

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Global Food Security and Hunger - 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
216	Integrated Pest Management Systems	100%		100%	
	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	25.0	0.0	13.0	0.0
Actual Paid Professional	18.1	0.0	0.9	0.0
Actual Volunteer	94.0	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
248727	0	73466	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1505585	0	284849	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
110688	0	180832	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research

- Develop new and novel techniques for pest management and pest detection

Delivery

- Provide IPM information to a wide variety of stakeholders
- Employ new methods for delivery IPM information

Education

- Conduct IPM educational programs for stakeholders
- Conduct IPM educational training for university students
- Conduct IPM educational training for Vo-Ag and FFA students
- Conduct IPM public awareness campaign

Extension

- Work with communities, schools, businesses to help them meet their regulatory responsibilities on pesticide application
- Help growers develop scouting programs to identify pest populations before significant plant damage occurs.
- Develop pest management options to be used in an integrated or rotational program.
- Identify indicators to help growers anticipate pest problems.
- Develop monitoring techniques and population damage thresholds for selected pests.
- Provide scientifically sound advice to state regulatory bodies on pest management and pesticide issues
- Create a multidisciplinary program comprising of faculty, staff, volunteers, industry partners and government officials
- Investigate IPM methods to help growers produce top quality crops, limiting or reducing production costs.
- Evaluate all pest and crop management practices into a set of commercially used methods. These include the use of: pesticides, economic/aesthetic threshold levels, resistant cultivars, optimum horticultural practices, environmental monitoring, pest scouting, and fertility monitoring and recommendations.

2. Brief description of the target audience

- Municipalities
- Pesticide applicators and their employers
- Commercial pesticide applicators
- State Dept. of Environmental Protection
- Staff and students who gain valuable scientific experience
- Industry partners in agriculture and related commodities
- Consumers
- NJAES Faculty and Staff involved in pest management research/outreach
- Farmers
- Commodity groups
- New Jersey residents
- School faculty, staff and children
- NJAES researchers
- Secondary and university students
- Governmental agencies
- Environmental organizations
- Agricultural, landscape, fine turf and other related industries

3. How was eXtension used?

Invasive Species CoP was used by faculty.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2757	25	0	0

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	6	5	11

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- A variety of strategies will be implemented to reach target audiences. This will include and not be limited to workshops, field visits, classes, newsletters, media releases, electronic communications, publications. In addition a trained volunteer teaching base will be developed. Quantitative reports of participation will be collected

Year	Actual
2012	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Short Term - Develop improved IPM delivery methods. Develop detection, monitoring and sampling methods that reliably predict pest levels. Develop novel management methods for a wide variety of pests. Develop IPM training for secondary and university students. Improve public awareness about IPM Determine the effectiveness of pheromones for mating disruption of pests. Greater understanding of entomopathogenic nematode species'effects on pests. Evaluation of the effectiveness of natural pesticides and crop management to reduce pests. Determine which types of plants attract pests to be used as a pest control method.
2	Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.
3	Long Term - Protect commodities, homes and communities from pests. Increased abundance of high quality food and fiber products. Increased acreage in New Jersey grown under IPM practices. Reduced environmental problems associated with current pest management practices. A comprehensive understanding of best management practices for IPM that are economically viable and environmentally safe.
4	Development of Fruit Entomology Program Aimed at Developing Reduced-Risk Strategies for Integrated Pest Management (IPM), With a Focus on Insect Ecology and Behavior: Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.
5	Turfgrass Entomology Program: Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.
6	Development of Best Management Practices for Suppression of Anthracnose Disease on Annual Bluegrass Turf: Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.
7	North Jersey Ornamental Horticulture Conference Turf Day Program: Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop

	<p>new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.</p>
8	<p>Enabling Pesticide Registrations for Specialty Crops and Minor Uses: Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.</p>
9	<p>Nursery Integrated Pest Management: Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.</p>
10	<p>Pesticide Safety: Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.</p>
11	<p>Upland Fruit (Tree Fruit and Grape) Integrated Pest Management (IPM) Delivery: Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.</p>
12	<p>Blueberry and Cranberry Insect Pest Management ? Towards the Development and Implementation of Reduced-Risk Strategies: Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.</p>
13	<p>Developing and Implementing Integrated Pest Management Strategies : Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.</p>

14	<p>Weed Control in Vegetables, Tree Fruit, Small Fruit, and Cranberries: Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.</p>
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Outcome #1

1. Outcome Measures

Short Term - Develop improved IPM delivery methods. Develop detection, monitoring and sampling methods that reliably predict pest levels. Develop novel management methods for a wide variety of pests. Develop IPM training for secondary and university students. Improve public awareness about IPM Determine the effectiveness of pheromones for mating disruption of pests. Greater understanding of entomopathogenic nematode species'effects on pests. Evaluation of the effectiveness of natural pesticides and crop management to reduce pests. Determine which types of plants attract pests to be used as a pest control method.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

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)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code **Knowledge Area**
216 Integrated Pest Management Systems

Outcome #2

1. Outcome Measures

Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Developing Integrated Urban Pest Management Strategies

Environmental issues are among the most serious problems faced statewide and nationally. The top four environmental issues in New Jersey were: 1) land use change, 2) indoor pollution, 3) invasive species and 4) outdoor air pollution.

What has been done

The Extension Specialist in Urban Entomology conducted a variety of research activities in two housing complexes in Newark, New Jersey; one housing authority in Jersey city, New Jersey; and a housing complex in Indianapolis, Indiana. This included: 1) field testing of new bed bug lures and trap designs developed by our research team; 2) survey of bed bug infestations in low-income housing communities; 3) implemented an integrated bed bug management program; and 4) evaluation of resident behavioral change after education. Events. Research findings were delivered at the following conferences: Bed bug summit organized by Singapore Pest Management Association; XXIV International Congress of Entomology, Daegu, South Korea; National Conference on Urban Entomology, Atlanta, GA; Eastern Branch of the ESA meeting, Hartford, CT; Entomological Society of America annual meeting. Reno, NV. Demonstrated

integrated bed bug management program in two housing complexes. Provided face to face trainings to housing staff, health officers, and pest control technicians in New Jersey. Presented a webinar to health care and social workers in the U.S. A 7 minute video on bed bugs; 5 short video clips; two powerpoint presentations for training residents and staff; five brochures on bed bugs; a bed bug web site (<http://njaes.rutgers.edu/bedbug/info>).

Results

Change in knowledge; residents, housing staff, social workers, and health officers are more aware of the biology of bed bugs and how to prevent them and control them using safe, effective methods. Pest control technicians are more aware of the newest pest control technologies and their effectiveness. Change in actions; after our education on proper bed bug prevention and control methods, residents report that they rarely use over-the-counter sprays or foggers for bed bug control. Increased number of housing staff are using monitors to monitor bed bug infestations and using non-chemical methods to control bed bugs. These methods include using a steam machine to treat infested furniture and installing mattress encasement. Many social workers, law enforcement officers, health workers now follow our advice on bed bug prevention when doing their work. Change in conditions; we demonstrated two bed bug management programs in a low income housing complex in Newark, New Jersey. Eight apartments were included in each treatment program. After 12 weeks, the number of bed bugs were reduced by 92 and 95 percent respectively. We also implemented a building-wide bed bug management program in Indianapolis, Indiana. After 1 year, the infestation rate was reduced by 27 percent. The number of apartments with more than 10 bed bugs was reduced by 83 percent. Surveys of 89 residents show 90 percent of the residents rated the program good or very good, while 10 percent of residents rated the program as fair.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #3

1. Outcome Measures

Long Term - Protect commodities, homes and communities from pests. Increased abundance of high quality food and fiber products. Increased acreage in New Jersey grown under IPM practices. Reduced environmental problems associated with current pest management practices. A comprehensive understanding of best management practices for IPM that are economically viable and environmentally safe.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

{No Data Entered}

What has been done

{No Data Entered}

Results

{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #4

1. Outcome Measures

Development of Fruit Entomology Program Aimed at Developing Reduced-Risk Strategies for Integrated Pest Management (IPM), With a Focus on Insect Ecology and Behavior: Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
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2012

0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Development of Fruit Entomology Program Aimed at Developing Reduced-Risk Strategies for Integrated Pest Management (IPM), With a Focus on Insect Ecology and Behavior

Endemic pests and invasive insects threaten the livelihood of NJ's long-standing fruit production. There is an immediate need to develop curative management strategies to protect peach, wine grapes and cranberries from this suite of dynamic pest species so that NJ growers can continue to provide locally produced fresh-market produce.

What has been done

Extension practices have been focused on on-farm visits to understand grower operations and needs and to make the necessary connections with growers and extension collaborators. The research and extension program is targeted to generate science-based research results that growers can readily apply to their farm or orchard to make production practices more economically and environmentally sustainable. Focused work has developed a phenological model and a reduced spray program for management of Brown Marmorated Stink Bug (BMSB) that has been the topic of numerous extension talks and has been integrated into the Rutgers Tree Fruit Production Guide 2013. We had three cooperating growers who participated in the on-farm reduced spray program, all of whom were quite happy with the results and have agreed to participate again in 2013.

Results

The immediate result of the NJAES research program have been a decrease in the amount of insecticide active ingredient applied to tree fruit. This increases economic outputs for the grower, increases worker safety and reduces the amount of materials put into the environment.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #5

1. Outcome Measures

Turfgrass Entomology Program: Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Turfgrass Entomology Program

In the USA (in New Jersey), turfgrass in its many forms, e.g. lawns, parks, cemeteries, sod farms, golf courses, athletic fields, covers > 30 million (0.9 million) acres and is a \$45 billion (\$0.8 billion) industry. The most wide-spread, destructive, and difficult to control turfgrass insect pest in New Jersey and the Northeastern USA are several species in the white grub complex. In fine turf, the annual bluegrass weevil is a pest of increasing importance and difficulty to control in New Jersey and the Northeastern USA. The black cutworm is perennial and cosmopolitan pest of on golf courses. Due to the implementation of the Food Quality Protection Act of 1996 and local legislation, fewer and fewer insecticides are available for the control of these pest. Preventive applications of insecticides have become the standard for these pests but are expensive, of limited compatibility with IPM, and do not work well against some white grub species and often require several applications per year for the annual bluegrass weevil. The number of annual bluegrass weevil populations with resistance to insecticides continues to be on the rise. There is a dire need for the development of alternative control agents and control strategies.

What has been done

The target Extension audiences are turfgrass professionals (golf, athletic fields, landscapers, sod growers, etc.), County Ag Agents, and homeowners (mostly through County Ag Agents and master gardeners). Activities include: 1) teaching (Cooperative Extension Talks, local and regional turf conferences, Continuing Education courses, Field day), 2) turf insect management recommendations (publications and by email/phone/personal), 3) publications (trade journal and newsletter articles, fact sheets, bulletins).

NJAES research developed and implemented ecologically-based IPM for turfgrass systems with emphasis on sustainability and non-chemical control approaches.

Results

Research and Extension efforts will help turfgrass managers and homeowners in New Jersey and the Northeast to manage turfgrass insect pests more effectively with reduced risk to health and environment. The financial impact cannot be estimated at this time, as it will depend on the cost and persistence of the developed control agents/strategies. However, in most turfgrass situations health and environmental concerns tend to outweigh financial concerns.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #6

1. Outcome Measures

Development of Best Management Practices for Suppression of Anthracnose Disease on Annual Bluegrass Turf: Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Development of Best Management Practices for Suppression of Anthracnose Disease on Annual Bluegrass Turf

Turfgrass is a valuable and rapidly expanding component of our urban and rural landscape. Turfgrass is used to stabilize soil and produce a playing surface on more than 17,000 golf courses in the US. Golf courses are an important component of the turfgrass industry providing a source of green space in the urban environment and offering recreation and enjoyment for approximately 36 million Americans. Golf courses also generate jobs, commerce, economic development, and tax revenues for communities throughout the country. A recent report by the World Golf Foundation stated that golf contributes \$62.2 billion worth of goods and services each year to the national economy (www.golf2020.com).

What has been done

Due to the increasing severity of anthracnose on golf courses in North America, studies were initiated at nine universities (CA, CT, MD, MI, NC, NJ, NY, PA and ON [Guelph, Canada]), including Rutgers as part of a multistate turf regional research project (NE-1025; now NE-1048). The goal of the anthracnose portion of this project was to develop and disseminate a set of best management practices (BMPs) to golf course superintendents that would result in successful control of anthracnose in a sustainable manner, while reducing pesticide inputs and maintaining acceptable turfgrass quality. The objectives of this project were specifically to 1) Fill critical knowledge gaps in our understanding of the biology, ecology, and impact of anthracnose associated with annual bluegrass on golf courses in the Northeast and Mid-Atlantic US; 2) Identify and develop new cultural, biological, chemical, and genetic control options for suppressing anthracnose on golf courses; 3) Develop improved IPM decision tools for managing anthracnose; and 4) Develop BMPs that will help reduce the economic and environmental costs associated with fungicides currently used to control this disease.

Findings were disseminated to stakeholders via state, regional, national and international conferences, newsletters, trade and professional publications, blogs, podcasts, and webcasts. Information to the general public was disseminated through publications in the popular press, magazines, oral and written presentations at workshops and at golf course research field days. A feature article on the biology and control of anthracnose was published in Golf Course Management (GCM) Magazine (an international trade journal with a readership of 23,000 turf managers) in 2008 to widely disseminate research results from the first 3-years of this project. Four follow-up articles were published in the May/June 2012 issues of GCM to document further project accomplishments and to update our BMPs for superintendents in the US and abroad. A list of all publications developed by NE-1025 members have been updated each year and posted on the NE-1025 and the NE-1048/NIMSS (www.lgu.umd.edu) website.

Results

Based on a validation of the research conducted for this project in 2012, different combinations of BMP cultural management factors resulted in the following reductions in fungicide usage (i.e., few fungicide applications during the summer compared to a 14-day calendar-based application schedule): a 10% reduction was documented where the BMP mowing height (0.125 inches) and non-BMP N rate (2 lb N 1000 ft-2 yr-1) was implemented; a 50% reduction where a BMP N (4 lb N 1000 ft-2 yr-1) and non-BMP mowing (0.09 in) regime was used; and an 80% reduction with a combination of BMP N and BMP mowing heights.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #7

1. Outcome Measures

North Jersey Ornamental Horticulture Conference Turf Day Program: Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater

understanding of entomopathogenic species biology and ecology.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

North Jersey Ornamental Horticulture Conference Turf Day Program

Turfgrass is a valuable and rapidly expanding component of our urban and rural landscape. Turfgrass is used to stabilize soil and produce a playing surface on more than 17,000 golf courses in the US. Golf courses are an important component of the turfgrass industry providing a source of green space in the urban environment and offering recreation and enjoyment for approximately 36 million Americans. Golf courses also generate jobs, commerce, economic development, and tax revenues for communities throughout the country. A recent report by the World Golf Foundation stated that golf contributes \$62.2 billion worth of goods and services each year to the national economy (www.golf2020.com).

What has been done

The North Jersey Ornamental Horticulture Conference (NJOHC) has been serving the turf industry for 51 years. The main objective of the NJOHC Turf Day program is to promote the adoption of integrated pest management practices by industry professionals. Adoption of IPM practices will reduce the amount of fertilizers and pesticides used on residential, commercial and public properties.

Results

On the program evaluation, 99% of the participants learned something they intend to apply to their turf management practices. Ninety-four percent of the professionals will make more informed pest management decisions.

Of the participants who indicated they had attended programs in the past, 86% have changed their pest control practices as a result of the program. Changes were described as practicing IPM, using less chemicals, using organic chemicals, and better record keeping. One participant noted "applied field test results to my actual treatments-not trial and error."

Fifty-one percent of the professionals reported they use less pesticide. Evaluations showed that

27 professionals reduced use by 1-10%, 24 by 11-20% and 6 by 21 -30%. As a result of the training, 41% of the participants indicated their business saved money. The amounts ranged from \$2,000 to \$8,000 dollars.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #8

1. Outcome Measures

Enabling Pesticide Registrations for Specialty Crops and Minor Uses: Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Enabling Pesticide Registrations for Specialty Crops and Minor Uses

Agricultural chemical producers readily test and seek U.S. Environmental Protection Agency (EPA) approval for new pesticides for blockbuster crops like corn and wheat. That's because there's a potential to market a product that can be used on from 70 to 80 million acres. The chemicals industry recoups its investment and makes a profit.

Other, smaller crops like mint and cucumbers are generally not worth the industry's attention. But these minor crops?defined as those grown on 300,000 acres or less?are helped by a federal-state project known as Interregional Research Project No. 4, or IR-4.

According to the most recent census of agriculture, 11 million acres of minor crops are grown annually in the United States," says Guest. "They have a combined value of \$32 billion and represent 42 percent of all crop sales. In 27 states, these minor crops exceed the value of all the other major crops including corn, cotton, soybeans, and wheat."

What has been done

The IR-4 Project continues to develop necessary data to support the registration of pest control products for specialty crops and other markets where industry sector lacks the incentive to register the important uses. Food Program: based on IR-4 submissions, EPA approved 188 new pesticide tolerances supporting 766 new uses. EPA also codified updates to the stone fruit and tree nut crop groups. To support future registrations on food crops, IR-4 initiated 75 new residue studies that consisted of 532 field trials. IR-4 also conducted over 85 efficacy and/or crop safety trials on food crops to answer the product performance data requirements for 29 projects. IR-4 submitted new residue tolerance petitions on 37 different chemicals to EPA that cover over 160 IR-4 requests from stakeholders and should provide hundreds of new crop registrations for growers.

Ornamental registrations and label amendments for ornamental horticulture crops partially based on IR-4 data, which specifically impacted 2,485 ornamental uses. During this period IR-4 implemented activities for future registrations including: initiating 740 field and greenhouse trials on ornamental crops to collect efficacy and/or crop safety data within 481 studies; writing and submitting to registrants 22 data summaries to registrants to expand the use of pesticides on ornamentals; and collaborating with national and international scientists on the development of efficacy data for invasive species. Public Health Program: IR-4 submitted additional data to support IR-4's 1st public health pesticide residue study to support registration of etofenprox to control adult mosquitoes near crops. Also expanded online database and published Public Health Pesticides Inventory, with information on specifications, regulatory, use, efficacy, and safety information on 600+ materials.

Results

The IR-4 Project leverages resources to pursue registration for such uses. When well-established methods of measuring direct and secondary economic impacts are used to gauge the contributions of the IR-4 Project and its three primary programs, including the Food Crops, Ornamental, and Biological and Organic Support programs in terms of sales, employment and gross domestic product is significant. Each program posts real economic benefits to growers and the economy as a whole. Specifically, growers benefit in higher yields with higher quality output, consumers benefit by higher varieties and lower costs to food and ornamental crops, and the industry benefits through better global competitiveness of U.S. output. Including all secondary impacts, the IR-4 Project is anticipated to support research and industry sales sufficient to support 104,650 U.S. jobs and bumps annual gross domestic product by \$7.3 billion.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #9

1. Outcome Measures

Nursery Integrated Pest Management: Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Nursery Integrated Pest Management

According to the USDA 2007 Agricultural Census, there are 183 nurseries located in Cumberland & Salem Counties. Cumberland County's 135 nurseries alone accounts for the largest concentration of nurseries for any county in New Jersey and the fifth largest in the United States. Within Cumberland County there are over 7,500 acres of stock in the open and more than an additional 115 acres listed as being under protection. The nursery with the most diverse plant inventory produces over 2,000 varieties of plants. Pesticide development has evolved from products that control a wide range of pests to ones that are very focused on certain pests or pest classes. This has resulted in more specificity along with higher pesticide costs.

The combination of many plant varieties, the various pests, and the issue of increasingly pest-specific pesticides creates a serious challenge to growers in their efforts to control pests. In addition, growers need to rotate between classes of pesticides to help reduce the possibility of pest resistance. The final issue is grower concern of phytotoxicity.

What has been done

Integrated pest management relies on scouting plant material to determine pest presence and pressure. Using scouting information, Cooperative Extension personnel offer control strategies.

The Cooperative Extension Program Associate, scouted a total of 182 acres of nursery plant

material during the 2012 growing season.

Results

A goal of the IPM program and a measure of success is to have nurseries train their personnel and start their own integrated pest management programs. Two nurseries continued to take advantage of personnel training during 2012. One nursery that was involved with the scouting program during 2010 and 2011 initiated their own program for 2012. It was the fourth nursery to take on their own scouting program, with nurseries initiating their own programs in 2009, 2010 and 2012. Work continues with growers from three additional nurseries to train personnel in scouting techniques.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #10

1. Outcome Measures

Pesticide Safety: Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Pesticide Safety

Pesticides are designed to (in most cases) kill pests. Many pesticides can also pose risks to

people. However, in many cases the amount of pesticide people are likely to be exposed to is too small to pose a risk. To determine risk, one must consider both the toxicity or hazard of the pesticide and the likelihood of exposure. A low level of exposure to a very toxic pesticide may be no more dangerous than a high level of exposure to a relatively low toxicity pesticide.

What has been done

The annual Salem County pesticide safety meeting, entitled "2012 Salem County Pesticide Safety Meeting," was held. Farmers of various commodities attended this workshop to learn about current and emerging insecticides, pesticide control and monitoring in groundwater, weed resistance and herbicides for vegetable crops, worker protection standards and pesticide regulations, weed control for grain crops, and pesticide infiltration into water sources.

Results

Seventy-four farmers received pesticide handling safety equipment: 100% of farmers surveyed 6 months after the meeting has utilized safety equipment, 5 producers changed record-keeping policies to coincide with NJDEP regulations, 8 producers made appropriate changes to reduce herbicide resistance in weeds on their operation, 2 producers began posting re-entry interval signs to comply with worker protection standards, 3 producers plan to utilize drip irrigation to make more efficient use of pesticides, 6 producers plan to utilize filter strips and/or swales to reduce pesticide runoff. Overall, 47% of participants made changes to their operations as a result of this meeting.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #11

1. Outcome Measures

Upland Fruit (Tree Fruit and Grape) Integrated Pest Management (IPM) Delivery: Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Upland Fruit (Tree Fruit and Grape) Integrated Pest Management (IPM) Delivery

New Jersey tree fruit production is located in both southern and northern counties. Statewide in 2012, tree fruit was valued at over \$16 million for apples and just over \$32 million for peaches. The industry in southern counties is heavily oriented towards wholesale markets and peach production, while the industry in northern counties is heavily dependent on direct markets and apple production. Retail market fruit production in northern counties is valued at approx. \$10-12 million.

What has been done

An integrated crop management (ICM) program was delivered to commercial fruit growers who produced apples, peaches, nectarines, and grapes. The program reached both primary and secondary participants. Secondary participants attended Extension update meetings, and received other IPM/ICM information through personal visits, fax broadcasts, articles, newsletters and the Internet. Primary participants are those growers who access all the above information and participate in a field scouting program.

A broadcast fax service was used in Hunterdon and Gloucester Counties to advise of timely pest events and supplement the Plant and Pest Advisory Fruit Edition Newsletter. Organized grower meeting contact reached a total of 537 audience members, while on-farm consultations totaled 1,986 visits. 29 weekly articles were written in a statewide newsletter, with a total circulation of 178 subscribers in NJ and 9 other states. Acreage impacted by primary participants totaled 75% of all state tree fruit acreage. Over 95% of total state tree fruit acreage was impacted by the program. IPM information reached over 90% of NJ grape growers.

Results

Weekly pest management recommendations to growers led to pest free fruit valued at \$48 million throughout the state for tree fruit and \$39 million for grapes.

Laboratory tests were completed in 2012 as part of the fertility component. Over 75% of areas sampled were shown have sufficient to excessive phosphorous levels, which led to decreased phosphorous use on those sites.

The invasive insect, brown marmorated stink bug (BMSB) has set pest management programs back 30-40 years. A trial project conducted in 2012 demonstrated that growers could treat field edges while using mating disruption and ground cover management to reduce insecticide use by up to 75% compared to most commercial practices now being used for BMSB.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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216 Integrated Pest Management Systems

Outcome #12

1. Outcome Measures

Blueberry and Cranberry Insect Pest Management ? Towards the Development and Implementation of Reduced-Risk Strategies: Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Blueberry and Cranberry Insect Pest Management ? Towards the Development and Implementation of Reduced-Risk Strategies

The blueberry and cranberry industry in New Jersey suffers major yield losses due to insect pests. Growers rely heavily on insecticides to manage pest problems. What is needed are these reduced-risk strategies that are expected to impact positively the environment and the well being of humans and their communities.

What has been done

The Blueberry/Cranberry Entomology Program at Rutgers University, focuses on the development and implementation of cost-effective reduced-risk insect pest management practices in blueberries and cranberries and the dissemination of this information to blueberry and cranberry growers. Several methods of information transfer including annual grower meetings, field days, twilight meetings, newsletters, and electronic media are used to serve the blueberry and cranberry industry in New Jersey. Newsletter articles (30) were published throughout the growing season to provide information on pest management and to update findings on new pesticides. Educational sessions were regularly offered in Atlantic and Burlington Counties. These sessions

provided an overview of research progress and future work. More informal twilight meetings were held during the growing season to provide seasonally-relevant pest management information. Summer sessions directed to the community (local schools and senior institutions) were also conducted regularly during the growing season. The research program also delivered presentations at meetings to the scientific community.

Results

Researchers and Extension faculty/staff developed and implemented new tools for monitoring insect pest populations in blueberries and cranberries, worked with IR-4 on the registration of new insecticides in blueberries and cranberries, evaluated, implemented, and promoted adoption of new reduced-risk strategies for insect control in blueberries and cranberries, and delivered presentations to more than 100 New Jersey blueberry and cranberry growers on the use of new insect pest management practices, resulting in positive environmental impact and the well-being of humans and their communities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #13

1. Outcome Measures

Developing and Implementing Integrated Pest Management Strategies : Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Developing and Implementing Integrated Pest Management Strategies

Our society is facing increasing urban pest problems as more houses are built, more people are living closely with the natural environment and more travel and international economic activities are occurring each year. Pests such as termites, bed bugs, cockroaches, ants, flies, ticks, rodents, etc. cause billions of dollars of commodity loss, structural damage, and a number of diseases. Pesticide use for controlling urban pests often pollute the environments, pose risks to human and pets, and lead to insecticide resistance. The public needs to understand biology pests, pest control methods, and insecticides to reduce pests, reduce diseases vectored by urban pests, and minimize health risks associated with pesticide applications.

What has been done

NJAES conducted bed bug behavior and management research. In the laboratory, we studied different bed bug monitor design, different lure formulations, and different carbon dioxide sources. We trained staff from public housing authorities on bed bug prevention and control. The objective was to provide housing authority staff necessary knowledge on bed bug prevention and control with the goal of improving their ability to combat the increasing bed bug infestations and reduce the cost and bed bug control.

Results

A bed bug lure technology was licensed to two private companies. A patent application was filed to U.S. Patent Office.

A home-made, simple bed bug monitoring system developed in our laboratory provided to be at least as effective as the commercial active bed bug monitors. It represents 95% cost savings compared with the most effective commercial active bed bug monitor.

Implementing a bed bug management program in a 223-unit apartment building for 12 months resulted in 27% reduction in infestation rate and 83% reduction of apartments with medium or high bed bug infestations. Interviews of 89 residents in the building showed that 90% of them are satisfactory with our bed bug management program implemented in that building.

A new bed bug treatment technique (dust band) was tested and found it was as effective as integrated pest management which includes both chemical and non-chemical treatments. The results were published in a peer-reviewed journal.

Our bed bug video titled "Bed bugs and integrated pest management" received approximately 3,000 views as of December 2012 (not including on-site shows). The second video titled "Bed Bug management for Professionals" received approximately 500 views as of December 2012.

A survey of audience who watched our short bed bug video shows that 100% of the 250 surveyed people think the video material is useful and will recommend to others.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #14

1. Outcome Measures

Weed Control in Vegetables, Tree Fruit, Small Fruit, and Cranberries: Medium Term - Research and educational programs, and public awareness campaign results in increased adoption of IPM in traditional and non-traditional systems. Research findings used to develop new projects. IPM training of students creates new IPM interns, professionals and researchers. Knowledge of various natural insecticides and their effectiveness on pests. Determining the best time and application method for IPM products. Greater understanding of pest biology and ecology. Greater understanding of entomopathogenic species biology and ecology.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Weed Control in Vegetables, Tree Fruit, Small Fruit, and Cranberries

The cost of controlling weeds in vegetable and fruit crops continues to affect the profitability of these crops for New Jersey growers. Manufacturers continue to cancel registrations on old herbicides due to loss of market share in the major markets.

What has been done

Alion has been recommended in blueberries, and recommendations for use in vineyards, pome fruits and stone fruits. Research conducted at Rutgers Agricultural research and Extension Center in growers orchards and vineyards supported the use of Alion in late fall or early spring for annual weed control. Alion is most consistent when applied in late fall, when rainfall to activate the herbicide is assured.

The Callisto label has been expanded to include blueberries and cranberries, including newly planted cranberry bogs. In blueberries, the target weeds are common lambsquarter and other annual broadleaf weeds. The minor crop labels for the use of Callisto on cranberries was the result of a nation-wide cooperative effort between university faculty, government agencies such as IR-4 and the EPA, and industry. The effort was initiated by the innovative and accurate results of the weed control research conducted at Rutgers NJAES.

Fluroxypyr (Quinstar 4F) has received a federal label for use in cranberries to control dodder, and many other annual and certain perennial weeds, including yellow loostrike (swamp candle), the most widespread weed in cranberries, worldwide. The label effort was initiated by the innovative and accurate results of the weed control research conducted at Rutgers NJAES.

Results

Several new herbicides, and new registrations for old herbicides will be recommended in New Jersey as a result of research conducted at Rutgers.

Weed control will be improved. Crop yield and quality will be increased. Farm profits will be increased. Soils will be improved. Herbicide use will be reduced.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

See Qualitative Outcomes

Key Items of Evaluation

See Qualitative Outcomes