

**V(A). Planned Program (Summary)**

**Program # 10**

**1. Name of the Planned Program**

Integrated Pest Management

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
133	Pollution Prevention and Mitigation	6%	0%	10%	0%
202	Plant Genetic Resources	5%	0%	5%	0%
205	Plant Management Systems	9%	0%	10%	0%
211	Insects, Mites, and Other Arthropods Affecting Plants	16%	0%	20%	0%
212	Pathogens and Nematodes Affecting Plants	10%	0%	20%	0%
213	Weeds Affecting Plants	17%	0%	5%	0%
215	Biological Control of Pests Affecting Plants	11%	0%	5%	0%
216	Integrated Pest Management Systems	20%	0%	20%	0%
601	Economics of Agricultural Production and Farm Management	4%	0%	5%	0%
901	Program and Project Design, and Statistics	2%	0%	0%	0%
	<b>Total</b>	100%	0%	100%	0%

**V(C). Planned Program (Inputs)**

**1. Actual amount of FTE/SYs expended this Program**

Year: 2015	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	4.0	0.0	5.0	0.0
<b>Actual Paid</b>	6.0	0.0	3.2	0.0
<b>Actual Volunteer</b>	0.6	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
43000	0	134981	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
43000	0	134981	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
729000	0	821173	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

Fulfill the specific Inputs and Activities outlined in the "Oklahoma State University Coordination Program for IPM Oklahoma!" (as made to USDA-NIFA "Extension Integrated Pest Management Coordination and Support Program (EIPM-CS)" ), including the identification of new program priorities for future funding.

Provide information on IPM upon request to stakeholder groups, and attend stakeholder sponsored meetings as invited.

Conduct targeted research on pest status, suppression and IPM approaches for crop, animal, and urban systems in Oklahoma.

Develop and deliver extension IPM programs to stakeholders, in the form of workshops, field demonstrations and meetings.

Develop pesticide applicator education and pesticide information through printed media, fact sheets and current reports.

Assess impact of educational activities on stakeholder IPM

**2. Brief description of the target audience**

Agricultural Producers, Agricultural Groups, Commercial Growers, Retailers, Agricultural Professionals (private, commercial and non-commercial), and landowners, nurseries, individual stakeholders, storers and handlers of grain

**3. How was eXtension used?**

Food Safety Community of Practice (COP): David Hillock, J. Hasse, R. Grantham, C. Keck,  
 Grapes COP: Dr. Eric Rebek  
 Red Imported Fire Ant COP: Dr. R. Grantham, Dr. Eric Rebek, Dr. J. Talley  
 Urban Integrated Pest Management COP: C. Keck, R. Grantham, C. Luper, Dr. T. Royer, K.

Shelton,

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	3191	80983	0	0

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

Year: 2015  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2015	Extension	Research	Total
<b>Actual</b>	29	4	32

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Stakeholder assessment

<b>Year</b>	<b>Actual</b>
2015	1

**Output #2**

**Output Measure**

- Pesticide applicator education schools and workshops

<b>Year</b>	<b>Actual</b>
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2015 15

**Output #3**

**Output Measure**

- County-based variety field tours of row-crops and small grains for Oklahoma growers

<b>Year</b>	<b>Actual</b>
2015	15

**Output #4**

**Output Measure**

- Extension publications will be created or revised

<b>Year</b>	<b>Actual</b>
2015	29

**Output #5**

**Output Measure**

- News releases on the subject of IPM horticulture crops, livestock, agronomic crops and urban systems (Public Housing).

<b>Year</b>	<b>Actual</b>
2015	46

**Output #6**

**Output Measure**

- A summarized annual report will be developed for distribution to involved stakeholders demonstrating the impact of IPM programs to Oklahoma citizens.

<b>Year</b>	<b>Actual</b>
2015	0

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Increased use of pest management approaches for targeted cropping system acres
2	Number of trained certified pesticide applicators
3	Increase in percent of growers with knowledge and adoption of iWheat program for winter wheat.
4	Home gardeners will gain knowledge about IPM practices for their home gardens.
5	People will gain knowledge about IPM programs by visiting the IPM Oklahoma! booth at various meetings, including the Oklahoma Ag Expo and the Oklahoma School Plant Managers Association.
6	Participants will understand connections between pest management of bed bugs, the near environment, housing, health, and well-being resulting in an increase in the number of Oklahoman?s practicing bed bug risk reduction.
7	Stakeholders will increase awareness of invasive species in Oklahoma (such as saltcedar, brown marmorated stink bug, emerald ash borer, etc) and how they might be managed.
8	Sugarcane Aphid Management
9	Managing Hessian fly through acreage planted to resistant wheat varieties
10	Management of Horn Flies in Cattle

## **Outcome #1**

### **1. Outcome Measures**

Increased use of pest management approaches for targeted cropping system acres

### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2015	350000

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

#### **Issue (Who cares and Why)**

Canola is a potentially valuable rotation crop for Oklahoma wheat growers. It allows them opportunities to manage difficult grassy weeds such as Italian ryegrass, and cheat while providing them with an additional cash crop. Harvested acreage in Oklahoma has grown from 41 acres in 2002 to over 125,000 acres in 2014-15. Oklahoma canola producers harvested 3.4 million bushels of sorghum worth ca. \$10.2 million. However, insect pests (aphids and caterpillars) regularly infest winter canola throughout winter and spring causing economic damage.

#### **What has been done**

In 2007, canola producers were surveyed about their pest management concerns and listed insects as the second most important production problem that they faced and aphids (cabbage, turnip and green peach aphids) the key insect pest problem. Because producers were unfamiliar with their management, they often made multiple insecticide applications to control them with limited success. In addition, blackleg, a disease caused by *Leptosphaeria maculans* had become a concern among growers. Dr. John Damicone's lab is currently screening germplasm for resistance to this disease. Entomologists and area agronomists conducted research demonstrations from 2005-2007 to evaluate management strategies for canola aphids. They determined that aphids could be effectively managed with a combination of insecticide seed treatments and regular scouting using a threshold of 200 aphids per plant. Dr. Damicone has identified five races for use in screening germplasm for resistance to blackleg disease.

#### **Results**

The research demonstrations showed that producers could save an average of \$30 per acre by

reducing insecticide applications from four per season to one with no loss in yield. This resulted in \$3.75 million in potential cost savings in the 2014-15 canola crop.

#### 4. Associated Knowledge Areas

<b>KA Code</b>	<b>Knowledge Area</b>
133	Pollution Prevention and Mitigation
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management

#### Outcome #2

##### 1. Outcome Measures

Number of trained certified pesticide applicators

##### 2. Associated Institution Types

- 1862 Extension

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

<b>Year</b>	<b>Actual</b>
2015	6370

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

**Issue (Who cares and Why)**

**What has been done**

**Results**

#### 4. Associated Knowledge Areas

<b>KA Code</b>	<b>Knowledge Area</b>
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133	Pollution Prevention and Mitigation
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
901	Program and Project Design, and Statistics

**Outcome #3**

**1. Outcome Measures**

Increase in percent of growers with knowledge and adoption of iWheat program for winter wheat.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2015	10

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

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants



216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management

#### **Outcome #4**

##### **1. Outcome Measures**

Home gardeners will gain knowledge about IPM practices for their home gardens.

##### **2. Associated Institution Types**

- 1862 Extension

##### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

##### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2015	258

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

###### **Issue (Who cares and Why)**

Despite the recent down-turn in the economy, gardening remains the number one hobby of Americans including citizens of the State of Oklahoma. Consequently, over 500 nurseries, greenhouse and or garden center operations remain viable businesses throughout the state (stat from Oklahoma Nursery and Floral License Directory, ODAFF). Given the sheer number of green industry professionals not to mention allied groups such as landscape architects, urban foresters, arborists, etc., it seems reasonable to assist these groups in order that they remain ranked in the top ten states for gross sales of products and services (Oklahoma has been ranked no. 10 (ten) in the nation on occasion for its gross sales).

###### **What has been done**

A program to introduce and assist growers with using a ?banker plant? system of biological controls was developed. Currently, a graduate student is working with three grower cooperators to evaluate its potential. Work is continuing that will evaluate effectiveness of the system and growers? attitudes towards biological control.

###### **Results**

##### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
133	Pollution Prevention and Mitigation

205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

**Outcome #5**

**1. Outcome Measures**

People will gain knowledge about IPM programs by visiting the IPM Oklahoma! booth at various meetings, including the Oklahoma Ag Expo and the Oklahoma School Plant Managers Association.

Not Reporting on this Outcome Measure

**Outcome #6**

**1. Outcome Measures**

Participants will understand connections between pest management of bed bugs, the near environment, housing, health, and well-being resulting in an increase in the number of Oklahoman?s practicing bed bug risk reduction.

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2015	0

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

**Issue (Who cares and Why)**

Bed bugs are significant pest, can build up in large numbers before they are noticed, and are difficult to eliminate from the home environment. There are significant barriers to successful eradication. Barriers include: stigma associated with bed bug infestation, social and mobile nature of humans today, and high cost of most effective treatments.

**What has been done**

Bed bugs risk reduction is being taught through healthy homes programming, that is, a holistic approach to consumer health, welfare, and safety in the home environment.

**Results**

Twenty-one people attended a bed bug management program geared for in-service to extension educators in 4H and FCS. A new healthy homes app will provide consumers education needed to reduce risk. IPM is featured as part of the app.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
216	Integrated Pest Management Systems

**Outcome #7**

**1. Outcome Measures**

Stakeholders will increase awareness of invasive species in Oklahoma (such as saltcedar, brown marmorated stink bug, emerald ash borer, etc) and how they might be managed.

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2015	0

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

**Issue (Who cares and Why)**

The invasive weed, Musk thistle (*Carduus nutans* L) was first identified in Oklahoma in 1944, and is currently found in more than 62 counties. Infestations of musk thistle in improved pastures cause significant economic losses in Oklahoma. In 1998, Oklahoma legislators passed a law designating musk thistle, along with scotch and Canada thistles, as noxious weeds in all counties of the state.

**What has been done**

A musk thistle IPM program was developed in the early 1990s and has been implemented statewide through cooperative efforts of researchers, Extension personnel, and landowners. It focuses on increasing public awareness of the problem, development of educational information, demonstrating various control options, and introducing new biological control agents. One

demonstration and educational meeting was conducted in 2015 for landowners and NRCS employees. Extension educators, landowners and NRCS personnel collected approximately 10,000 musk thistle head weevils and 1,000 musk thistle rosette weevils in Alfalfa and Grant counties in spring of 2015 for redistribution.

**Results**

To date, this program collected and redistributed more than 944,000 musk thistle head weevils and 47,710 musk thistle rosette weevils across the state. Landowners in NE Oklahoma have noted from 80% to 95 % decrease in number of musk thistle plants in areas where they are using an integrated approach that includes use of the musk thistle weevils. If the typical landowner applies 1 lb. active ingredient of herbicides per acre annually, biological control has decreased the amount of herbicides applied to the environment by 7.1 million lbs per year.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
211	Insects, Mites, and Other Arthropods Affecting Plants
213	Weeds Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

**Outcome #8**

**1. Outcome Measures**

Sugarcane Aphid Management

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2015	0

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

**Issue (Who cares and Why)**

Sorghum was grown on 310,000-400,000 acres in Oklahoma. In 2013, sugarcane aphid switched to infesting sorghum in 2013, causing significant yield losses in sorghum in Texas,

Louisiana, and Mississippi. Research conducted in 2013 indicated that currently registered products for aphid control in sorghum were ineffective. The aphid was found in one Oklahoma county in 2013.

#### **What has been done**

The discovery of this aphid in 2013 prompted the Oklahoma Sorghum Growers to ask the OSU IPM coordinator and the Pesticide Education Program coordinator to support an emergency Section 18 registration for the use of sulfoxaflor to help control them. In addition, the Sorghum checkoff program funded 5 research/extension demonstrations to evaluate chemical and varietal control options and the impact of the aphid on production. One news release, 5 field day presentations and one television program (Sunup; viewership 20,000) were provided through OSU to assist growers in identifying sugarcane aphid, with suggestions for determining the need for control.

#### **Results**

In 2015, sugarcane aphid was found in 32 counties, infesting a minimum of 200,000 acres statewide. Based on the results of the research/extension demonstration that evaluated impact on yield, an uncontrolled infestation of sugarcane aphid reduced yield by an average of 18 bushels per acre. Sulfoxaflor was applied to 150,000-200,000 acres of grain sorghum in 2015. Based on an extension demonstration coordinated by the IPM Crops Insect Pest Management Team, this Emergency registration saved Oklahoma sorghum growers ca. \$7.2-\$14.4 million in lost grain yield, depending on whether they sprayed once or twice for sugarcane aphid.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

#### **Outcome #9**

##### **1. Outcome Measures**

Managing Hessian fly through acreage planted to resistant wheat varieties

##### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

##### **3a. Outcome Type:**

Change in Condition Outcome Measure

### 3b. Quantitative Outcome

Year	Actual
2015	1200000

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Winter wheat is grown on 5.6 million acres in Oklahoma for pasture, grain and dual purpose (pasture + grain). Hessian fly has become a more prominent pest due to fly-susceptible varieties. Traditional "fly free" planting dates that were developed in the 1930's appears to be ineffective.

#### What has been done

Estimates of yield loss suffered by Hessian fly infestations can reach 5 bushels per acre, when a susceptible variety is infested with 1 fly per stem. A Hessian fly screening program (lab and field) was instituted to evaluate new winter wheat releases through the Oklahoma State winter wheat breeding program. In 2015, 25.9% of the wheat acres in Oklahoma were planted to H fly resistant varieties. Two fully resistant varieties "Duster" (released in 2006) and "Gallagher" (released in 2011) are the most planted (14.1%) and 3rd most planted (5.8%) varieties in 2015. Additional varieties, "Billings" (1.3% planted) which was released in 2009, "Ruby Lee" (5.0% planted) released in 2011, is partially resistant. Results of H. fly monitoring from 2011-2013 demonstrated that H. fly emergence had two peaks, one in the fall, and one in the spring. Emergence occurred too late for insecticide seed treatments to be effective in the fall, and for too long of a period for foliar insecticides to be reliably effective. This suggests that host plant resistance coupled with cultural controls should be the predominant method for Hessian fly management in Oklahoma.

#### Results

Approximately 1.2 million acres of the winter wheat acres were planted to "Duster", Billings or Gallagher in 2015. Currently, Hessian fly has been reported to be infesting winter wheat in western Oklahoma. A minimum of 5%, or 70,000 acres were planted in areas where Hessian fly was documented (from 2009-2011) to be a serious problem. Producers that planted these varieties will recoup an estimated \$1.4 million in yield savings.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
216	Integrated Pest Management Systems

### Outcome #10

#### 1. Outcome Measures

Management of Horn Flies in Cattle

#### 2. Associated Institution Types

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2015	0

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

**Issue (Who cares and Why)**

Oklahoma beef production represents 53% of the total cash receipts received by Oklahoma agricultural commodities. A major pest that impacts both health and production of beef animals is the horn fly. This pest can impact daily weight gains, weaning weights and cause the animal to consume more forage without the gain advantage when this pest is present.

**What has been done**

Two major beef sectors (stockers and cow/calf) rely on insecticides to control the horn fly and the Animal Pest Management group within the IPM team has conducted trainings as well as efficacy trials to determine which products are more effective. Through these trainings and trials, we monitor horn fly populations in relation to certain insecticide application methods. The trainings and demonstration trials utilize all aspects of the Oklahoma Cooperative Extension Service which include County Educators, Area Extension Livestock Specialist, and State Extension Specialists.

**Results**

Through our trainings and demonstration trials we were able to show the most efficacious application method for horn fly control are ear tags impregnated with insecticides. When compared to other application methods ear tags required fewer follow-up insecticide applications when compared to sprays and pour-on applications. This results in lower labor costs due to reduced insecticide applications as well as improved environmental quality to pasture ecosystems. Another advantage was the cattle tagged with insecticide impregnated ear tags gained 24.8 lbs more than those sprayed multiple times to reduce horn fly populations. These results were presented to beef producers at 15 different beef extension meetings and out of 400 attendees at these meetings 20% stated they would change their insecticide application practices to control horn flies. If 20% of Oklahoma beef producers changed to this method of fly control, the Oklahoma beef market would realize \$35.16 million in additional income (24.8 lb X \$1.61 per pound = \$7.73 per animal X 4.55 million beef animals in Oklahoma X 0.2 adoption rate).

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

#### **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
- Populations changes (immigration, new cultural groupings, etc.)

##### **Brief Explanation**

#### **V(I). Planned Program (Evaluation Studies)**

##### **Evaluation Results**

The number of people receiving training and the publications generated shows impact within Oklahoma.

##### **Key Items of Evaluation**

Number of people receiving training, number of presentations given, and the number of publications generated.