Holland Marsh IPM Program

Dennis Van Dyk – OMAFRA
Dr. Mary Ruth McDonald – University of Guelph
Zach Telfer – University of Guelph
Kevin Vander Kooi – University of Guelph
Holland Marsh

- 50 km North of Toronto
- Salad bowl of Ontario
- 7000 acres contained within the dyke system
- 2500 acres in surrounding marshes
  - Keswick
  - Cookstown
  - Srebot
  - Colbar
Crops Produced

- Carrots – 3631 acres
- Onions – 2717 acres
- Celery
- Lettuce
- Beets
- Parsnips
- Asian vegetables
  - Bok choy
  - Pak choy
  - Napa cabbage
History of IPM in the Marsh

• 1980-1998
  – Ontario government extension with expertise from the University of Guelph

• 1998-2003
  – Private companies

• 2004-Present
  – Muck Crops Research Station – University of Guelph
MCRS IPM Program

• Objectives
  – Grower field scouting
  – Disease and insect forecasting
  – Identification/diagnosis of diseases, insects, and weeds
  – Provide growers with timely, accurate and convenient access to insect and disease pest information
  – Update and improve the IPM program
IPM Program Funding

- $ comes from 3 main sources
  1. Project grants
  2. Agrochemical company sponsorships
     - Registered products listed in IPM Updates
     - New product registrations announced
     - Important use information
  3. Participating growers
     - $50/acre
IPM Updates

• Agriphone/Agrifax (IPM Updates)
• Sent bi-weekly from May-September
• Sent to mailing list
  – Growers
  – Extension personnel
  – Researchers
  – Industry reps

---

Bayer CropScience
syngenta
Dow AgroSciences
ENGAGE AGRO
BASF
BRADFORD CO-OPERATIVE STORAGE LTD.
IPM Updates

• Weather information
  – Temperature, precipitation, soil temp
• Insect/disease pressure
• Registered products for issues
• Control recommendations
• Insect DD accumulation
• Disease forecasting
• Upcoming events
• New product registrations
• Minor Use updates
IPM Scouting

- May-September
- 2x per week from May – August
- 1x per week in September (carrots/celery only)
- Monday/Thursday or Tuesday/Friday
- 2 full-time scouts and 1 part-time
- Rain or shine
  - Except for celery
  - Except when fields are too wet
IPM Scouting

- Report is filled out for every field visit
  - Insect counts
    - At threshold?
  - Diseases
    - At threshold?
  - Disorders
- Delivered to growers barn/office same day
- Most growers like to talk with their scouts daily
IPM Scouts

• Grower/Scout relationship is very important
• Trust that is earned
• Communication is key
  – Pesticide use
    • Restricted entry intervals (REI)
  – Issues in the field
  – Issues in the area
Spore Trapping

- Rotorod spore traps (3 areas)
- Collected Mon/Wed/Fri
- Early warning detection
Spore Trapping

- Rotorod spore traps (3 areas)
- Collected Mon/Wed/Fri
- Visually assessed for spores using compound microscope
  - Identified to genus
  - Counts
Diagnostic Lab

- Over 200 submissions each year
- 80% disease/insect damage samples
- 20% abiotic disorders or nutrient deficiency
- Insect ID
- Pathogen identification
  - Spore ID
  - Isolation/Plating
- Inoculum for trials
Disease Forecasting

- **DOWNCAST** – Onion downy mildew
  - Sporulation Infection Periods (SIP)
- **BOTCAST** – Onion Botrytis leaf blight
  - Cumulative DSV to initiate spray
- **BREMCAST** – Lettuce downy mildew
  - Sporulation Infection Period (SIP)
Insect Forecasting

• Degree Day Models
  – Predict overwintering emergence
  – Insecticide application timing

• Information delivered to growers
  – IPM Updates
  – Word of mouth by scouts
Twitter

• @MuckIPM
• Disease alerts
  – Onion downy mildew
  – Stemphylium leaf blight
  – Carrot rust fly generational peak
• Degree day thresholds
Onvegetables blog

- onvegetables.ca
- Research
- Events
- Crop updates
- Minor Use
IPM Program Improvements

- Evaluation of carrot rust fly monitoring methods
  - Colour/Material
  - Angle
IPM Program Improvements

- Evaluation of carrot weevil monitoring method
  - Rotation (overwintering adults)
  - Spatial
CARROTS
Carrot Diseases

- Cavity spot and Pythium root dieback (rusty root)
- Nematodes – Carrot Cyst and Root Knot
- Carrot leaf blight –
  - *Alternaria dauci*
  - *Cercospora carotae*
- White mold/Sclerotinia rot
- Bacterial leaf blight
- Violet root rot
Carrot Insect Pests

- Carrot weevil
  - *Listronotus oregonensis*
- Carrot rust fly
  - *Psila rosae*
- Aster leafhopper
- Cutworms
Carrot Weevil

- Adult 6 mm in length
- Tan with dark brown blotches
- Larva yellowish cream with brown head, legless
- 1-2 generations/year
- Peak oviposition: mid May to early June

![Carrot Weevil Image]
Carrot Weevil Degree Day Model

- Model is base 7°C
- Useful to predict egg-laying activity of the 1st generation only
- Timing for monitoring:
  - 1st oviposition is expected at 147 DD
  - 90% oviposition expected by 455 DD
Monitoring Carrot Weevil

- Boivin traps
- Weevil traps - 4 per field
  - 2 sets of 2 traps
- Set out early (May 1) to capture adults
Carrot Weevil Management

• Spray threshold
  – 1.5 cumulative weevils/trap at 2\textsuperscript{nd} leaf stage
  – 5 cumulative weevils/trap at 4\textsuperscript{th} leaf stage
• Imidan (Group 1B - organophosphate)
• Matador (Group 3A - pyrethroid)
• Rimon (Group 15 – benzoylurea)
  – Reduction in damage only
Historical Data

• Important to have long-term data to monitor
  – Changing biology
  – Resistance development
• Carrot weevil oviposition period shifting
• Carrot weevil 2\textsuperscript{nd} generation
• Carrot weevil Imidan resistance
• Changing pest pressure
  – Carrot rust fly
Emerging Issues with Carrot Weevil IPM

- CW attacking carrots plants earlier than expected
- CW attack killing young carrot plants
- Concerns of CW tolerance to Imidan
- CW exhibiting new bivoltine tendencies in Ontario and Quebec
Real Life IPM Analysis

- Data from University of Guelph – Muck Crops Research Station IPM Program over 2005-2015 used for analysis

- Growers fields monitored and assessed for CW damage

- Potential for high damage at no threshold cause for concern
Novel Carrot Weevil Activity

- Early CW pressure has changed in two ways:
  - Attacking carrots earlier in season according to established DD model
  - Attacking carrots at earlier crop growth stage
Carrot Seeding Date Trial

Dead Carrot Plants (%)

<table>
<thead>
<tr>
<th>Seeding Date</th>
<th>2016</th>
<th>2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early May</td>
<td>A</td>
<td>AB</td>
</tr>
<tr>
<td>Mid May</td>
<td>AB</td>
<td>A</td>
</tr>
<tr>
<td>Late May</td>
<td>AB</td>
<td>a</td>
</tr>
<tr>
<td>Early June</td>
<td>b</td>
<td>ab</td>
</tr>
<tr>
<td>Mid June</td>
<td>B</td>
<td>ab</td>
</tr>
<tr>
<td>Late June</td>
<td>B</td>
<td>B</td>
</tr>
</tbody>
</table>

Seeding Date
Carrot Weevil Causing Carrot Death

- Currently unreported in scientific literature
- Appears early CW attacks results in carrot death
- Possibility for larvae to attack multiple carrots
Carrot Weevil Mortality (%)

- Using 1/9th scale Potter spray tower, groups of 10 CW

- Compared laboratory strain to field strain of both genders

- 7-fold decrease in mortality at 2x field rate

Carrot Weevil Sex and Phosmet Rate

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>F</th>
<th>M</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1x RR</td>
<td>100</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2x RR</td>
<td>0</td>
<td>0</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

HM and QC bars represent experimental data.
Imidan Tolerance – Field Trials

- Large plots (25x14 m or 15x14 m) used to assess IPM Program

- According to recommendations, IPM plots received 1 phosmet spray

- No significant differences under regular CW pressure
Partial Second Generation

- Two 1.5 m row sections sampled in late July (2016) or early August (2015) and mid October (both years)
2016 Degree Day Accumulation

- **DD Accumulation**
- **Oviposition Begins**
- **90% Oviposition**
- **Emerging CW Adults**
Carrot Bait Stations – Oviposition Pits

Oviposition Pits/CRS/Day

- 2017
- 2016
- Action Threshold

15-May 15-Jun 15-Jul 15-Aug
Improvements Needed

• Monitoring methods and thresholds require more research

• CW biology information lacking, degree day model needs revision

• Chemical control requires more rotation, new insecticide options
Laboratory Control Studies

- Groups of 10 adult CW from laboratory strain
- Insecticides applied with a 1/9th scale Potter spray tower
Carrot Weevil Control

- Four 5 m rows with 5 reps/trt
- Foliar applications on June 23, July 7, 2016, 11 August at highest RR
Conclusions

• Combination of issues demand a revision of the CW IPM program in southern Ontario

• Improving monitoring can allow for better predicted CW pressure/thresholds, allow for quantification of second generation

• Cyantraniliprole (Exirel) and novaluron (Rimon 10 EC) provided the best control in 2016
Onion Insect Pests

• Primary Pests
  – Onion Maggot
  – Onion Thrips

• Secondary Pests
  – Cutworms

• Occasional Pests
  – Leek Moth
  – Leafminers
Onion Diseases

- Stemphylium leaf blight
- Onion downy mildew
- Onion white rot
- Botrytis leaf blight
- Purple blotch
- Onion smut
- Pink root
- Bacterial diseases
- Iris yellow spot virus
- Aster yellows
Stemphylium leaf blight

- First found in the HM in 2009
- Very difficult to control
- Often starts as a tipburn
- Long lesion on inside of leaf
- Brown/olive coloured lesions
- Rest of the leaf yellows and dies
Stemphylium Research Summary

• Fungicide efficacy
• Fungicide spray timing
  – Disease forecasting models
• Cultivar susceptibility
  – Differences but all susceptible
• The role of stress in susceptibility
  – Surfactants
  – Herbicides
• Overwintering structures
Onion Downy Mildew

- Can wipe out a field in weeks
- Takes 10 days from infection until sporulation

- Forecast with DOWNCAST
  - Predicts Sporulation Infection Periods (SIP)
## 2017 Weather Summary

<table>
<thead>
<tr>
<th>Month</th>
<th>Temperature (°C)</th>
<th>Rainfall (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>13.8</td>
<td>12.1</td>
</tr>
<tr>
<td>June</td>
<td>18.7</td>
<td>18.3</td>
</tr>
<tr>
<td>July</td>
<td>22.0</td>
<td>20.7</td>
</tr>
<tr>
<td>Aug</td>
<td>22.6</td>
<td>19.1</td>
</tr>
<tr>
<td>Sep</td>
<td>17.4</td>
<td>17.3</td>
</tr>
<tr>
<td>Treatment</td>
<td>Active Ingredient</td>
<td>Rate/ha</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>----------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>CUEVA</td>
<td>copper octanoate</td>
<td>2 %</td>
</tr>
<tr>
<td>ORONDIS ULTRA + LI700</td>
<td>oxathiapiproline + manpropamid</td>
<td>350 mL +0.2%v/v</td>
</tr>
<tr>
<td>REASON</td>
<td>fenamindone</td>
<td></td>
</tr>
<tr>
<td>RIDOMIL or ALIETTE</td>
<td>mefenoxam or fosetyl-al</td>
<td>2.5/2.8 kg</td>
</tr>
<tr>
<td>REVUS</td>
<td>manpropamid</td>
<td></td>
</tr>
<tr>
<td>DITHANE</td>
<td>mancozeb</td>
<td>3.25 kg</td>
</tr>
<tr>
<td>ZAMPRO + SYLGARD</td>
<td>ametoctradin + dimethomorph</td>
<td>1.0 L + 0.25 v/v</td>
</tr>
</tbody>
</table>
Downy Mildew Trial Results 2017

Lesions per plant

- ORONDIS
- DITHANE
- ZAMPRO
- RIDOMIL/ALETTE
- REASON
- REVUS
- CUEVA
- Untreated Check

The bars with the same letter indicate no significant difference in the number of lesions per plant.
Downy Mildew Trial Results 2017

- **ORONDIS**
- **DITHANE**
- **ZAMPRO**
- **RIDOMIL/ALIETTE**
- **REASON**
- **REVUS**
- **CUEVA**
- Untreated Check

T/ha
UNTREATED

ZAMPRO + Syl
Onion Downy Mildew

• Fungicides most effective when applied before infection takes place,
• DOWNCAST forecasting and spore trapping worked well in 2014-2016 but not in 2017.
  – Underestimated the risk in 2017
• Zampro, Orondis look very promising to rotate along with Ridomil MZ/Aliette
• Dithane providing a surprising amount of control on its own
Questions?