Final Report to the Western IPM Center
September 30, 2011

A. Grant Data

Grant #07-001492-UA3
Title: Crop Pest Losses and Impact Assessment Work Group
Progress Report to the Western IPM Center, September 30, 2011
Type: IWG
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States Involved: Arizona, California
Funding Year: 2009-2011
Funding Amount: $10,000 per year for 2 years

B. Nontechnical Summary

Through this project, focused in the low deserts of Arizona and Imperial Valley California, we develop accurate “real world” data on crop pest losses, control costs, target pests and pesticide use, through face-to-face workshops in an interactive survey process that encourages (and rewards) stakeholder input. Growers, pest control advisors (PCAs), Extension personnel and industry professionals attend workshops to complete the survey, and are offered incentives to offset the costs of participation. This face-to-face approach results in improved response rates, a more representative and better quality set of data, education of all those involved, and collaborative partnership with key stakeholder groups. As necessary, we conduct follow-up mail surveys with key PCAs to ensure good representation of region-wide acres in the final datasets. We currently collect data for cotton, cantaloupes, watermelons and head lettuce. The data generated are useful for responding to pesticide information requests generated by EPA & USDA, and can provide a basis for regulatory processes such as Section 18 or 24c requests, as well as for evaluating the impact of our extension programs on risk reduction to growers.
C. Objectives

1. **We will engage agricultural stakeholders in Arizona and California to develop Crop Pest Losses (CPL) data for key desert crops (currently cotton, head lettuce, watermelons and cantaloupe), including the most relevant pest groups (insects, weeds, diseases, nematodes) for each crop.**

   This objective was achieved. We held five meetings in the 2009-10 season and five in the 2010-11 season, discussing and developing crop pest losses data for cotton, head lettuce, watermelons, cantaloupes and interacting with about 132 stakeholders from Arizona and California. We also collected survey data by mail and email. Workshops serve as a focal point for discussion about shifting pest management needs and IPM program emphases. For example, in 2011, John Palumbo collected important information from PCAs about bagrada bug infestation levels and insecticides used to control it in cole crops. The bagrada bug is a new invasive pest of Arizona cole crops.

2. **We will serve as a clearinghouse for information and metrics on crop pest losses and impact assessments.**

   This objective was achieved. Through the Arid Southwest IPM Network, we have continued to coordinate responses to federal pesticide information requests for Arizona and neighboring states in the arid southwest. As appropriate, we have incorporated CPL data into our responses to federal pesticide information requests and posted our responses online. CPL data have also served local and regional needs (detailed in previous reports), including a recent economic analysis for Arizona Cotton Growers Association of the value of Bt Cotton in our markets (Ellsworth 2010).

   Since the last report, we have updated the Cotton Pest Losses website which now features detailed Cotton Pest Losses data and analysis from 1979 through 2008 (http://ag.arizona.edu/crops/cotton/insects/cil/cil.html) (2009 data were previously posted, but have been removed to revise and reanalyze some data. 2010 data have been compiled and analysis is in process. These data will be finalized once final cotton prices for the year are available.) In 2010, we created a working group page on the Arizona Pest Management Center website (http://cals.arizona.edu/apmc/croplosswg.html). This page states the purpose of the working group, provides access to all grant reports, a link to the Western IPM Center website, and direct links to the Vegetable and Cotton Pest Losses sites. New publications were added to the Vegetable Pest Losses website (http://ag.arizona.edu/crops/vegetables/insects/vegiloss.html).

3. **We will conduct outreach, presenting data and information about the data collection process to agricultural stakeholders and colleagues, locally, regionally, and nationally.**
This objective was achieved. Data generated by the working group is frequently presented to educate growers, pest control advisors and others about desert pest management, and the impact of key insect pests, weeds and diseases and their control strategies on yield and profit. In particular, annual Cotton Pest Losses data, which is available for the longest span, is used to show dramatic impacts of evolving IPM strategies on pesticide use, grower profits and the environment.

4. **We will develop an impact assessment analysis and report based on 6 to 30 years of crop pest losses data (depending on the crop) and other data sources.**

This objective is in progress. We have developed and analyzed crop pest losses data and developed graphics used in presentations and publications to educate stakeholders about crop pest losses and the impact of IPM programs and pest management technologies. For example, John Palumbo developed an assessment of insect losses and insecticide use data on Arizona head lettuce using CPL data from 2004-2010.

Another data source to illuminate grower pest management practices is the Arizona Pest Management Center pesticide use database, which contains 20 years of state pesticide use records as well other useful data. In April 2011, we hired a dedicated Assistant in Extension, Wayne Dixon, who is now helping us to mine these data, and has also started integrating crop pest losses data into a separate database. Though more work remains to be done, many of the components of the report have been developed.

**E. Outputs**

- Held 10 face-to-face interactive stakeholder crop pest workshops in Arizona and California, attended by 132 stakeholders, including pest control advisors, growers, Extension personnel and agro-industry representatives. Many participants completed crop losses questionnaires and engaged in dialog to help us improve the process.
- In 2011, John Palumbo collected important survey information from pest control advisors (PCAs) about bagrada bug, a new invasive pest of Arizona cole crops. He is examining the extent and changes in infestation levels, and insecticides used to control it. The CPL workshops provide an important ongoing opportunity for face-to-face feedback from PCAs about important emerging pest issues.
- The Cotton Pest Losses survey was either emailed or physically mailed to 35 potential respondents (mostly PCAs) in 2009 and to 25 in 2010. In 2011, for the first time, Melon Pest Losses surveys were mailed out to PCAs, but the response rate was disappointing. Data from mailed surveys helps supplement face to face data and provide a more complete picture of pest losses.
- In addition to insect information, Crop pest losses surveys now collect detailed data on weed losses and management (all crops) and disease losses and management (lettuce and melons). Our collaboration with additional scientists to develop this aspect of the data has been successful and we plan to continue.
- Collected, analyzed, and presented data on pest losses, including information on the yield impact of key insect pests, diseases and weeds of cotton, lettuce and
Published 8 articles and reports that included CPL data, including 3 peer reviewed journal articles for Pest Management Science and Southwestern Entomologist, 4 reports and one trade press article. Two additional UA research reports have been submitted.

A conservative tally of Extension presentations making use of these data over this two-year grant is 35, which includes 10 new presentations added to the bibliography at the end of this report. In addition, through presentations at national (e.g., Entomological Society of America) and international (e.g., International Bemisia Conference) conferences we have shared data with scientific colleagues.

Incorporated CPL data into federal pesticide information requests related to oxamyl, spirotetramat, thiodicarb. Our replies to information requests are available by clicking “Information Requests” on our website at http://ag.arizona.edu/apmc/Arid_SW_IPM.html.

We used CPL data in a recent economic analysis done for the Arizona Cotton Growers Association on the value of Bt Cotton in our markets (Ellsworth 2010).


Created a working group page on the Arizona Pest Management Center website (http://cals.arizona.edu/apmc/croplosswg.html) with statement of purpose, links to grant reports, a link to the Western IPM Center website, and direct links to the Vegetable and Cotton Pest Losses sites.

Published an assessment of insect losses and insecticide use data on Arizona head lettuce using CPL data from 2004-2010, as part of a Vegetable IPM Update on the ACIS website. This was sent as smart phone update to over 300 stakeholders and was picked up by Western Farm Press and further distributed to thousands throughout the west. http://ag.arizona.edu/crops/vegetables/advisories/more/insect31.html

Meeting Participation

A summary of meeting participation is presented in table 1. 132 stakeholders, including pest control advisors, growers, Extension personnel and agro-industry representatives, participated in 10 meetings in 2 states. Many participants completed crop losses questionnaires and engaged in dialog to help us improve the process.
Table 1: Crop Insect Losses meeting participation summary, Sept 2009 – Aug 2011.

<table>
<thead>
<tr>
<th>Date</th>
<th>Crops</th>
<th>Pests</th>
<th>Location</th>
<th>Participants</th>
<th>CEUs</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/2/09</td>
<td>Cotton</td>
<td>Insects, weeds</td>
<td>Maricopa, AZ</td>
<td>9</td>
<td>3AZ, 3CA, 3CCA</td>
</tr>
<tr>
<td>12/3/09</td>
<td>Cotton</td>
<td>Insects, weeds</td>
<td>Poston, AZ</td>
<td>5</td>
<td>3AZ, 3CA, 3CCA</td>
</tr>
<tr>
<td>12/10/09</td>
<td>Cotton</td>
<td>Insects, weeds</td>
<td>Yuma, AZ</td>
<td>12</td>
<td>3AZ, 3CA, 3CCA</td>
</tr>
<tr>
<td>4/28/10</td>
<td>Head Lettuce</td>
<td>Insects, weeds, diseases</td>
<td>Yuma, AZ</td>
<td>23</td>
<td>2AZ, 2CA, 2CCA</td>
</tr>
<tr>
<td>7/13/10</td>
<td>Cantaloupe &amp; Watermelons</td>
<td>Insects, weeds, diseases</td>
<td>Yuma, AZ</td>
<td>15</td>
<td>2AZ, 2CA</td>
</tr>
<tr>
<td>11/9/10</td>
<td>Cotton</td>
<td>Insects, weeds</td>
<td>Maricopa, AZ</td>
<td>9</td>
<td>2.5 AZ</td>
</tr>
<tr>
<td>11/12/10</td>
<td>Cotton</td>
<td>Insects, weeds</td>
<td>Yuma, AZ</td>
<td>1</td>
<td>2.5 AZ</td>
</tr>
<tr>
<td>12/2/10</td>
<td>Cotton</td>
<td>Insects, weeds</td>
<td>Blythe, CA</td>
<td>8</td>
<td>2.5 AZ</td>
</tr>
<tr>
<td>12/2/10</td>
<td>Cotton</td>
<td>Insects, weeds</td>
<td>Yuma, AZ</td>
<td>2</td>
<td>2.5 AZ</td>
</tr>
<tr>
<td>4/21/11</td>
<td>Head Lettuce</td>
<td>Insects, weeds, diseases</td>
<td>Yuma, AZ</td>
<td>48</td>
<td>2AZ, 2CA</td>
</tr>
<tr>
<td>10 mtgs</td>
<td>4 crops</td>
<td>3 pest types</td>
<td>2 states</td>
<td>132</td>
<td>25AZ, 15CA, 11CCA</td>
</tr>
</tbody>
</table>

Response Rates

Survey response rates for this project period are shown in Tables 2, 3 and 4. Response rates reflect completed surveys used in data analysis, including surveys completed at workshops and those returned by mail. We noted a decline in both the number of responses for cotton and the percentage of acres represented, compared with 2007-08: from an average of 21.5 responses representing about 48% of cotton acres to an average of 16.5 responses representing about 37% of acres. Survey responses for spring and fall head lettuce increased from an average of 11.25 respondents representing an average of 65.5% of 2007-09 Arizona acres to an average of 16.5 respondents representing an average of 69.5% of Arizona acres in 2009-11. In 2009 a decision was made to discontinue collection of data from central Arizona melon growers due primarily to poor participation in the previous years. A melon pest losses workshop was held in Yuma in July 2010, but in 2011 the workshop was discontinued and survey forms were mailed out to PCAs instead. This experiment was disappointing, as only a single response was returned. Therefore we have no 2011 data for cantaloupe and watermelon pest losses. Response rates for melon losses surveys in 2010 were similar to 2009 and down slightly from 2008.
Table 2: Cotton Insect Losses Responses, Arizona, 2009 & 2010.

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of PCA respondents</td>
<td>16*</td>
<td>17**</td>
</tr>
<tr>
<td>Arizona Acreage reported</td>
<td>56,825</td>
<td>70,125</td>
</tr>
<tr>
<td>% of total AZ acreage</td>
<td>38.64%</td>
<td>35.09%</td>
</tr>
</tbody>
</table>

*Plus 4 respondents not used or representing CA acreage
**Plus 2 respondents not used or representing CA acreage

Table 3: Head Lettuce Insect Losses Responses, 2010-2011.

<table>
<thead>
<tr>
<th></th>
<th>Fall 2009 / Spring 2010</th>
<th>Fall 2010 / Spring 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of PCA respondents</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td>Acreage reported</td>
<td>38,822</td>
<td>44,722</td>
</tr>
<tr>
<td>% of total acreage</td>
<td>63%</td>
<td>76%</td>
</tr>
</tbody>
</table>

Table 4: Melon Insect Losses Responses, 2010

<table>
<thead>
<tr>
<th>Survey use statistics</th>
<th>Cantaloupes 2010</th>
<th>Watermelons 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of PCA respondents</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Acreage reported</td>
<td>1,750</td>
<td>1,210</td>
</tr>
<tr>
<td>% of total acreage</td>
<td>50%</td>
<td>60%</td>
</tr>
</tbody>
</table>

F. Impacts and Potential Impacts

This working group continues to expand its efforts and the value of the data generated through this stakeholder-driven process. In the past few years, we have expanded data collection for melons to include insects, plant pathogens and weeds and their management tools. The lettuce survey now includes insects, weeds and plant pathogens and the cotton survey includes insects and weeds. Pest Control Advisors have responded favorably to this approach. Since the same individuals are responsible for all aspects of pest control, it makes sense to collect information on all pests at these meetings. The newly expanded data will serve as a baseline to help us measure changes in non-insect crop pests and their management that occur over time.

The data developed through these efforts are publicly available on the Arizona Crop Information Site (ACIS) and through numerous websites and publications listed in the Appendix. Data identify the leading pest threats in these crops and provide information on control costs and pesticide use preferences and patterns. We have had several information requests in the past year that these data have helped to satisfy. This includes
Federal pesticide information requests (see below) and more local / regional requests from researchers who have used the data in grant proposals and reports.

**Impact of the Data**

These data and this Work Group serve to address any Federal, regional, state, and local requests for information on the impact of insects or insecticides on our key crops. During this project term, we responded to 10 information requests, and used Crop Pest Losses data in about one third of our responses. Formal responses are posted on the Arid Southwest IPM Network website at http://ag.arizona.edu/apmc/Arid_SWPMC_Info_Requests.html.

What makes these data unique with respect to pesticide (and IPM) policy is that we are directly measuring the “intent” of each insecticide input. That is, stakeholders are asked to identify the specific intent or intended target or targets of their management decisions and inputs. So in addition to rich quantitative data, we also have unique qualitative insights into the decision-making experience of the pest manager. These insights help guide our existing and new programs of IPM research, implementation and outreach.

These data are useful in evaluating changes in grower practices and implementation of our IPM programs over time, and facilitating quick responses to the ever-changing needs of grower communities.

Our ongoing dialog with stakeholders through annual Crop Pest Losses workshops helps us quickly evaluate and respond to emerging pest management issues. For example, in 2011 we were able to quickly evaluate the impact of a new invasive insect pest, bagrada bug, on broccoli yields, quality and insecticide use. This information forms the basis of developing a response plan to this new pest.

**Impact Statements that use Crop Pest Losses data**

Through this data source have we been able to document:

- 2006 and 2007 are the two years with the lowest foliar insecticide use in cotton on record in Arizona (records begin in 1979).
- In 2007, we recorded the lowest grower costs for foliar insecticides in cotton.
- 2008 was the first year since 1965 that cotton growers have not deployed insecticides to control pink bollworm statewide.
- Statewide averages for cotton insecticide use patterns in Arizona from 1979 through 2010 show that insecticide use on cotton for all insects combined—including whiteflies, pink bollworm, Lygus bug and others reached a 32-year low over the last 5 years, while also reducing costs to all-time lows. The estimated cumulative savings in control costs and yield (from reduced losses to insects) from 1996 through 2010 was more than $223 million.
- The last 5 years have shown the lowest insecticide use in cotton on record (32 years), at just 1.5 sprays season-long, reducing insecticide loads on the environment by more than 1.6 million pounds of active ingredient annually and
saving growers over $10 million annually in combined control costs and yield savings.

- The percentage of cotton acres never sprayed for insects in 2010 was 29.3 percent, the highest level ever measured. Overall, cotton acreage in Arizona is expanding, from 150,000 acres in 2009, to 201,000 in 2010, and close to 250,000 acres in 2011 (projected), indicating a health in the industry that can be attributed at least in part to higher yields and lower pest control costs.

- Results from 6 years of Lettuce Pest Losses surveys show that 1) costs associated with spray applications and management fees have increased steadily, 2) western flower thrips has become an important economic pest in both fall and spring lettuce, and 3) the use of older, broadly toxic insecticides has dropped significantly, whereas use of the newer, softer reduced-risk chemistries continues to increase.

An understanding of the impact of key insect pests, weeds and diseases on crop yield, expense of control, and pesticide use provides a basis for evaluating research and education priorities. These data help us to evaluate adoption and impact of our IPM programs and focus our attention on the major issues that impact growers.
Crop Pest Losses and Impact Assessment Working Group

Appendix: Publications, Presentations and Websites

Websites:

The Crop Pest Losses and Impact Assessment Working Group webpage highlights the purpose of the group and includes links to previous grant proposals and reports, Crop Pest Losses information pages, and the Western IPM Center, at http://cals.arizona.edu/apmc/croplosswg.html.

Cotton Insect Losses data, survey instruments, and links to national cotton insect losses data, is available on the Arizona Crop Information Site (ACIS) at http://ag.arizona.edu/crops/cotton/insects/cil/cil.html.

Lettuce and Melon Insect Losses data, survey instruments, presentations and publications are available on ACIS at http://ag.arizona.edu/crops/vegetables/insects/vegiloss.html.

Publications:


Presentations:

Ellsworth, P.C. 2005. Cotton Insect Losses Working Group. Presented at the Maricopa Agricultural Center, Maricopa, Arizona. November 21, 2005. [Note: This is a typical Cotton Pest Losses Workshop presentation which has been continually updated annually to guide the survey process. http://ag.arizona.edu/crops/presentations/05_CIL_Yuma-Blythe-MAC.pdf]


