IPM In-Depth: A New York Model for Hands-on Interactive Greenhouse Workshops

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SUMMARY. Growers of greenhouse ornamentals in New York State (NYS) have identified the need for improved diagnosis and management of diseases, insects, and media/fertility problems to reduce crop loss and improve crop quality. With the objective of using an interactive small-group format to encourage active learning of topics, our team developed a hands-on workshop model that we termed integrated pest management (IPM) In-Depth. In addition, we wanted to deliver the workshop in several locations around NYS to reach growers who traditionally have not attended on-campus programs. Each program consisted of three modules focusing on an insect, disease, or plant culture topic. Participants were divided into small groups that rotated through the areas. From 2009 to 2013, we present 20 In-Depth workshops in 14 NYS counties reaching 309 attendees. The project succeeded in its intent to reach growers who had limited access to previous IPM programming; 59% of attendees had not previously attended any type of IPM programming. The majority of attendees (66%) reported that they had learned information they intended to implement at their operations. Additional impacts and challenges of offering this hands-on program are discussed.

New York State has a diverse and geographically widespread greenhouse industry, which has historically been primarily composed of floriculture crops. The wholesale value of floriculture in NYS was \$169 million in 2012, produced in 565 acres of covered greenhouse by 577 operations with greater than \$10,000 in sales [U.S. Department of Agriculture (USDA), 2013]. The production of vegetables in greenhouses and high tunnels is expanding in NYS, adding to the diversity of the industry. Greenhouse vegetable production had an annual wholesale value of \$18 million in NYS produced by 201 operations with 68 acres of covered greenhouse space according to the most recent data available (USDA, 2009).

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Growers of greenhouse crops in NYS have identified the need for improved diagnosis and management of diseases and insects and information on substrate and fertilizer management to reduce crop loss or loss in quality. Extension specialists and educators have traditionally offered 1-d greenhouse conferences in January each year at four or five locations around the state following a lecture presentation format. However, we felt this format was not the best way to convey some of the information that attendees were requesting, such as identification of greenhouse insects and diseases from living specimens, or being able to practice water and media sample testing. In response, our team developed a hands-on workshop model for educational sessions that we termed Integrated Pest Management In-Depth. The objective of the program was to use an interactive small-group format to encourage active learning of topics related to IPM and plant culture leading to practice change and improved profitability in greenhouse operations. Initially, the

program was offered on the Cornell University campus in Ithaca, NY. Although this campus-based program was well attended, we also wanted to respond to geographic barriers that prevented some growers from attending. We applied for and received funding from the New York Farm Viability Institute to offer the program at several locations throughout the state. Therefore, another objective of the project was to reach growers and extension educators that we had not previously reached with our on-campus workshops.

Methods and workshop format

The project was based on the development and presentation of educational modules in three topic areas: insect identification and management, disease identification and management, and production factors relating to media and plant nutrition. For each module, we incorporated as much hands-on interaction as possible. Each program consisted of three modules, one for each topic area, with groups of up to 15 individuals rotating through the three modules. Within each group of up to 15 people, growers were divided into small groups so they could participate as fully as possible in the hands-on activities. For example, we tried to ensure that there would be no more than two people per microscope or media test. Insect topics (and the number of times presented) included aphids [Aphididae (10)], fungus gnats [*Bradysia* sp. (5)], thrips [Thysanoptera (4)], and mites [Acari (1)]. Insect modules included identification of the insect (including live specimens), its biology/lifecycle, and methods of managing it, with an emphasis on biological control (often including live specimens of biocontrols). Disease topics included botrytis (*Botrytis cinerea*) (9), foliar fungi (8), nematodes (2), and viruses (1). Each disease topic included information on identification of the disease, its biology, the environmental and cultural factors that affect it, and management, with an emphasis on cultural and environmental control. Media and plant nutrition topics included soilless

Units

To convert U.S. to SI, multiply by	U.S. unit	SI unit	To convert SI to U.S., multiply by
0.4047	acre(s)	ha	2.4711

Cornell University
New York State
Integrated Pest Management Program

EVALUATION - 2013 IPM In-Depth Workshops

Your opinions help shape our programs for the future. Thank you!

1. What is your primary business? (Check all that apply)

☐ Wholesale Greenhouse ☐ Retail Greenhouse ☐ Vegetable Grower
☐ Garden Center ☐ Nursery ☐ Educator ☐ New/potential grower
☐ Landscaper ☐ Research ☐ Supplier ☐ Master Gardener
☐ Botanical garden/Arboretum ☐ Ag & Mkts/DEC Other

2. Reason(s) you attended this program (please mark all that apply)

Topics Pesticide Credits Location
 Expanding knowledge Other (please specify)

3. How did you hear about the IPM In-Depth program?

Cornell /CCE newsletter Cornell website NYSFI newsletter
 DEC program listing Email Employer Other (please specify)

4. Have you attended any previous IPM In-Depth programs (on the Cornell Campus (mid July) or other counties)?

2008 2009 2010 2011 2012 No

5. Are you doing anything different at your business based on what you learned at a past In-Depth?

Yes No

If yes, please describe

6. Have you attended any other IPM programs (local In-depths, biocontrol, bedding plant schools, etc)?

Yes No

7. Are you doing anything different at your business based on what you learned at a past IPM program?

Yes No

If yes, please describe

8. Did you learn any specific information today that you plan to incorporate into your business?

Yes No

If so, what?

9. What topics would you like to see at future IPM programs?

10. If you would like to receive information on NYS IPM programs and other information on pest management, please include your contact information.

Please use the back for any additional comments! Thanks for your help!

Fig. 1. Example of the evaluation form that attendees of the integrated pest management In-depth workshops were asked to complete.

media components and their physical properties (8), testing media pH and electrical conductivity (EC) (7), organic and conventional media amendments (3), and diagnosing nutrient deficiencies (2). Each media and nutrition module included hands-on testing of media and water samples brought in by growers or diagnosing nutrient disorders of plant samples.

The choice of which modules to present in each location was largely based on the advice of the assisting Cornell Cooperative Extension educator and local growers' needs. For example, in regions where there were more greenhouse vegetable producers, aphids were often chosen because they are frequent pests of high tunnel- or greenhouse-produced greens. Occasionally, the availability of insects and diseased plants relative to the season affected which modules were presented. The educational programs that included the three hands-on modules lasted a total of 4 h and was followed by a plant diagnosis panel who evaluated plant problems that attendees brought with them or a guided tour of a nearby commercial greenhouse operation in which we discussed some of the workshop concepts in practice.

We transported and set up equipment and materials for the participants to use in each of the modules before the start of the day's program. This included microscopes, pH and EC meters, live insects, and disease-infected plants.

To determine knowledge gained and intent to change practices, we surveyed the attendees before they left the program (Fig. 1). Attendees were asked if they had previously attended any IPM programming (including in-depth on-campus or off-campus programs or other IPM programming). We asked whether participants learned something at the current session that they intended to implement at their operation. In addition, if participants had previously attended any sort of IPM programming they were asked if they had implemented changes in their operation based on information learned from the previous programs.

During the project, we worked closely with local extension educators to hold the workshops. Our group would indicate our availability to county-based extension educators and

they would contact us if they wanted to host a workshop. In the arrangement, our group provided the expertise, supplies, and instructional materials and had grant funding to cover our travel costs. The host provided the location (often a county extension office or head-house of a nearby greenhouse operation), local advertising to their clientele, registration, refreshments, lunch, and helped identify a greenhouse for the tour. The county educator charged whatever registration fee they felt was appropriate for their location/clientele and to recoup any of their costs.

Attendees could sign up to receive NYS Department of Environmental Conservation pesticide applicator recertification credits.

Results and discussion

Through the grant from the New York Farm Viability Institute, we offered 20 IPM In-depth workshops in 14 counties throughout NYS from 2009 to 2013. The locations included Acra, Akron, Albany, Ballston Spa, Binghamton, Canandaigua, Hamden, Ithaca (local extension office, not on-campus), Lockport, Mexico (two times), Millbrook, New Paltz, Penn Yan, Riverhead (three times), Rochester, and Warsaw. Eleven of the programs included a greenhouse tour component to provide a real-world view of the topics presented. There were 309 attendees at these 20 programs and attendee affiliation/background is noted in Table 1. Although the programs were originally aimed at ornamental producers, many different types

of producers and other related businesses were represented. For example, 25 participants noted their business produces vegetables. In addition to these 20 programs, we held five summer IPM In-depth programs from 2008 to 2012 on the Cornell University campus reaching an additional 127 participants (these evaluation numbers are not included in Tables 1 and 2).

Of the participants who attended our off-campus IPM In-depths, 83% had not previously attended an IPM In-depth workshop and 59% had never attended any type of IPM programming. Therefore, we believe the project succeeded in its intent to reach growers who had limited access to IPM programming; and our approach of going out to present at several different communities appears to be an effective way of reaching new audiences. The majority of attendees reported that they had learned information they intended to implement at their operations (66%). Of those who had previously attended programs, over half had already implemented practices based on information learned in previous IPM programs (57% from IPM In-depth workshops, 60% from IPM programs overall). An open-ended question asked which practices they had put in place and the results are summarized in Table 2.

We noted several additional impacts of the program included beyond grower adoption of new practices. These included many new individuals were reached (many of these individuals have signed up for our weekly IPM update e-mail), new or renewed

Table 1. Background of integrated pest management In-depth workshop participants. Respondents could choose more than one option.

Business	Attendees (no.)	Attendees (%)
Retail greenhouse	96	26
Wholesale greenhouse	81	22
Garden center	45	12
Nursery	28	8
Vegetable	25	7
Educator	24	6
Landscaper	22	6
Master gardener/homeowner	14	4
New or potential grower	10	3
Inspector/government/regulatory	7	2
Field crops	4	1
Public garden	3	1
Consultant	2	1
Research	3	1
Other agriculture/green industry	8	2

Table 2. Practice changes implemented by attendees of the integrated pest management (IPM) In-depth workshop who had participated in any previous IPM programming (IPM In-depths, biocontrol workshops, bedding plant schools, etc.). Results are grouped by topic.

Practice	Responses (no.)	Responses (%)
Biocontrol	30	36
Scouting	22	27
IPM	16	19
Sanitation	8	10
Growing media	3	4
Pest identification and management	2	2
Nutrition/fertility	1	1
Media testing (pH/EC)	1	1

connection with many county-based extension educators, and firsthand exposure to local needs and production systems scattered throughout NYS. This will aid us in creating more appropriate extension programs for the future.

Implementing the series of workshops was not without its challenges. We view funding of the program (including substantial travel and supply costs) as the greatest barrier that may prevent its replication in other states. We were fortunate to receive funding from a NYS program, without which we would have been unable to offer the program. Now that the funding period is over, the future of the IPM In-depth program is uncertain, we may be able to offer workshops occasionally when registration fees can recoup costs. Another challenge is assembling a team to deliver the workshops that can devote significant time to travel and to teach

intensive hands-on modules to a relatively smaller number of participants rather than a traditional auditorium-style class. We were fortunate to have an overall coordinator (E. Lamb) who was independent of the instructors for the modules [pathology (B. Eshenaur); culture, substrates, and fertilizers (N. Mattson); and entomology (J. Sanderson)]. The overall coordinator spent significant time along with the local extension host coordinating the dates, details, advertising, and logistics of each workshop. The use of live specimens (insects, disease organisms, biocontrol organism, and plants with nutrient disorders) required significant planning and maintenance of these specimens. Because of the time and travel involved, we typically required that a location had a minimum of ≈ 10 participants to offer the workshop. Sometimes participants were reluctant to preregister for the workshop making it difficult

to plan ahead and requiring additional legwork by local extension personnel. In two cases we canceled the workshop only to find out that there had been sufficient interest but participants failed to register ahead of time.

In summary, through the IPM In-depth program we offered 20 workshops around NYS reaching 309 individuals including ≈ 182 that had not previously attended an IPM program. The hands-on small-group format appears to facilitate learning as the majority of respondents indicated they learned something they planned on or already had implemented. With increased adoption of Internet technologies and declining resources for extension travel, there is a growing trend toward webinars and other electronic course offerings. However, our positive experience with the In-depth program indicates that hands-on training at diverse geographic locations can help reach an underserved audience.

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