facilities, and General Purpose Farm Supplies</td>
<td>0%</td>
<td></td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>402</td>
<td>Engineering Systems and Equipment</td>
<td>0%</td>
<td></td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td>403</td>
<td>Waste Disposal, Recycling, and Reuse</td>
<td>0%</td>
<td></td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>404</td>
<td>Instrumentation and Control Systems</td>
<td>0%</td>
<td></td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>405</td>
<td>Drainage and Irrigation Systems and Facilities</td>
<td>0%</td>
<td></td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td>723</td>
<td>Hazards to Human Health and Safety</td>
<td>0%</td>
<td></td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>0%</td>
<td></td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

<table>
<thead>
<tr>
<th>Year: 2012</th>
<th>Extension</th>
<th>Research</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1862</td>
<td>1890</td>
</tr>
<tr>
<td>Plan</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Actual Paid Professional</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Actual Volunteer</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

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

1. Brief description of the Activity

Engineering research activities to advance OARDC goals will continue to include both basic and applied research. Laboratories, construction sites, farms, a research park, and multiple field sites/research stations are available throughout state to permit data gathering and to continue long-term activities. All functional laboratories and sites are improved over time as program need warrants. OARDC faculty and staff engage in appropriate levels of outreach, engagement, and consultation, with both internal stakeholders such as fellow extension personnel, and with external stakeholders.

2. Brief description of the target audience

Targeted audiences include, but not limited to: specific individuals or groups who have expressed a need for engineering information that is to be derived through new research, extracted from on-going research, or is derived from scientific literature. Often those requests are communicated to OARDC by an intermediary such as a staffer at a USDA office, NRCS, Ohio Department of Agriculture, Soil and Water Conservation Districts or a county extension agent; fellow academic units that rely on engineers to create systems and processes needed to support not only the research, but also the adoption of the research findings by stakeholders fellow agencies or support organizations who will not only use the information but will also be brokers of that information, including embedding it into groups to encourage change; populations who have not requested the information but will likely benefit from that information, e.g. recreational animal owners; other scientists and scientific groups; political entities; extension personnel; students for pre-school to post doctorate studies; news organizations; and business groups such as small town administrators, county commissioners, or commodity groups.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures
### 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**

<table>
<thead>
<tr>
<th>2012</th>
<th>Extension</th>
<th>Research</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual</td>
<td>0</td>
<td>20</td>
<td>0</td>
</tr>
</tbody>
</table>

### V(F). State Defined Outputs

**Output Target**

**Output #1**

**Output Measure**

- number of graduate students completed

  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>Provide appropriate facilities design and engineering processes commensurate with stakeholders demand, including fellow research units demands, to the extent that they have all the information necessary for making adoption decisions</td>
</tr>
<tr>
<td>2</td>
<td>Develop enhanced systems to support integrated plant growth systems that will annually result in increased productivity at reduced costs for the industry</td>
</tr>
<tr>
<td>3</td>
<td>Improve systems to that will permit small farmers to take advantage of alternatives to traditional commodity crops at a rate commensurate with demand</td>
</tr>
<tr>
<td>4</td>
<td>Improve mechanical devices and instrumentation needed by stakeholders</td>
</tr>
<tr>
<td>5</td>
<td>Develop improved systems to aid in meeting new or yet to emerge or novel needs</td>
</tr>
<tr>
<td>6</td>
<td>Advance development of state of the art integrated waste management systems to the extent that OARDC and Ohio are viewed as one of the top ten programs/states in this area nationally</td>
</tr>
<tr>
<td>7</td>
<td>Advance the knowledge of ecological based engineered systems for waste management to the extent that, where cost effective and appropriate, they will be adopted over mechanical systems</td>
</tr>
<tr>
<td>8</td>
<td>Aid rural stakeholders with onsite waste disposal systems to the extent that all rural Ohio onsite waste management systems could meet state standards</td>
</tr>
<tr>
<td>9</td>
<td>Reduce through research, development, and outreach the negative impact of farm-, recreation-, or industry-related accidents within agriculture and natural resources.</td>
</tr>
</tbody>
</table>
**Outcome #1**

1. **Outcome Measures**

   Provide appropriate facilities design and engineering processes commensurate with stakeholders demand, including fellow research units demands, to the extent that they have all the information necessary for making adoption decisions

   Not Reporting on this Outcome Measure

**Outcome #2**

1. **Outcome Measures**

   Develop enhanced systems to support integrated plant growth systems that will annually result in increased productivity at reduced costs for the industry

   Not Reporting on this Outcome Measure

**Outcome #3**

1. **Outcome Measures**

   Improve systems to that will permit small farmers to take advantage of alternatives to traditional commodity crops at a rate commensurate with demand

   Not Reporting on this Outcome Measure

**Outcome #4**

1. **Outcome Measures**

   Improve mechanical devices and instrumentation needed by stakeholders

   Not Reporting on this Outcome Measure

**Outcome #5**

1. **Outcome Measures**

   Develop improved systems to aid in meeting new or yet to emerge or novel needs

2. **Associated Institution Types**
● 1862 Extension
● 1862 Research

3a. Outcome Type:
Change in Knowledge Outcome Measure

3b. Quantitative Outcome

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0</td>
</tr>
</tbody>
</table>

3c. Qualitative Outcome or Impact Statement

**Issue (Who cares and Why)**
The opportunity to sell corn stover is present with bioenergy conversion plants being built across the Midwest. Farmers are aware that soil organic matter remains the foundation upon which sustainable, and profitable agricultural systems are built. Farmers, extension educators and professional services personnel working in this area, as well as industry need a simple and easy-to-use tool, in order to understand how management influences soil organic matter.

**What has been done**
CFAES research and extension personnel at OSU South Centers gathered both user needs data and calculator options and parameters to better understand how to create a useful calculator.

**Results**
South Centers developed the Soil Organic Matter (SOM) calculator tool based on the impacts of stover removal, crop rotation, drainage, manure and organic amendments, fertilizers, conservation tillage practices, and cover crops. The outputs of the calculator consist of total, active, and passive soil organic matter, total nitrogen, CO2-C sequestration, and overall soil health. The tool also helps to calculate the revenue from residue sales.

4. Associated Knowledge Areas

<table>
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<tr>
<th>KA Code</th>
<th>Knowledge Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>402</td>
<td>Engineering Systems and Equipment</td>
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<td>Instrumentation and Control Systems</td>
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</tbody>
</table>

**Outcome #6**

1. Outcome Measures

Advance development of state of the art integrated waste management systems to the extent that OARDC and Ohio are viewed as one of the top ten programs/states in this area nationally
Outcome #7

1. Outcome Measures

Advance the knowledge of ecological based engineered systems for waste management to the extent that, where cost effective and appropriate, they will be adopted over mechanical systems

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
</tr>
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<tbody>
<tr>
<td>2012</td>
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3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Wastewater from food processing plants is often pretreated at considerable expense before it is sent to municipal wastewater treatment plants. An alternative is needed.

What has been done
OARDC agriculture engineers have been working for several years with a turkey processing plant on an alternative to pretreating wastewater and sending it to a municipal source. After extensive modeling a solution way found.

Results
Research on treatment of turkey slaughterhouse wastewater has resulted in the construction and operation of a full-scale treatment system. The 4-acre sand and gravel bioreactor is treating the wastewater from the processing of 7000 birds per day. The bioreactor cost is estimated to be $2.8 million over 20 years saving the owner about $10 million from the proposed alternative of pretreatment before discharge to a municipal treatment plant. The new bioreactor plant went online in August 2012 and is achieving 99% BOD removal and 53% - 85% ammonia removal.

4. Associated Knowledge Areas

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<td>Structures, Facilities, and General Purpose Farm Supplies</td>
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</table>
Outcome #8

1. Outcome Measures

Aid rural stakeholders with onsite waste disposal systems to the extent that all rural Ohio onsite waste management systems could meet state standards

Not Reporting on this Outcome Measure

Outcome #9

1. Outcome Measures

Reduce through research, development, and outreach the negative impact of farm-, recreation-, or industry-related accidents within agriculture and natural resources.

Not Reporting on this Outcome Measure

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

As noted above a number of factors continue to impact this planned program. The impact is typically situational as to the degree that any particular external factor affects outcome. As noted in other planned programs the greatest challenge is for OSU Extension and OARDC to find adequate resources to respond to growing demand. Perhaps the greatest factor affecting productivity to OARDC engineering efforts are our lack of formal laboratories on the Wooster campus. As noted in previous ROAs, the building housing these laboratories was destroy by a tornado and the replacement, with construction to be underway in early 2013, will not be completed and fully operational until 2014-15.

V(I). Planned Program (Evaluation Studies)
Evaluation Results

No formal evaluation results to report from OARDC. Publications, research grants garnered, number of stakeholders served, and anecdotal data provide a positive assessment of this planned program. CFAES' food, agricultural and biological engineering program is consistently ranked one of the top programs in the nation.

Key Items of Evaluation

No specific data to report.