

# Making New York Vegetable Crop and Pest Management Systems Information Available in a User-friendly Format

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**ADDITIONAL INDEX WORDS.** recommendations, vegetables, integrated pest management, integrated crop management

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**SUMMARY.** The document *Cornell Integrated Crop and Pest Management Guidelines for Commercial Vegetable Production* was revised in 1999 to become inclusive and integrative of all aspects of crop and pest management. As an adjunct to the printed publication, additional information was presented in tables at an Internet web site. Links on the web site were made to other sites with more detailed information on specific topics, such as photographs of pests and diagnostic information, soil fertility testing, cover crops, environmental impact of pesticides, pesticide labels, and images, sources, and life cycles of beneficial insects. The revision and web site have proven to be popular with cooperative extension staff and the vegetable industry in New York.

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In New York, and elsewhere, pest management recommendations are compiled annually in a document prepared by cooperative extension and the land grant university (Precheur et al., 2000; Reiners and Garrison, 1994; Strange et al., 1994). This document is then made available to growers and other interested parties. In 1997, the document published for use by vegetable growers in New York was entitled *Cornell University Pest Management Recommendations for Commercial Vegetable and Potato Production* [*CPMR* (Bellinder et al., 1997)]. In its 231 pages, the *CPMR* emphasized the proper use of pesticide-based pest control strategies for the management of 33 crops or crop groupings. During the previous decade, various alternative strategies had been gradually incorporated into the *CPMR*, but they were often contained in the text as opposed to being presented in the tabular format used for pesticide-based recommendations. Perhaps as a result, growers and other users of the *CPMR* often missed the alternative management information when referencing the document, and instead focused on pesticide-based tactics. Alternatives were not discussed for some crops, often because those crops were not grown widely and little attention had been given to ensuring that recommendations were current.

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In addition, by 1997 cultural (fertility and variety information) recommendations had been removed from the *CPMR* and published separately in a vegetable production handbook. This resulted in reduced usefulness of the *CPMR*.

The condition of the *CPMR* in 1997 also did not allow it to function well as a tool in new pest management and marketing initiatives. An integrated pest management (IPM) labeling project aiming to help consumers identify products grown using IPM practices was initiated recently in New York. The project is the result of successful cooperation among a major supermarket chain, a vegetable processing company, growers and the New York State IPM Program. Beginning with the use of IPM practices in the field, products are labeled as IPM in the marketplace. Project partners have identified sets of IPM elements or criteria that must be satisfied for each crop in order for it to be labeled as IPM. Previous versions of the *CPMR* did not clearly and efficiently identify the specific set of recommendations that apply to specific IPM elements. By 1997, we also recognized the potential value of the Internet as an extension information delivery tool. It was clear that the *CPMR* needed to be reformatted for electronic media, with clickable references to fact sheets and other more detailed sets of information.

## Procedures

For several years a team of vegetable extension faculty and staff at Cornell University discussed rudimentary designs of a tabular presentation of the pest and crop management information for vegetables. Progress toward a usable design was slow for several reasons: 1) several faculty and staff felt that farmers would prefer the document to remain as a listing of pesticide based options without IPM information, 2) others felt that incorporating all pest management options into the document would make it too long, and 3) undertaking a revision of this magnitude required an editor dedicated to the project for a significant period of time, and funding for an editor was not available.

Lengthy discussion by a larger team resulted in the authors submitting a proposal for revision of the document to the USDA Northeast

Regional IPM Program. With funding secured in late 1997, we proceeded with the revision. A half-time editor was hired in early 1998 and began to collect a complete set of pest and crop management information applicable to vegetable production in New York.

Although many structural and content related changes were made, certain elements of past recommendations documents were retained. For example, as before, the book is divided into chapters that gave basic information on 10 general pest and crop management topics followed by several crop specific chapters. Major reformatting changes were required to include a single table with all available pest management information for each pest within each crop-specific chapter. Fig. 1 is a sample page for the sweet corn (*Zea mays*) pest European corn borer (*Ostrinia nubilalis*), that shows the format of the table of pest management options [both hardcopy and Internet versions (Petzold et al., 2001; Reiners et al., 2001)] and the links that are available to connect to other information sites [Internet version only (Petzold et al., 2001)]. The information presented for each pesticide was expanded to include the trade name, common name, concentration of active ingredient, recommended rate range, preharvest interval, worker re-entry interval, environmental impact quotient (EIQ), and a comment field. Each crop chapter also includes recommended varieties (along with their pest resistance rating if known), and sections on planting methods, fertility, harvest, and storage (if applicable).

The editor met every 2 weeks with the editorial board (authors) to update them on progress with the revision. Hardcopy revisions and reformatting were complete by Sept. 1998, the copy due date for the 1999 edition. The 1999 edition, titled *Integrated Crop and Pest Management Recommendations for Commercial Vegetable Production*, was available in late January 1999 (Reiners et al., 1999).

The second phase of the *CPMR* revision process, making it Internet-ready, began when the hardcopy was complete. Considerable research and discussion with various publication resources at Cornell University, led us to decide that the software program Dreamweaver (Macromedia, Inc., San Francisco, Calif.) would be used to develop and support the Internet ver-

sion. This software package allows for easy editing and link establishment; both are critical to the future inexperienced editor (first author) of the web document. However, the software for the hardcopy version [Adobe Pagemaker (Adobe, San Jose, Calif.)] was largely incompatible with Dreamweaver, necessitating a laborious process of document entry. Thankfully, information entry into Dreamweaver was not necessarily difficult. By June 1999, the Internet version of the document was online, although links were added to the document through Aug. 1999. Many links were made to sites with more detailed information on specific topics such as photographs of pests and diagnostic information, soil fertility testing, cover crops, environmental impact of pesticides, pesticide labels, and images, sources, and life cycles of beneficial insects. The address for the document is <<http://www.nysaes.cornell.edu/recommends/>> (Petzold et al., 2001).

Today, the hardcopy version (Reiners et al., 2001) is edited annually by a team of faculty and staff (headed by Reiners)—a process requiring about 2 months. Changes are then made (by Petzoldt) on the Internet version (Petzoldt et al., 2001) a process requiring nearly 3 weeks. The Internet version is updated periodically throughout the year as new information becomes available. For the 2000 version, Cornell University policy required that the title be changed to *Integrated Crop and Pest Management Guidelines for Commercial Vegetable Production*.

## Results and discussion:

Alternatives to pesticides are much more apparent in the revised version of the *Integrated Crop and Pest Management Guidelines for Commercial Vegetable Production* (Petzoldt et al., 2001; Reiners et al., 2001). Users find it much easier to locate and interpret descriptions of alternative strategies for pest management. Additionally, combining the crop and pest management guidelines into one document has made it a valuable reference book for many audiences.

The Internet and hard copy versions of the document are formatted differently and serve different uses. Currently the Internet document is most useful at a workstation—it is similar to an easily accessed, pre-in-

SWEET CORN: [Recommended Varieties](#) | [Planting Methods](#) | [Fertility](#) | [Harvesting](#) | [Disease Management](#) | [Insect Management](#) | [Weed Management](#)

**European corn borer (ECB), *Ostrinia nubilalis***

See [pictures of ECB damage](#)  
See [pictures of ECB life cycle](#)  
See [Cornell ECB fact sheet](#)

**Time of concern:** Mid-May through September

**Key characteristics:** Eggs are laid in scale-like masses on the undersides of leaves. They are gray with rows of brown spots. The head capsule is dark brown. Larvae are 3/4 inch long when developed. The adult is a yellowish to reddish brown moth, about one inch in length. In corn damage may appear in leaves as a series of small pin holes perpendicular to the leaf. To stems is evidenced by the presence of sawdust-like material in leaf axils and broken tassels. See [References 11 and 12](#).

**Management Option: Recommendation**

**Scouting/thresholds** [Processing sweet corn](#) - Use a pheromone trapping system to monitor the flight activities of adult moths. Use degree day models which describe insect development. See [Reference 13](#). Critical time periods . . .

[Fresh-market sweet corn](#) - Sample fields once per week, more often if the temperature is above 80°F. Use the sampling protocol in [fields of sweet corn](#). If fields are larger, divide them into ten acre blocks and sample each block separately. See [Reference 8](#).

**Thresholds:**  
Early tassel and tasseling stage: 15% infestation  
Silk stage through maturity: 5% infestation in ear zone

See [Appendix 26.1](#) for specific sampling instructions and scouting form. [NEWA](#) makes daily degree day forecasts for ECB emergence. The most recent trap catches of the [WHNY Sweet Corn Pheromone Trap Network](#) are updated each Tuesday during the growing season. Download the [IPM Sweet Corn FAW Scouting Form \(188K.pdf\)](#).

**Natural enemies** A variety of natural enemies help suppress ECB infestations including predatory lady beetles, minute pirate bugs and lacewings, and fly and wasp parasitoids. Bird predation of overwintering larvae in unfilled stalks may also be important. Use [Reference 9](#) for identification of natural enemies. *Eriborus terebrans*, *Podisus maculiventris*, *Nuclear polyhedrosis virus*, *Ornus insidiosus*, *Ornus tristicolor*, *Vairimorpha neocatrix*, *Coleosmagilla maculata lengi*, *Chrysoperla*, *Trichogramma minutum*, *Trichogramma ostriniae*, *Trichogramma evanescens*, *Trichogramma nubilalis*, *Microgaster thuringiensis* var. *kurstaki*, *Propylosa quatuordecimpunctata*, *Meteorus grandis* [Goidandich](#), *Lydella thompsoni*, *Beauveria bassiana*, *Apomyza*, *Nosema*

**Resistant varieties** No resistant varieties are available.

**Crop rotation** Crop rotation may be useful if corn follows another crop and from other corn fields or noncultivated areas having alternate weed hosts.

**Postharvest** Destruction of corn residue and plowing in the fall can destroy a large percentage of overwintering larvae.

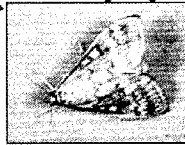
**Site selection and Sanitation** These are not currently viable management options.

**Compound(s)  
Common name**

Trade name	Rate/A Product	PHI (days)	REI (hours)	Field Use EIQ	Comments
<i>chlorpyrifos</i>					
Lorsban 4E 4 lb/gal	1.5 pt	35	24	36	
<i>cyfluthrin</i>					
*Baythroid 2 lb/gal	1.6-2.8 fl oz	0	12	1-2	

**European Corn Borer Fact Sheet**

Click for larger image



**Adults:**

The adult female is a creamy, yellowish-brown moth approximately 0.75 inches long. It has a stout body and a wing expanse of about 0.6 inches in the resting stage. The outer third of the forewings is marked by two dark serrated lines that run across the wings. The forewings of the female are usually lighter in color than those of the male. The hind wings of both males and females have light markings. The abdomen of the female does not extend beyond the wings at rest. The reddish-brown male has a long slender body and is



**The Northeast Weather Association**  
a source for in-field weather monitoring and pest forecasts

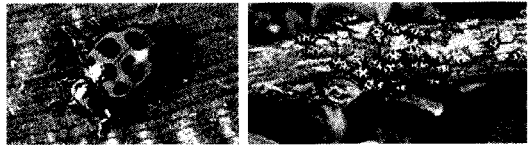
**The Sweet Corn Pheromone Trap Network for Western New York**

Location	ECB-E	CRW	FAW
Baldwinsville (Onondaga Co.)	4	2	16
Basom (Genesee Co.)	6	--	--
Byron (Genesee Co.)	6	0	0

**BIOLOGICAL CONTROL:**

A Guide to Natural Enemies in North America

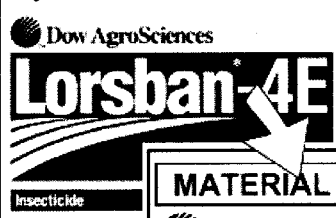
Weeden, Shelton, and Hoffmann, Editors



**Environmental Impact Quotient**

Common Name	Trade Name	Applicator	Picker	FarmW	Consumer	fish	birds	bees	preo	Ecolog	EIQ total
2,4-D (acid)	Weedone	45.0	27.0	72.0	6.0	1.0	18.0	9.0	60.0	68.0	56.3
acephate	Orthene	5.0	1.0	6.0	3.0	1.0	9.0	15.0	18.7	43.7	17.9
<i>Bacillus thuringiensis</i>	Dipel	10.0	2.0	12.0	4.0	3.2	6.0	3.0	10.3	22.5	13.5
benomyl	Benlate	15.0	15.0	30.0	45.0	25.0	15.0	15.0	73.5	128.5	69.5
chlorpyrifos	Lorsban	37.5	7.5	45.0	7.5	25.0	45.0	15.0	19.9	104.9	52.8
copper hydroxide	Kocide	7.5	4.7	12.2	4.1	10.8	24.3	9.3	38.3	82.7	33.3

**Specimen Label**



**MATERIAL SAFETY DATA SHEET**



Fig. 1. Sample page showing tabular format of the *Integrated Crop and Pest Management Guidelines for Commercial Vegetable Production* [hardcopy and Internet versions (Petzoldt et al., 2001)] and links to other sites (Internet version only).

dexed library of information dealing with vegetable integrated pest and crop management. The hardcopy, while more difficult to use to track reference materials, offers the important advantage of portability.

Sales of the hardcopy version have risen from about 1100 in 1997 to 1400 in 2001. About 6,000 hits per month are recorded at the Internet version, and this number is increasing. Growers and other members of the industry responded positively to both versions of the document. About five questions per month arrive by email to the editor from users of the Internet document. A poster describing the revision and current documents won the Outstanding Extension/Regulatory Award at the Entomological Society of America meeting in 1999.

## Conclusions

In 1999, a major revision of the *Cornell University Pest Management Recommendations for Commercial Vegetable and Potato Production* (Bellinder et al., 1997) was completed so that the document could contain alternatives to pesticide use. It was also important to present pesticide information, cultural and fertility practices, and variety information in a systems-oriented fashion. The title of the document reflects these changes, *Integrated Crop and Pest Management Guidelines for Commercial Vegetable Production* (Petzoldt et al., 2001; Reiners et al., 2001).

Information is presented in the hardcopy document (Reiners et al., 2001) in ways that allow users to more easily understand and make use of all pest management options rather than

only pesticides. ICM/IPM (integrated crop management/integrated pest management) information is cross-referenced so that crop management practices and pest management practices are integrated into a series of management options from which the user can choose. Pest management option topics available for many pests include time for concern, brief scouting descriptions, threshold information, pest resistant varieties, crop rotation considerations, field selection advice, seed treatments, postharvest considerations, field sanitation techniques, cover crops that reduce pests, planting considerations, effective pesticides and other types of information. Situations when these techniques are unlikely to be helpful to manage a particular pest are also noted in the text.

The document was also placed on the Internet (Petzoldt et al., 2001) with many links to sites with more detailed information on specific topics, including pest pictures and pest diagnostic information, soil fertility testing, cover crops, beneficial insect pictures, sources, life cycles, environmental impact of pesticides, and pesticide labels.

An editor dedicated to the task for 9 months was required to revise hardcopy version of the document (Reiners et al., 2001). A second 9-month period of time was required to place the document on the Internet (Petzoldt et al., 2001). The changes have resulted in increased sales and access through the Internet. IPM information has become more available to users of the *Integrated Crop and Pest Management Guidelines for Commercial Vegetable Production*.

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