



Building an Integrated Pest Management network in cooperation with Iowa fruit and vegetable growers

Abstract: Fifty-one commercial growers of apples, strawberries, tomatoes, and/or watermelons cooperated with Iowa State University (ISU) Extension specialists in a three-year program to evaluate IPM control techniques. Scouts and growers monitored pest infestations and diseases such as codling moth on apples, tarnished plant bugs on strawberries, and anthracnose on tomatoes and melons. Growers sprayed only when pest populations or disease risk values reached levels capable of doing crop damage. Weather conditions were monitored for periods favorable to pest outbreaks. On average, ISU researchers estimate that growers applied from 25 to 55 percent fewer insecticide and fungicide sprays (depending on the year and the particular pest) by using IPM methods in comparison to their usual practices. For the growers, this meant decreased input costs, a better bottom line, and enhanced competitiveness.

Background

For 50 years, most commercial fruit and vegetable growers in Iowa have relied on an intensive program of chemical pesticide applications to protect their crops from diseases and insect pests. Three recent trends have spurred growers to seek alternative strategies. First, the Alar scare focused public attention on the safety of pesticides used on food products. New restrictions were placed on pesticide registration and application. Second, more target pests are becoming resistant to pesticides. Third, industry globalization is pressuring growers to cut costs in order to remain economically competitive.

IPM (Integrated Pest Management) is an alternative pest control strategy that allows growers to minimize reliance on chemical pesticides without sacrificing yield or quality. Users of IPM realize that if they know how insects and diseases operate, they can more effectively combat these pests. IPM allows the grower to apply pesticides only when a significant risk of a pest outbreak is documented and alternative control measures are ineffective. However, few Iowa growers use IPM because they perceive it as excessively risky, labor-intensive, and/or too costly. Some growers think IPM is too complex for their use and needs to be simplified. Another barrier to IPM adoption is the lack of an Iowa infrastructure or network to implement technology transfer.

The investigators chose these survey indicators to measure IPM implementation by Iowa farmers and growers:

- 1) 30 percent of respondents would indicate increased awareness and understanding of IPM approaches
- 2) 15 percent of respondents would indicate that they increased use of IPM methods during the study
- 3) 30 percent would indicate a greater willingness to try IPM tactics in the future.

Approach and methods

Manual: In January 1993, Iowa State University Extension (ISUE) issued the 175-page manual *IPM for the Iowa Commercial Fruit and Vegetable Growers*. The book helped growers, scouts, and educators to recognize

Principal Investigator:
Mark L. Gleason
Plant Pathology

Co-investigators:
Donald R. Lewis
Entomology

Forrest W. Nutter
Plant Pathology

Gail R. Nonnecke
Horticulture

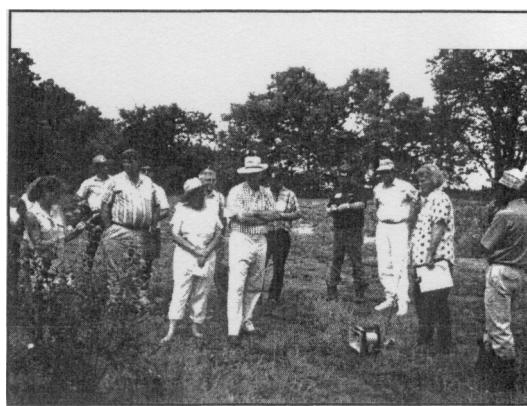
Paul Lasley
Steven C. Padgett
Sociology

Eldon R. Everhart
Extension

Gary Peterson
Extension
Iowa State University

Naomi Maahs
Iowa Fruit and
Vegetable Growers
Association

Budget:
\$3,000 for year one
\$11,000 for year two
\$14,000 for year three



Field day for strawberry IPM cooperators.

key insect pests and disease symptoms on six crops: apples, strawberries, cucurbits (including melons), tomatoes, potatoes, and sweet corn. ISUE produced videos on IPM for apples, strawberries, and general fruit and vegetable use that offered growers an introduction to the process. Information on IPM was also distributed via field days, association meetings, and newsletter articles.

On-farm demonstration trials: Tests of efficacy of selected IPM methods were conducted in fields or orchards of cooperating commercial growers. Among them were:

Crop	Pest	IPM tactic
Apple	apple scab	"four-spray" program
	codling moth	Population monitoring
Strawberry	fire blight	Maryblyt model
	gray mold	Bloom sprays
Tomato	tarnished plant bug	Population monitoring
	Septoria blight	Tomcast model
	early blight	
Melon	anthracnose	
	anthracnose	Melcast model

Volunteer growers agreed to comply with the recommended IPM program on a portion of their acreage. Cooperators received written protocols for the IPM program they selected, along with monitoring supplies. Fifty-one different cooperators located throughout the state participated; many of them conducted trials on more than one pest or crop in the same growing season. Results are reported for those who cooperated closely with ISU on the trials. Approximately 10 additional cooperators used the IPM information on an advisory basis.

IPM tactics varied greatly. The least complex were the "four-spray" and "bloom spray" programs for apple scab and gray mold. These programs targeted specific application of fungicide sprays at predetermined stages of crop development that research has shown to coincide with peak disease risk. The codling moth, tarnished plant bug, and fire blight IPM programs represented an intermediate level of technological complexity. Simple, inexpensive monitoring equipment was required for each. The highest level of technological complexity emerged with the tomato and melon

disease-warning systems, both of which required electronic wetness sensors and dataloggers to gather hourly data. (These systems used weather information to produce a rating of each day's disease risk. When the disease risk value was high enough, spray was applied.) ISU personnel assisted cooperators by scouting for insects and measuring incidence of pest and disease damage. They also operated the disease-warning systems for several crops and provided data to growers.

Results of the on-farm trials were compiled after each growing season and shared with cooperators and other members of the Iowa Fruit and Vegetable Growers Association. An end-of-project survey on IPM use and perceptions was mailed to 320 Iowa fruit and vegetable growers in early 1996.

Trial Results

Apples: Cooperators applied three to four fungicides for control of apple scab during tight cluster and first cover. No scab symptoms were found on leaves or fruit. This saved about two sprays (or 33 percent) during the season with no loss in disease control efficiency. Also, broadcasting only four sprays allowed growers to tank-mix fungicides and insecticides, saving time and money.

The Maryblyt disease-warning system was used against fire blight. Cooperators used slightly less streptomycin spray with good results in disease control, but other growers reported more substantial savings from decreased spraying. However, the Maryblyt system is not inexpensive to own and operate. A personal computer is required to run the Maryblyt software; informal surveys, however, indicated that at least 50 percent of Iowa fruit and vegetable growers do not own a personal computer.

During 1993, cooperators saved three insecticide sprays per season with the pheromone-trap IPM strategy, compared with the standard spray schedule for codling moth. However, the incidence of fruit injury by codling moth was unacceptably high, averaging 3.1 percent of the apples sampled at harvest, compared

with 2.2 percent for standard protectant programs. In addition, more damage by nontarget insects was noted in IPM plots. The IPM program was modified the next season by adding sprays early in the season and a more acceptable level of insect control was achieved and savings still resulted. The pheromone traps were a success; growers found them to be simple, inexpensive, and not time-consuming to monitor.

Strawberries: There was zero incidence of gray mold for all three years of the trial when the cooperators used the IPM tactics calling for sprays to be applied only at 10 percent and full bloom. Savings were estimated at 33 percent over the traditional protectant regime which called for one to three additional spray applications.

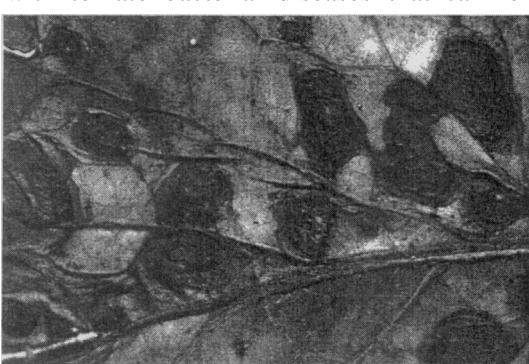
For tarnished plant bug, cooperators saved an average of one spray in 1993, none in 1994, and 0.5 in 1995. Damage from tarnished plant bugs was no more common on IPM than on control plots. Checking for the bugs was simple and inexpensive, but growers sometimes had difficulty making correct identifications of the nymph stage of the bug.

Tomatoes: The Tomcast disease warning system was used for pinpoint timing of fungicide sprays to control Septoria leaf spot, early blight, and anthracnose fruit rot. None of the cooperators in 1994 or 1995 reported foliage injury from Septoria or early blight or fruit injury and consequently estimated that they had saved an average of two sprays (33 percent) per season. However, Tomcast can be expensive and difficult to use. Iowa tomato growers are plagued with tomato bacterial diseases that can re-

semble the targeted fungal diseases and misdiagnosis can occur. The advent of commercial weather data providers may ease matters.

Watermelons: A new disease warning model called Melcast was used in trials near Muscatine to control anthracnose on watermelon. Spray advisories were passed along to growers who report that Melcast saved them an average of two sprays in 1995, or a 33 percent reduction in spraying frequency, while incidence of anthracnose was extremely low on test plots. Melcast appears promising, but can be expensive. Again, commercial weather data providers may make the system cheaper and easier to operate.

End-of-Project Survey: The survey sent to 320 fruit and vegetable growers had a 56 percent response rate (180 replied). Nearly one-half (49.4 percent) of all the respondents had increased use of IPM methods in the past three years. Sixty-one percent of the group who reported greater use of IPM tactics said that these techniques had decreased the amount of pesticide sprays they used and 63 percent reported that IPM use was equivalent to, or more effective than, the methods they had used previously. In learning about IPM options, they cited ISU Extension state and field specialists as "most valuable" sources of information, followed by field days, grower association meetings, and written IPM guides.



Early blight, a fungal disease of tomatoes.

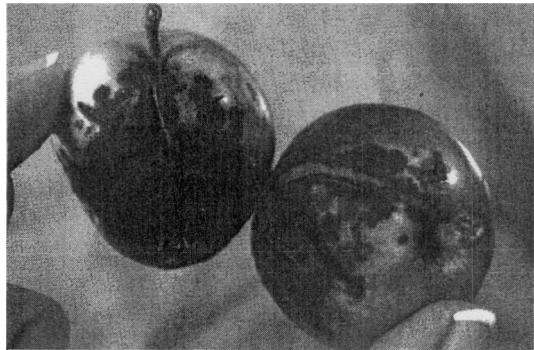


Grower and County Extension Education Director check weather monitor.

Conclusions

IPM tactics employed in on-farm trials with 51 commercial growers of apples, strawberries, tomatoes, and melons from 1993 to 1995 resulted in a range of reductions of 25 to 55

Apple scab can be treated with the "four-spray" program.



percent (with an average range of 25 to 33 percent) in frequency of chemical sprays compared to standard protectant spray schedules. Practices most likely to have sustained use by Iowa fruit and vegetable growers include the "four-spray" program for apple scab, pheromone trap monitoring for timing of codling moth insecticide sprays, and the "bloom spray" program for gray mold control.

Several of the IPM tactics face substantial constraints to wider implementation:

- The Maryblyt disease warning system software costs \$200; less than half of the growers have computers on which to use it.
- Population monitoring to time insecticide sprays for tarnished plant bug is hampered by the potential for misidentification of the bug nymphs and eventual savings may not be great enough to motivate growers to act.
- Tomcast and Melcast require detailed measurement of the duration of wetness periods which can only be done with relatively expensive and complicated equipment. Newly established commercial weather services now are able to provide the site-specific weather information needed for these programs, but the reliability of their data has not yet been tested.

For more information contact Mark Gleason, Plant Pathology, Iowa State University, Ames, Iowa 50011; (515) 294-0579; e-mail mgleason@iastate.edu.

Survey results showed that the project achieved substantially better results than the targets set by the education program evaluation in the original proposal. One half of the respondents to a final survey said that they had expanded use of IPM methods on their farms in the past three years and planned to increase their use of IPM practices in the future.

Implications

Growers using these IPM methods can realistically expect average savings of 25 to 33 percent, despite the experimental range of 25 to 55 percent cost reduction for pest control chemicals. The most promising near-term prospects for more substantial reductions in chemical pesticide use may hinge on biological control methods. Potential options include the use of insect growth regulators to control codling moth, the use of several naturally occurring saprophytic fungi on strawberries to treat gray mold and tarnished plant bug, and growing new varieties of apples with genetic resistance to scab and other major diseases.

Education and Outreach

Iowa fruit and vegetable growers attending field days, winter meetings, and ISU workshops were kept informed about the results of the IPM tests over a three-year period. A total of more than 500 growers attended these events held in Adel, Des Moines, Vinton, and Iowa City in 1993-1994. The next year (1994-95) found 300 growers in attendance at meetings in Waterloo, Cedar Falls, Hamburg, Nebraska City, Des Moines, Davenport, and Donnellson. Wrap-up results were shared with 175 growers at the Iowa Fruit and Vegetable Growers winter meeting in Des Moines in early 1996.