

Crop Insect Losses and Impact Assessment Work Group (2006 – 2007)
Progress Report to the Western IPM Center
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Introduction

Impact assessment is central to the evolution and evaluation of our IPM programs. Quantifiable metrics on insecticide use patterns, costs, targets, and frequency, crop losses due to all stressors of yield and quality, and other real world economic data are our most objective tools for assessing change in our systems. Our efforts prior to establishment of this work group have been organized around cotton. This project has enabled us to formalize and extend this process to melons and lettuce in AZ and extend our coverage to the low deserts of CA. 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.

Project Objectives

- 1) In collaboration with scientists and stakeholders throughout the low desert areas of AZ and southern CA, we will serve as the **forum for discussion and development of crop insect loss** and impact assessment in key economic crops of this region, including
 - a. Cotton
 - b. Lettuce
 - c. Melons (watermelon and cantaloupe)
 - d. Alfalfa
- 2) Under the auspices of the APMC and with the facilitation of its Manager, we will **periodically assemble diverse sources of information and perspective in the evaluation of crop losses** and the associated causes and underlying costs.
- 3) We will serve as a clearinghouse for developed information and metrics on crop insect loss and impact assessment for the benefit of assessments of other pest groups and in new areas of the West and beyond.
 - a. We will address all Federal, state and local requests for information on the impacts of insects or insecticides in our key crops.
 - b. We will assist others in the extension of this process as a model for development of additional stakeholder-derived data as requested.
 - c. We will post summarized data on crop insect losses to a dedicated webpage, making these data available worldwide.

Project Highlights 2006-2007

- We held 7 face-to-face interactive stakeholder workshops in Arizona, California and West Texas centered around the topic of insect losses in 3 major crops: cotton, head lettuce and melons (table 1).
- Work group members began developing an Alfalfa Insect Losses questionnaire and presented it to pest control advisors (PCAs) for input.
- We reached out to weed management and plant pathology colleagues with a proposal to expand future data collection efforts beyond insect losses to incorporate weeds, plant pathogens, nematodes, and their control tools. (They have agreed to collaborate with us in the coming grant term, if funded).
- We presented a poster at the International Lygus Symposium on the economic impact of Lygus in cotton, comparing Crop Insect Losses data to Pesticide Use Reporting data to develop a complete picture of Lygus pest status in Arizona cotton. We published these data as part of a paper on the same topic in the 2007 University of Arizona Cotton Report (<http://cals.arizona.edu/pubs/crops/az1437/az14374a.pdf>).
- Data collected through this process were also incorporated into responses to Federal pesticide information requests.
- We updated the Cotton Insect Losses website which now features detailed Cotton Insect Losses data and analysis from 1979 through 2006 (<http://ag.arizona.edu/crops/cotton/insects/cil/cil.html>).
- We published 3 University of Arizona 2006 Vegetable Report articles summarizing 2004-2006 crop losses data for head lettuce, cantaloupe and watermelon (<http://cals.arizona.edu/pubs/crops/az1419/contents.html>).

Objectives 1 and 2: Stakeholder Engagement & Data Development

Objectives 1 and 2 of this project essentially boil down to stakeholder engagement on the topic of crop insect losses and impact assessment. Here we describe our process for engaging diverse clientele and stakeholders in the development of crop insect losses data and summarize meeting and survey participation and outcomes.

The Process.

We develop accurate “real world” data on crop insect losses through face-to-face workshops in an interactive process that encourages (and rewards) stakeholder input. Growers, pest control advisors (PCAs), Extension personnel and industry professionals attend Crop Insect Losses and Impact Assessment Working Group (CILIAWG) meetings, complete the survey instrument, 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 in our system of program assessment. Each year, participants provide input that helps us revise our questionnaires and the whole process. When necessary, we conduct follow-up mail surveys with key PCAs to ensure good representation of region-wide acres in the final datasets.

Stakeholder feedback about the process was uniformly positive and reflected a desire to continue in this process each year. Some participating PCAs now ask us for the questionnaire in advance of the meeting, and check their records before providing responses. The overall process of engagement has been very satisfying for participants, who look forward to learning from their peers about pest management issues and practices.

Meeting Participation

A summary of meeting participation is presented in table 1. 107 stakeholders, including pest control advisors, growers, Extension personnel and agro-industry representatives, participated in 7 meetings in 3 states. Many participants completed crop losses questionnaires and engaged in dialog to help us improve the process. Survey responses and the acreage they represent for the various crops are presented in tables 2-5.

Table 1: Crop Insect Losses meeting participation summary

Date	Crop	Location	Participants	Comments
12/12/06	Cotton	Maricopa, AZ	26	
12/13/06	Cotton	Yuma, AZ	15	
12/20/06	Cotton	Blythe, CA	5	
4/4/07	Lettuce	Yuma, AZ	19	
6/19/07	Cotton	Lubbock, TX	15	Pilot meeting in West TX
7/2/07	Melons	Yuma, AZ	19	
7/19/07	Melons	Phoenix, AZ	7	
Total	3 crops	3 states	107	

Table 2: Cotton Insect Losses Responses, Arizona, 2006

Survey use statistics	Cotton
No. of PCA respondents	25 (AZ & CA)
Arizona Acreage reported	80,000
% of total AZ acreage	40%

Table 3: Head Lettuce Insect Losses Responses, Yuma Valley, 2006-2007

Survey use statistics	Fall Lettuce	Spring Lettuce
No. of PCA respondents	14	13
Acreage reported	18,370	14,180
% of total acreage	70%	70%

Table 4: Spring Melon Insect Losses Responses, Yuma Valley, 2006-2007

Survey use statistics	Cantaloupes	Watermelons
No. of PCA respondents	9	6
Acreage reported	4,196	1,522
% of total acreage	80%	65%

Table 5: Spring Melon Insect Losses Responses, California, 2006-2007

Survey use statistics	Cantaloupes	Watermelons
No. of PCA respondents	3	3
Acreage reported	6,750	1,900
% of total acreage	70%	50%

Alfalfa Insect Losses Update

- In 2006-2007, we developed a draft survey instrument for alfalfa insect losses with former project collaborator Mike Rethwisch (University of California, Riverside) and presented it to PCAs for input at one of our cotton insect losses meetings.
- Based on input from PCAs and Extension personnel, we have further modified the questionnaire and are in the process of adding sections on weed and plant disease losses. The instrument will be ready for a pilot alfalfa insect losses workshop in the coming year.
- Eric Natwick, Imperial County Extension Director and Entomology Advisor, has joined us as a collaborator in our 2007-2009 Crop Pest Losses and Impact Assessment Work Group proposal. He has a keen interest in participating in an alfalfa pest losses process that will include PCAs from the Imperial Valley region of California.
- Data on alfalfa insect losses will be developed and made available in the same way as for the other crops.

Objective 3: Serve as a clearinghouse for information on Crop Insect Losses

- Objective 3a: respond to information requests. Out of 10 formal pesticide information request responses handled by the Arid Southwest IPM Network in this past grant term, two responses included crop insect losses data. These were for endosulfan use in cotton and methomyl use in lettuce. These data provide unique insights into insecticide use not available in Pesticide Use Reporting data.
- Objective 3b: assist others in extension of this process as model for developing stakeholder-derived data. ***In June 2007, we had the exciting opportunity to introduce the Cotton Insect Losses process to West Texas.*** On June 19, 2007, we conducted a pilot cotton insect losses meeting in Lubbock, Texas with the cooperation with Texas Cooperative Extension colleagues, Dr. Megha Parajulee and Dr. David Kerns. They are excited about introducing this process to West Texas to collect baseline data on cotton insect losses and associated economic data. 15 stakeholders, including Texas Extension IPM Agents, crop consultants and agro-industry representatives, participated in the meeting. Although this was a pilot process, participants were very interested and engaged in the dialog. We are optimistic that they may adapt our survey instrument and process to their needs. ***While not a planned objective for this grant term, the Texas meeting satisfies objective 3b of the grant, our long-term goal of assisting others in the development of crop insect loss data based on our model process.***

- Objective 3c: Make crop insect losses data available worldwide. As cited throughout this report, we have posted articles, raw data and analyses of all information derived through this process to make this information publicly available. In this grant term, we updated the cotton insect losses information online through 2006 and posted 4 independent articles in University of Arizona Crop Reports summarizing and analyzing the real world data developed by stakeholders through this work group.

Data Summary

Cotton

Selected Cotton Insect Losses data for the top three cotton insect pests in the desert southwest for 2006 are presented in Table 6. (Complete data for all years available online at <http://ag.arizona.edu/crops/cotton/insects/cil/cil.html>.) Foliar insecticide applications required to control all pests in 2006 were 2.4 sprays in conventional cotton and 1.2 sprays in Bt cotton. Lygus had the most impact on yield in Bt cotton in 2006, accounting for about 0.80% of yield loss. Total yield loss from all pests in Bt cotton was about 2%. Pink Bollworm accounted for about 2.3% yield loss (out of 4.9 for all pests). While whiteflies represented the most significant portion of control costs for convention and Bt cotton, at \$27 and \$21, respectively.

2006 was the first year of a major insect control program in our area, the Pink Bollworm Eradication Program, which went into effect in most cotton growing areas represented in our data, with the exception of Yuma County. As this program progresses, our data will provide one of the few objective sources of information on change in insecticide use and arthropod incidence as a result of this program. Furthermore, it is anticipated that we will see a large increase in the number of adopting acres to Bt cotton, because this is a primary control element of the program in the program areas (central and eastern AZ). For example, we have averaged about 70-80% Bt cotton for several years statewide. With the eradication program, Bt cotton now accounts for about 95% or all cotton planted.

	Bt cotton (86.3%)			Non-Bt cotton (13.7%)		
	Insecticide applications	Control costs	Yield loss	Insecticide applications	Control costs	Yield loss
Pest	(No./A)	(\$/A)	(%)	(No./A)	(\$/A)	(%)
Lygus bugs	0.249	\$4.37	0.838	0.298	\$5.21	0.901
Pink bollworm	0.000	\$0.00	0.030	0.496	\$8.68	2.258
Whitefly	0.748	\$21.40	0.559	1.042	\$27.08	0.714
All Pests	1.183	\$28.34	1.956	2.442	\$50.85	4.851

Lettuce

Lettuce production covered by this survey includes Yuma Valley, AZ and Imperial Valley, CA. The most important pests for fall 2005 lettuce in terms of estimated yield loss were flea beetles (1.0%), beet armyworm (1.0%), cabbage looper (0.9%), seedling pests such as ground beetles, earwigs and crickets (0.8%) and silverleaf whitefly (0.6%). The average number of insecticide treatments in fall lettuce was highest for beet armyworm (3.6), cabbage looper (2.9), salt marsh caterpillar (2.0) and budworm/bollworm (1.6). Silverleaf whitefly received an average of 1.4 applications. In general, the same pests were important in the previous year (fall 2004), with slightly higher yield losses and similar insecticide use levels recorded.

In spring 2006 lettuce, the most important pests in terms of estimated yield loss were green peach aphid (1.2%), cabbage looper (0.7%), thrips (0.6%), beet armyworm and foxglove aphid (0.5% each). The average number of insecticide treatments in spring lettuce was highest for thrips (2.2), lettuce aphid (1.9), green peach aphid (1.9), and foxglove aphid (1.6). Silverleaf whitefly received an average of 1.0 applications. Comparatively, the previous year (spring 2005) showed much higher losses to many of these pests (e.g., seedling pests 1.4%; thrips 1.7%; beet armyworm 1.0 and cabbage looper 1.1). In spring lettuce in 2005 as 2006, various aphid species accounted for the highest average number of insecticide applications (2.0 to 2.5), apart from thrips (2.5).

A complete summary of 2004-2006 Head Lettuce Insect Losses data for Arizona are available online: http://cals.arizona.edu/pubs/crops/az1419/3_WEB.PDF.

Data Analysis and summaries for 2007 melon losses are in progress and will be published on the Arizona Crop Information Site when they are available this fall.

Melons

Melon losses data from central Arizona for 2006 were still being compiled and analyzed at the time of this report. However, based on statewide data for 2005, the major pests in cantaloupes were cabbage looper (80.2% of acres treated with an average of 1.1 sprays) and whiteflies (64.7% of acres treated with an average of 1.3 sprays). For watermelons in 2005, whiteflies and cabbage loopers were also the most important pests statewide. 100% of acres were treated for both of these pests, with whiteflies receiving an average of 2.0 sprays and cabbage looper receiving an average of 1.7 sprays. Cabbage looper was responsible for 1.1% of cantaloupe yield losses and less than 0.1% of watermelon yield losses. Whiteflies accounted for 1.3% of watermelon yield losses but did not have a major impact on cantaloupe yields. In addition, seed corn maggot was an important pest in cantaloupes, accounting for 0.8% of the yield loss statewide. Based on Yuma and Imperial Valley data for 2006, whiteflies and cabbage looper continue to be the most important pests in cantaloupe, with 1.3% and 0.6% yield loss, respectively. In watermelons, cabbage looper accounted for 1.1% of yield losses and whiteflies only 0.3%, but beet armyworm was important, accounting for 0.7% of yield losses. Average foliar sprays in Yuma and Imperial Valley to control each of these pests in watermelon

were up from last year's state average: 2.3 for whiteflies and 2.2 each for cabbage looper and beet armyworm.

A complete summary of 2004-2006 Melon Insect Losses data is available online:

- Spring Melons in Southwestern Arizona:
http://cals.arizona.edu/pubs/crops/az1419/1_WEB.PDF
- Cantaloupes and Watermelons in Central Arizona:
http://cals.arizona.edu/pubs/crops/az1419/2_WEB.PDF

Data Analysis and summaries for 2007 melon losses are in progress and will be published on the Arizona Crop Information Site when they are available this fall.

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. As coordinator of the Arid Southwest IPM Network (another Western IPM Center – funded project), Al Fournier uses these data to respond to federal pesticide information requests for the crops involved. We had numerous informal requests for information in 2006 and 2007, and one formal request by the Arizona Cotton Growers Association to present comparative data on Bt versus non-Bt cottons on a continual basis.

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. For example, a pest manager might elect to spray compound X with a written prescription for pest A; however, through this dialog, we might learn that this pest manager intended to directly control pest B, C, and D in addition to A. Therefore, the apportionment of that spray might be 0.7 "sprays" towards A and 0.1 against each of B, C, and D. So in addition to the rich quantitative data collected in this exercise, we also have unique qualitative insights into the decision-making experience of the pest manager. These insights will help guide our existing and new programs of research, implementation and IPM outreach.

The data provided through this process are also useful in evaluating aspects of our IPM programs over time (e.g., changes in insecticide use or changes in pest status for these crops) and quickly responding to the changing needs of grower communities. Not only do we hope to sustain these activities to continue to maintain current insect loss data for cotton, lettuce and melons, we hope to expand these efforts over time to include more crops and more types of pests (e.g., weeds, nematodes and insect pathogens).

Current Status

- An internal UA College of Agriculture and Life Sciences (CALs) grant to support the crop insect losses effort was funded in 2006 for \$2,000, providing leverage dollars to offset the considerable cost of meetings, travel and logistics for this project.

- We are excited about the prospect of expanding to a new crop—alfalfa—in the coming year. In 2006, 250,000 acres of alfalfa hay were harvested in Arizona alone, at a total production value of over \$265 million, making this among the most valuable crops statewide (USDA National Agricultural Statistics Service, www.nass.usda.gov/Statistics_by_State/Ag_Overview/AgOverview_AZ.pdf). This crop has also been expanding in the low deserts of California (e.g., Imperial Valley). With the introduction of Roundup-Ready™ varieties, we expect major changes in weed management practices in alfalfa. The time is right to capture pest losses data in this important economic crop, and we have the right team in place to do so.
- Our new proposal to the WIPMC, if funded, will provide for expansion of this process *beyond* insect losses to capture relevant data on weed, nematode, and plant disease losses for all crops involved. We have enlisted the participation of UA Weed Scientist, Dr. Bill McCloskey; Plant Pathologist Dr. Mary Olsen and Plant Pathologist Dr. Mike Matheron. These scientists will participate in meetings and work with us to expand questionnaires to appropriately cover non-insect pests. We have added Eric Natwick, Imperial County Extension Director and Entomology Advisor, as a collaborator in this proposal, with the goal of increasing participation of California growers and PCAs from the Imperial Valley region.