The Lorsban “ban” – Cabbage maggot control without it

Acknowledgments

- **Faruque Zaman** – Assoc. Entomologist, CCE Suffolk Co.
- **Dan Gilrein** – Entomologist, CCE Suffolk Co.
- **Tony Shelton** – Professor, Cornell Entomology
- **Ben Werling** – Vegetable Production Educator, Michigan State University Extension
Cabbage maggot (*Delia radicum*)

- Found in northern temperate regions worldwide
- Feeds only on plants in Family *Brassicaceae* (mustards)
- Close relative includes seedcorn maggot – a generalist and sporadic pest of cabbage

Life Cycle

- Overwinters as pupa
- Complete one generation in 25-30 days in summer
- 3-4 generations per year

Photo credits: Ken Gray
Cabbage maggot eggs on base of cabbage stem

Cabbage maggot eggs on soil near base of stem

Mild damage

Severe damage

Photo courtesy: Dan Gilrein, CCE-SC
Severe cabbage maggot damage

How best to manage cabbage maggot?
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**Plant Resistance**
- None used

**Cultural Control**
- Crop rotation
- Avoid planting into high OM
- Row covers
Row covers will protect plants from ALL insects, not just cabbage maggot
NEWA cabbage maggot degree-day model for predicting fly activity

At least 4 generations on Long Island

Degree-day model will generate information to help determine when to remove row cover

http://www.newa.cornell.edu/
How best to manage cabbage maggot?

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Sterile Insect Technique
- Sterile male release

Biological Control
- Nematodes
How best to manage cabbage maggot?

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Chlorpyrifos

- EPA has threatened to pull all food uses for chlorpyrifos, including cabbage.
- NY chose NOT to ban chlorpyrifos, but its use will be restricted in the near future. Are there effective alternatives?
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NY chose NOT to ban chlorpyrifos, but its use will be restricted in the future.

Are there effective alternatives?

Insecticides labeled for cabbage maggot in Brassica Leafy Vegetables (Crop Group 5)

- Lorsban (chlorpyrifos) (1B)
- Diazinon AG500 (diazinon) (1B)
- Capture LFR (bifenthrin) (3A)
- Verimark (cyantraniliprole) (28)
- Coragen SC (chlorantraniliprole) (28)
- Entrust SC (spinosad) (5)
- Radiant SC (spinetoram) (5)
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- Suppression only

Insecticides available for cabbage maggot control in New York (IRAC 1B & 3A)

<table>
<thead>
<tr>
<th>Product</th>
<th>Rates</th>
<th>Application Method</th>
</tr>
</thead>
</table>
| Lorsban Advanced | 1.6-2.75 fl oz/ 1000 ft | • Direct-seeded: at-plant band (4")  
|                  |                   | • Transplants: direct spray at base of transplants after setting |
| Diazinon AG500   | 2-3 qts/acre 4-8 fl oz/ 50 gal | • Direct-seeded: broadcast at planting  
|                  |                   | • Transplants: water transplant treatment |
| Capture LFR      | 3.4-6.8 fl oz/acre | • Direct-seeded only: apply in 5-7" band in furrow |
### Insecticides available for cabbage maggot control in New York (IRAC 28)

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| Verimark   | 10 – 13.5 fl oz/acre | • In-furrow spray  
• Transplant tray drench  
• Transplant water treatment  
• Surface band  
• Soil shank injection |
| Coragen SC* | 3.5-7.5 fl oz/acre | • Transplant water treatment only                      |

*suppression only

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### Insecticides available for cabbage maggot “suppression” in New York (IRAC 5)

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| Entrust SC*| 5-10 fl oz/acre | • Directed spray at base of young direct-seeded plants (4")  
• Directed spray at base of transplants immediately after setting |
| Radiant*   | 5-10 fl oz/acre | • Same as above                                      |

*suppression only

- Use high gallonage of spray (e.g., 100 gallons per acre)
- Need at least 2 applications spaced 2-3 weeks apart
- Do not apply more than 29 fl oz of Entrust SC or 34 fl oz of Radiant SC per acre per crop for all methods of application
- Maximum Number of Applications: Do not make more than six applications per year
Evaluating alternatives to Lorsban for cabbage maggot management

Chemical Control
- Insecticides

Cultural Control
- Row covers

Insecticide treatments evaluated for cabbage maggot control in cabbage
Riverhead, NY  2017-2019

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<tr>
<td>Entrust SC*</td>
<td>8 fl oz/acre</td>
<td>Tray drench** + post directed</td>
</tr>
<tr>
<td>Radiant SC*</td>
<td>10 fl oz/acre</td>
<td>Tray drench** + post directed</td>
</tr>
<tr>
<td>Verimark</td>
<td>13.5 fl oz/acre</td>
<td>Tray drench + post directed</td>
</tr>
<tr>
<td>Lorsban</td>
<td>1.8 fl oz/ 1,000 ft</td>
<td>At planting 4” band furrow</td>
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* suppression only
** not labeled use
Transplant tray drench (e.g., Verimark)

- **Rate:** high rate of Verimark is 13.5 fl oz/acre
- **Number of plants/acre:** 16,786
- **Amount of Verimark per plant:** 0.0008 fl oz or 0.024 ml
- **Number of plants/tray:** 200
- **Number of trays per acre:** 84
- **Amount of Verimark/tray:** 4.7 ml in 250 ml of water
- **NOTE:** do not water trays for at least 24 hours before treatment

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Row covers evaluated for cabbage maggot control in cabbage  
Riverhead, NY  2017-2019

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<tr>
<td>Row cover netting</td>
<td>-</td>
<td>At planting</td>
</tr>
<tr>
<td>Black plastic mulch</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Row cover + plastic</td>
<td>-</td>
<td>At planting</td>
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Row covers will protect plants from ALL insects, not just cabbage maggot

Assessing cabbage maggot damage
Management of cabbage maggot in cabbage

Riverhead, NY 2017

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<th>Treatment</th>
<th>% Undamaged plants</th>
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<tr>
<td>Untreated control</td>
<td>0</td>
</tr>
<tr>
<td>Entrust (D)*,**</td>
<td>c</td>
</tr>
<tr>
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<td>b</td>
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<td>Lorsban</td>
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Modified from Faruque Zaman, CCE Suffolk Co.

Management of cabbage maggot in cabbage

Riverhead, NY 2018

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<tr>
<td>Entrust (D)***</td>
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<tr>
<td>Entrust (D+F)<strong>,</strong></td>
<td>bcd</td>
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<tr>
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<td>Verimark (D+F)</td>
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<td>Lorsban 75WG</td>
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Management of cabbage maggot in cabbage
Riverhead, NY 2019

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| **Estimated Costs for Cabbage Maggot Control**

**Assumption: 36" row spacing and 12" in-row plant spacing**

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<tr>
<td>Lorsban Ad.</td>
<td>1.6 fl oz/1,000 ft</td>
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<td>$8.33 $14.29 $8-14/acre</td>
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### Estimated Costs for Cabbage Maggot Control in Fresh Market Cabbage

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*Includes cost of 2 applications spaced 2 wk apart*
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<td>Verimark</td>
<td>10 fl oz/acre</td>
<td>13.5 fl oz/acre</td>
<td>$74.40 - $100.40</td>
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*Includes cost of 2 applications spaced 2 wk apart

### Summary

- **Lorsban** - excellent control (80-90%); NO control of other pests
- **Verimark** - tray drench good control (65-80%); drench + foliar 2 wks later was better (82-87%); controls worms and flea beetles! EXPENSIVE
- **Radiant & Entrust** – tray drench fair control (45-50%); drench + foliar 2 wks later better (70%); controls of worms! EXPENSIVE
- **Row cover** - was highly effective (nearly 100% protection); controls worms and flea beetles EXPENSIVE & NOT PRACTICAL
Future Research

- Evaluate Verimark, Radiant and Entrust applied as a tray drench followed by directed spray effective at lower than labeled rates
- Other options?
- Need a field site in 2020 with high cabbage maggot pressure to conduct trials (see me)