Sustainable Vegetable Production

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Sustainable Production Systems

- Physical and cultural controls
- Host resistance
- Risk assessment and spray thresholds
- Biological controls
- Reduced risk crop protection materials
- Sometimes conventional methods, such as fumigation, need to be tested
Research

- Sclerotinia rot of carrot
- *Fusarium* on spinach and carrots
- Stemphylium leaf blight of onion and asparagus
- Managing nematodes of carrots and tomatoes
- Onion maggot, onion thrips
The Holland Marsh

Much of the research was conducted in the Holland Marsh. Onions and carrots are the two major crops on the marsh. High organic matter soil: 48% - 80% om, pH 5.0-7.2
Sclerotinia Rot of Carrot
Cultural, Biological and Chemical control

- Disease in the Field
- and Cold Storage
Carrot trimmer in operation – Holland Marsh
Trimming and fungicide application on area under the disease progress curve of *Sclerotinia* on carrots - 2011

Darker bar on left is untrimmed, lighter bar on right is trimmed
Trimming for control of Sclerotinia

- Trimming reduced Sclerotinia on carrots
- The biorational product, Chitosan, reduced Sclerotinia as effectively as fungicide Lance (boscalid)
- Chitosan was more effective in combination with trimming
- Trimming is used extensively in eastern Canada for disease management
- Trimming can also make harvesting easier
Effect of fertilizer and fungicide application on Stemphylium fern blight of asparagus

Bars which share a letter in common are not statistically different (Tukey’s HSD, P≤0.05, n=4).
Stemphylium leaf blight

Stemphylium vesicarium

Caused by *Stemphylium vesicarium*.

Typically attacks leaf tips, other lesions, and injured or dying onion leaves.

Starts with small light brown lesions, these expand and black conidia develop.

Infection may kill entire leaves.

Usually limited to leaves and doesn’t extend to bulbs.
Objectives

- Improve the management of Stemphylium leaf blight on onion:
  - Evaluate efficacy of fungicides on incidence and severity of stemphylium leaf blight
  - Test disease forecasting models to improve timing of fungicide sprays
  - Screen onion cultivars for susceptibility to Stemphylium
  - Determine if surfactants increase the susceptibility of onions to Stemphylium
Fungicides for control of Stemphylium on onions 2011

% Foliage infected

cv. Tahoe

Fontelis
Luna Tranquility
Inspire
Pristine
Switch
Manzate
Bravo
Check

bcd
d
e
Fungicides for control of Stemphylium on onion - 2014

Disease severity

cv. Patterson

Quadris Top, Luna Tranquility, Dithane, Pristine, Fontelis, Switch, Inspire, Check
Cultivar susceptibility to Stemphylium
Aug.19, 2014

Trailblazer, LaSalle, Hamlet, Milestone, Gensis, Patterson, Stanley, Hendrix
Disease forecasting systems were tested

- Botcast – used to forecast Botrytis leaf blight
- Tomcast with Disease Severity Value 20 and 30 - 2013
- Tomcast with a DSV of 20 then spray at DSV 10 or weekly sprays
  - All based on temperature and leaf wetness duration
- Spraying following first time a Stemphylium spore is found on spore trap (rotorod trap, also used to monitor for Botrytis squamosa)
- Standard calendar spray schedule – 5 sprays, 7-10 days apart
Spray timing for Stemphylium control- 2014

No significant differences

Disease severity

Check | Botcast | Tomcast 20 | Spore trap | Tomcast 20 WK | Calendar

Quadris Top fungicide
What is contributing to Stemphylium outbreaks?

- Higher temperatures?
- Physiological stress?
- More susceptible cultivars?
- Increased use of surfactants for thrips control and with fungicides? NO
- More research is needed on the epidemiology of the pathogen
A new, or emerging, disease of carrots in Ontario

_Fusarium_ infection that develops in the field is unusual- it is most often seen as Fusarium dry rot in storage.

Source: Howard et al. Diseases and Pests of Vegetable Crops in Canada
Incidence and severity of carrot root rot caused by *Fusarium* on different carrot cultivars, October 2012

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>#Carrots with lesions</th>
<th>Mean # carrots with lesion</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>1 lesion</td>
<td>2 lesions</td>
</tr>
<tr>
<td>Fontana</td>
<td>18.0 ns</td>
<td>5.3 ns</td>
</tr>
<tr>
<td>Cellobunch</td>
<td>19.8</td>
<td>7.3</td>
</tr>
<tr>
<td>Olympus</td>
<td>21.3</td>
<td>5.0</td>
</tr>
<tr>
<td>Envy</td>
<td>21.8</td>
<td>8.3</td>
</tr>
<tr>
<td>CX 480</td>
<td>25.3</td>
<td>4.0</td>
</tr>
<tr>
<td>2289</td>
<td>25.0</td>
<td>8.3</td>
</tr>
<tr>
<td>2384</td>
<td>28.5</td>
<td>8.5</td>
</tr>
</tbody>
</table>
Fungicides for control of Fusarium on carrots

NO differences in percent of carrots with lesions or number of lesions per carrot
Fumigant PicPlus for control of Fusarium on carrots: 2014

Percent disease

NO differences in percent of carrots with lesions or number of lesions per carrot
Nematodes on vegetable crops

Meloidogyne hapla
Growth Room Trials

- Tomatoes and carrots (root knot nematode)

Treatments
1. Non-inoculated check
2. Inoculated check
3. Movento at 350 ml/ha spray post-plant
4. Abamectin at 1% v/v soil drench at planting
5. Dazitool at 60L/ha
6. Basamid at 392 kg/ha
7. Nimitz (was MCW-2) EC at 8.3 L/ha
8. MustGrow at 1680 kg/ha - biological
9. Busan 1236 at 275 L/ha

PIC PLUS cannot be used in these trials because of the problems in applying a volatile product.
Greenhouse trial- tomatoes
Nematode management- Field Trails

Pic Plus – chloropicrin recently registered
Dazitol (capsaicin, oleoresin of capsicum)
Agri-Mek
Nimitz (flufensulfone)
Vapam (metam sodium)
MustGrow (mustard meal)
Carrot Fumigant Field Trial- 2014

Percent infected and marketable yield

Yield (tonnes/ha)

Percent of roots infected

Pic Plus  |  Dazitol  |  Check

Pic Plus: a
Dazitol: ab
Check: b

A  |  A  |  B

a  |  ab  |  b
Field trial: Carrots 2014

Marketable Yield

- Vapam+PP: C
- Nimitz+PP: C
- Vapam: C
- Pic Plus: c
- Nimitz: Bc
- Agri-Mek: AB
- Dazitol: A
- MUSTGROW: A
- Check: A
Nematode management

- Several products look promising, especially Pic Plus, Dazitol, Basamid, Busan and Nimitz (new regulations for fumigants will affect Pic Plus and Busan)
- Biorational materials not as effective (not effective)
- Nematode survey from 2013 shows that carrot cyst nematode is also a problem.
- Nematode counts are often not closely related to damage in the field. More research is needed on extraction methods and time to sample.
OBJECTIVE: Thrips control on onions

- Onion thrips (*Thrips tabaci*) damage onions and other plants by scraping the leaf surface to feed.
- They multiply rapidly in warm weather.
- Thrips feed in the leaf axils and can be difficult to control with insecticides.
- They develop resistance to insecticides quickly.

- **Monitor:**
  - Spray at 1 thrips per leaf
- **Reduced risk insecticides**
- **Biological control**
Evaluation of insecticides for control of onion thrips - 2011

Thrips per plant

MET 52, Check, Movento, Concept, Dibrom + Sy..., Mov/Concept, Agri-Mek, Mov/Dibrom, Mov/Agral, Mov/AgriMek, Delegate, Mov/Deleg...
Conclusions: Sustainable Vegetable Production

- There are several cultural and physical controls that can contribute to disease suppression- including fertilizer management
- Biological and biorational materials may be inconsistent
- Several new reduced risk materials are effective
- Use and improve IPM programs
  - Sometimes older products (fumigants) are the only solution
Improving and Supporting IPM

- Improving thresholds and disease forecasting: Stemphylium on asparagus and onions
- Spore trapping: Sclerotinia, Stemphylium on onions, other diseases
- Improved insect trapping and risk assessment: carrot weevil and carrot rust fly
- Aerial photography: diseases, insect pests, drought and soil conditions
Octocopter for aerial photography

HighEye
Stemphylium on onions 2014
All research trials are summarized in the Annual Report

Download at the Muck Station website:

www.uoguelph.ca/muckcrop
Acknowledgments

- OMAFRA/University of Guelph Partnership
- Muck Crops Research Station Staff
Questions?
## Weather Data 2011-2014

<table>
<thead>
<tr>
<th>Month</th>
<th>Mean Temperature (°C)</th>
<th>Rainfall (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>14.1</td>
<td>15.9</td>
</tr>
<tr>
<td>June</td>
<td>18.4</td>
<td>20.1</td>
</tr>
<tr>
<td>July</td>
<td>22.8</td>
<td>22.2</td>
</tr>
<tr>
<td>Aug</td>
<td>20.2</td>
<td>20.1</td>
</tr>
<tr>
<td>Ave</td>
<td>18.9</td>
<td>19.6</td>
</tr>
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</table>
Comparison of disease ratings for Stemphyllium leaf blight symptoms and marketable yield of onions treated with fungicide at different periods, 2013.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Spray date</th>
<th>% Total Leaf Length with Symptoms</th>
<th>Marketable Yield (Bushel/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOMCAST 30</td>
<td><strong>Jul 12, 25</strong></td>
<td>Aug 2, 9, 19</td>
<td>15.5 a&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>TOMCAST 20</td>
<td><strong>Jul 3, 22</strong></td>
<td>Aug 2, 9, 19</td>
<td>16.3 a</td>
</tr>
<tr>
<td>Calendar spray</td>
<td><strong>Jul 15, 25</strong></td>
<td>Aug 2, 9, 19</td>
<td>16.3 a</td>
</tr>
<tr>
<td>Spore trap</td>
<td><strong>Jul 15, 25</strong></td>
<td>Aug 2, 9, 19</td>
<td>16.5 a</td>
</tr>
<tr>
<td>BOTCAST</td>
<td>Aug 2, 9, 19</td>
<td></td>
<td>17.9 a</td>
</tr>
<tr>
<td>Check</td>
<td>Not sprayed</td>
<td></td>
<td>23.7 b</td>
</tr>
</tbody>
</table>
Trimming and fungicide for control of Sclerotinia on carrots - 2011