Challenges in Canadian onion production

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Muck Crops Research Station, Ontario, Canada
44° 5’ N, 79° 35’ W
The research Muck Crops Research Station in the Holland Marsh. High organic matter soil: 48 - 80% om, pH 5.0 - 7.2 (~2830 ha)

Onions and carrots are the two major crops on the marsh

The research presented took place in the Holland Marsh
## Onions and Carrots in Canada- 2018

<table>
<thead>
<tr>
<th>Crop</th>
<th>Canada</th>
<th>Quebec</th>
<th>Ontario</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onions</td>
<td>5,439 ha</td>
<td>2,105</td>
<td>2,291</td>
</tr>
<tr>
<td>Carrots</td>
<td>8,133</td>
<td>2,939</td>
<td>3,439</td>
</tr>
</tbody>
</table>

Ontario and Quebec produce 81% of the onions in Canada
-almost all of the onions are produced on high organic matter soils
Onion Challenges

• **Marketing** – the U.S. is a large producer of onions

• **Labour**
  • Family farms plus mostly off-shore labour

• **Crop Protection**
  • Effective pest management
  • Registration of Crop Protection Materials

• **Other issues**-
  • Phosphorous in lakes and streams
  • Permits to take water for irrigation
Production Challenges

- Production-
  - Weed control
  - Stemphylium leaf blight
  - Onion maggot
  - Onion thrips
  - Downy mildew
  - Onion smut
  - Botrytis leaf blight

- Allium white rot
- Bacterial diseases

The Weather!
Onion maggots and seed corn maggots—up to 40 to 100% loss

Worst damage is usually on seedlings, early in the season, but the second generation of onion flies can also be damaging at times

Objective: To identify effective insecticide seed treatments to protect onions from onion and seed corn maggots.

5-8 maggots at base of bulb
## Insecticide treatments
cv. Highlander -2019

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Active ingredient</th>
<th>Rate g ai/1000 seeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>FI500 (Regard +Cruiser)</td>
<td>80% spinosad + 70% thiamethoxam</td>
<td>0.2 + 0.2</td>
</tr>
<tr>
<td>Trigard + Cruiser</td>
<td>75% cyromazine + 70% thiamethoxam</td>
<td>49.5 + 0.2</td>
</tr>
<tr>
<td>Cruiser</td>
<td>70% thiamethoxam</td>
<td>0.2</td>
</tr>
<tr>
<td>Untreated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All seed were treated with F300 fungicides: metalxyl-M, fludoxinil and azoxystrobin, which are the fungicides in FI500.

3 locations: Tulelake, California; New York State; Holland Marsh, Canada
Onion maggot damage is assessed in 2 m sections of the plots at 3 times: After the first generation of onion flies, second generation, and at harvest. Yield and marketable yield also assessed
Onion maggot damage – total season 2019

Percent damage

- **Check**: C
- **Cruiser**: b
- **Trigard +Cruiser**: b
- **FI500**: a

FI500: 80% spinosad + 70% thiamethoxam
Onion grown from transplants

Insecticide drench (500 ml/tray)

Verimark (cyantraniliprole)
Radiant (spinetoram)
Pyrinex (chlorpyrifos)

Seed treatments:
Trigard (cyromazine)
Sepresto (clothianidin+imidacloprid)

Onions in plug trays

Onion maggot damage on onions grown from transplants
Total season maggot damage on transplanted onions 2019

Percent damage

Check: b
Pyrinex: a
Sepresto: a
Trigard: a
Verimark: a
Radiant: a
Seed treatments compared to in-furrow applications
First generation maggot damage - 2014

Percent damage

Untreated, Lorsban, Actara, Capture, Force, Verimark, Entrust, Sepresto, Entrust+Cruiser, Trigard

Actara = thiamethoxam (Cruiser) in furrow
Verimark = cyantraniliprole (Exirel) in furrow
Conclusions: onion maggot control

- Moderate onion maggot damage (28-37%) in untreated checks
- FI500 (spinosad + thiamethoxam) and Trigard (cyromazine) + Cruiser are very effective as seed treatments, as is Sepresto (clothianidin+ imidacloprid)
- There may be other options: spinetoram, cyantraniliprole, and new products
- Seed treatments are the most effective
- In-furrow treatments are less effective
- (most are not effective)
- Foliar sprays are not effective
Stemphylium leaf blight

- Caused by a fungus: *Stemphylium vesicarium* (*Pleospora allii*)
- Host: *Onions*, asparagus, leek, parsley, alfalfa, pears and others—weeds?
- First reported in Ontario: 2008

**Disease severity – over 9 yrs**
Stemphylium leaf blight on onions

**Initial symptoms**

- Small, yellow to light brown water soaked oval lesions
- Lesions expand and coalesce
- Produces toxin that cause leaf dieback

(Singh et al., 2000, 1999)

**Later symptoms**

- Spots turn brown to dark olive brown as sporulation occurs.
- Entire leaf gradually dies
- **Disease severity assessed on leaf dieback**
Stephylium leaf blight

- In retrospect, we probably saw the symptoms prior to 2008 and just didn’t pay much attention
- Develops during warm weather with long leaf wetness
- 10 - 25 °C, at least 8 - 24 hours of wetness
- How can we manage or control this disease?
  - Resistant cultivars
  - Fungicides
  - Timing fungicide sprays
- Why did it become a problem?
Are any onion cultivars resistant to Stemphylium?
SLB disease severity (leaf dieback) on onion cultivars (0-100), 9 August, 2017.

Highest in 2015.

Severity (%)

Severities:
- Highest
- a
- ab
- abc
- a-d
- bcd
- d

Cultivars:
- Stanley
- Braddock
- Milestone
- Catskill
- Ridgeline
- TrailBlazer
- Patterson
- Hamlet
- LaSalle
- Highlander
- Frontier
Is susceptibility to Stemphylium leaf blight related to maturity (days to harvest)?
Not directly. However, some early cultivars are very susceptible to Stemphylium - Highlander and Frontier
# Efficacy of fungicides to control Stemphylium leaf blight

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Active Ingredient</th>
<th>Rate/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quadris Top</td>
<td>azoxystrobin + difenoconazole</td>
<td>13.7 oz</td>
</tr>
<tr>
<td>Luna Tranquility</td>
<td>fluopyram + pyrimethanil</td>
<td>16.4 oz</td>
</tr>
<tr>
<td>Inspire</td>
<td>difenoconzole</td>
<td>7.0 oz</td>
</tr>
<tr>
<td>Fontelis</td>
<td>pentyhiopyrad</td>
<td>19.2 oz</td>
</tr>
<tr>
<td>Pristine</td>
<td>pyraclostrobin + boscalid</td>
<td>1.2 lb</td>
</tr>
<tr>
<td>Manzate/Dithane</td>
<td>mancozeb</td>
<td>2.9 lb</td>
</tr>
<tr>
<td>Switch</td>
<td>cyprodinil + fluodioxinil</td>
<td>0.9 lb</td>
</tr>
<tr>
<td>Bravo</td>
<td>chlorothalonil</td>
<td>65.7 oz</td>
</tr>
</tbody>
</table>
Fungicides for control of Stemphylium on onions 2011

% Foliage infected

cv. Tahoe

Bravo = chlorothalonil
Manzate = mancozeb
Switch = cyprodinil and fludioxinil
Pristine = bocalid + pyraclostrobin
Inspire = difenoconazole
Luna Tranquility = fluopyram + pyrimethanil
Fontelis = penthiopyrad
Fungicides for Stemphylium on onions 2019

Disease severity

No differences in severity, except that Sercadis was different from the untreated check.

Aprovia Top = solatenol and difenoconazole
T-77 = Trichoderma atroviride
Sercadis = fluxapyroxad
What is happening to the fungicides?

In vitro Fungicide Sensitivity
Ontario

<table>
<thead>
<tr>
<th>Active Ingredient</th>
<th>Sensitive to 5 µg/ml</th>
<th>Insensitive to 5 µg/ml</th>
<th>No Effect at 100 µg/ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azoxystrobin</td>
<td>4</td>
<td>25</td>
<td>3</td>
</tr>
<tr>
<td>Pyrimethanil</td>
<td>23</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Both</td>
<td>16</td>
<td>14</td>
<td>0</td>
</tr>
</tbody>
</table>

In New York State
Resistance to azoxystrobin and pyrimethanil and cyprodinil
No resistance to fluopyram, fluxapyroxad or difenoconazole
<table>
<thead>
<tr>
<th>Forecasting systems</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOTCAST</td>
<td>BOTCAST</td>
<td>BOTCAST</td>
</tr>
<tr>
<td>TOMCAST 15</td>
<td>TOMCAST 15</td>
<td>TOMCAST 15</td>
</tr>
<tr>
<td>STEMCAST</td>
<td>TOMCAST 15 / 25</td>
<td></td>
</tr>
<tr>
<td>SPORE TRAP at 3-4 leaves</td>
<td>TOMCAST 15 / RAIN</td>
<td></td>
</tr>
<tr>
<td>CALENDAR 1 (local disease)</td>
<td>CALENDAR 2 (4 - 5 leaves)</td>
<td></td>
</tr>
<tr>
<td>UNSPRAYED CONTROL</td>
<td>UNSPRAYED CONTROL</td>
<td></td>
</tr>
</tbody>
</table>
Spray timing for Stemphylium control - 2015

Assessed 13 August, 6 to 10 sprays, starting June 13, 2015
Luna Tranquility (fluopyram+ pyrimethanil)
<table>
<thead>
<tr>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsprayed</td>
<td>Unsprayed</td>
</tr>
<tr>
<td>Weekly (4 leaf start)</td>
<td>Weekly (2 leaf start)</td>
</tr>
<tr>
<td>Weekly (2 leaf start)</td>
<td>Weekly (2 leaf start)</td>
</tr>
<tr>
<td>Civitas drench at 2 leaf</td>
<td></td>
</tr>
<tr>
<td>Azoxystrobin on seed (2 leaf start)</td>
<td>Azoxystrobin on seed plus fungicides, 2 leaf start</td>
</tr>
<tr>
<td></td>
<td>Azoxystrobin seed trt (no spray)</td>
</tr>
<tr>
<td>Penflufen on seed plus foliar fungicides, 2 leaf start</td>
<td>Penflufen on seed plus fungicides, 2 leaf start</td>
</tr>
<tr>
<td></td>
<td>Penflufen seed trt (no spray)</td>
</tr>
<tr>
<td>BSPcast (start at emergence)</td>
<td>BSPcast (start at emergence)</td>
</tr>
<tr>
<td>TOMcast</td>
<td>TOMcast</td>
</tr>
</tbody>
</table>
Disease Severity Index of SLB symptoms on onion, with scheduled fungicide application treatments on August 14, 2018

Bars with the same capital or lowercase letter do not differ at $P = 0.05$ based on Tukey’s test. Error bars = ±SE.
Disease Forecasting - Field Trial 2019

Disease Severity with scheduled fungicide application treatments on August 15, 2019

Bars with the same capital or lowercase letter do not differ at $P = 0.05$ based on Tukey’s test Error bars = ±SE.
What affects Stemphylium development?

- Drought stress? No
- Interaction with insects? No
- Surfactants used with insecticides for thrips?
Stemphylium on onions 2014- the pattern suggests that some stress associated with soil conditions increased Stemphylium in parts of the field.
Surfactants/Spray Adjuvants
Movento for thrips is applied with spray adjuvant

- SYLGARD 309 (siloxylated polyether 76%)
- PURESPRAY GREEN (99% mineral oil)
- WIDESPREAD MAX (polyether- polymethysiloxane-copolymer, polyether 100%)
- Alone and combined with QUADRIS TOP

- In 2014 Purespray Green was replaced with HASTEN (a blend of esterified vegetable oil and non-ionic surfactants)

- 5 sprays, starting July 22 and applied every 7-10 days
Effects of surfactants and Quadris Top on Stemphylium severity, 2013

Disease severity index

Surfactants did not increase susceptibility to Stemphylium

Quadris Top = azoxystrobin + difenoconazole
Does herbicide damage increase susceptibility to Stemphylium?
Chateau/ Valor (flumioxazin) was recently registered for use on onions in Canada.

Unexpected damage showed up in many fields.

Trial: Chateau at 70 and 140 g/ha applied 8 July, with and without Luna Tranquility sprayed 15, 24 July and 1, 10 August- 2017
Chateau and Stemphylium on onions
2017

Disease severity

Check  Chateau 140  Chateau 70  Chateau 140+L  Chateau 70+L  Luna Tranquility
Management of Stemphylium on onions

• Foliar sprays not very effective- fungicide resistance- Yes
• Treat seeds with fungicide – penfulfen?
• Better forecasting program needed, with effective fungicides
• Need to forecast low risk AND high risk
• Spray coverage?
• Other factors – herbicides?
  Not Chateau (flumioxazin)
  Not surfactants
Management of Stemphylium on onions

Future:

• New fungicides and other products
• Improved spray coverage
• Rapid assessment of spores for fungicide resistance
• Less susceptible onion cultivars?
All research trials are summarized in the Annual Report

Download at the Muck Station web site:

www.uoguelph.ca/muckcrop
Acknowledgements

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The Fresh Vegetable Growers of Ontario,
The Bradford Cooperative Storage,
The California Garlic and Onion Research Advisory Board and
The OMAFRA/University of Guelph partnership
Questions?
DYNAMICS OF AIRBORNE INOCULUM

• Spore Trapping: Burkard 7 - day volumetric sampler.

• Hourly weather data – Rainfall, air temperature, leaf wetness and RH were collected using an Onset® automatic weather station.
2015 Results

Seasonal Spore Distribution and Rainfall

- Spores/m³ of air
- Rainfall (mm)
- Ascospores
- Conidia

[Graph showing seasonal spore distribution and rainfall with specific dates and values.

Red arrow indicates a significant correlation between spore distribution and rainfall.

Rainfall peaks and spore distribution trends throughout the season.

Key dates and values for analysis.]
Fungicides for Stemphylium on onions 2017

Disease severity

- Check
- Fontelis
- Sercadis
- Merivon
- SYN A
- Pristine
- Quardis Top
- Luna T

Legend:
a
b

Note: The bars marked with 'a' and 'b' indicate different levels of disease severity.
Chateau and Stemphylium on onions 2019

Disease severity

No significant differences
Cultivar susceptibility: Lesions and Disease Severity (leaf dieback) (0-100, August 2015)

Lesions (Number/leaf)

- Pontiac
- Trialbl
- Hendrix
- Genesis
- Madras
- Highland
- Patterso
- Hamlet
- Prince
- Stanley
- LaSalle
- Mileston

Dieback

Severity (%)

- Lesions
- Dieback

* Indicates significant difference.