Best Practices for Managing Wheat Midge and Wireworm

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Extension Entomologist

NDSU Extension Service
Crop Damage from Wheat Midge

- Estimate losses of $3 million per year without IPM
- Lower yields
- Reduced grain quality
- Vectors *Fusarium* head blight (scab)

Saskatoon Research Centre, Canada
Life Cycle of Orange Wheat Blossom Midge
*Sitodiplosis mosellana*

Larva - drop from heads after rain or heavy dew
Estimated area (km²) where numbers of unparasitized larvae of wheat midge were above 500/m² (economic level)

11 years
2015 Wheat Midge Larval Survey
North Dakota

Low Risk:
Burke, Divide, Renville, Sheridan, Ward

0 – 429 midge larvae / m²
Average = 25 midge larvae / m²

Midge larvae / sq m
0 1-200 201-500 501-800 801-1200 >1200 Not surveyed

NORTH DAKOTA WHEAT COMMISSION
NDSU EXTENSION SERVICE
2016 Wheat Midge Larval Survey
North Dakota

High Risk:
Burke, Divide

0 – 2,071 midge larvae / m²
Average = 42 midge larvae / m²

Midge larvae / sq m

0 1-200 201-500 501-800 801-1200 >1200 Not surveyed
Difficult to tell visually if wheat midge is present in field during day or if field is damaged by wheat midge.
Monitoring for Wheat Midge in Field

- Regular field scouting on multiple nights in succession
- Inspect wheat heads after dusk - after 9 pm
- Temperatures must be above 60°F for midge to be active
- Wind speeds greater than 5 mph limit activity of midge
Identification

Lauxanid fly versus Wheat midge fly

Saskatoon Research Centre, Canada
Degree Days as a Tool for Wheat Midge Scouting

<table>
<thead>
<tr>
<th>DD Biological Event</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>450</td>
<td>Wheat midge breaks larval cocoons and move close to soil surface to form pupal cocoons.</td>
</tr>
<tr>
<td>1,300</td>
<td>10 percent of females will have emerged.</td>
</tr>
<tr>
<td>1,475</td>
<td>About 50 percent of females will have emerged.</td>
</tr>
<tr>
<td>1,600</td>
<td>About 90 percent of females will have emerged.</td>
</tr>
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</table>

Threshold Temperature = 40 F
NDAWN – https://ndawn.ndsu.nodak.edu/wheat-growing-degree-days.html
Wheat Midge Pheromone Trap

- Place traps in field during heading (at wheat head height)
- Three traps per 160 acres
  - 75 ft in field and at least 300 ft apart
- Examine every 1-2 days
- Threshold = >10 captured males per trap indicate NEED TO SCOUT FIELDS
- Available for $7.20/ trap unit (trap + pheromone)
- Great Lake IPM (source of insect trap supplies)
- http://www.greatlakesipm.com/

NDSU EXTENSION SERVICE
IPM - Chemical Control

- Economic Threshold =

  Hard Red Spring Wheat = one or more wheat midge for every four or five heads
  Durum Wheat = one or more wheat midge for every seven or eight wheat heads

- Evening application
- Okay to tank-mix with fungicides for scab
Field scouting should begin at heading and continue up to the mid-flower stage. Use wheat midge degree day model, planting date, larval soil survey map.

**Chlorpyrifos:** Lorsban 4E-SG* & generics

**Chlorpyrifos + lambda-cyhalothrin:** Cobalt Advanced*

**Chlorantraniliprole + lambda-cyhalothrin:** Besiege*

**Lambda-cyhalothrin:** Warrior* & generics

**Gamma-cyhalothrin:** Delcare*

* restricted use insecticide
Chemical Control Timing

1. If 30% of wheat is heading
   a. Wait up to 4 days, then treat

2. If 70% of wheat is at heading to early flowering
   a. Treat immediately

3. If 30% to 60% of wheat heads are at flowering
   a. Spray immediately, control may be reduced
   b. Treatment is NOT recommended
      a. Larvae protected inside glumes
      b. No longer attractive to adult wheat midge for egg laying
      c. Kill parasitoid wasp

Ransom, NDSU Extension Service
• *Macroglenes penetrans*  
  (Hymenoptera: Pteromalidae)  
  • 1-2 mm long and black metallic parasitoid wasp  
  • Egg-larval parasitoid of wheat midge
Highest Parasitism rate in Bottineau, Burke and McLean counties
Average = 4.8% parasitism rate
89% of samples had 0% parasitism
IPM – Use of Resistant Wheat Varieties Against Wheat Midge

• Host Plant Resistance
  – Discovered in 1996
  – Release in 2010
  – Single gene resistance - Sm1 gene
  – High levels of phenolic acid cause the midge larvae to stop feeding and larvae starve to death (antibiosis resistance)
IPM – Use of Resistant Wheat Varieties Against Wheat Midge

• “Refuge in the Bag” to prevent development of resistance
  – No other known source of midge tolerance
  – 90% midge tolerant variety and 10% susceptible variety
  – Canada Varieties – AC® Unity, AC® Goodeve VB, AC® Glencross VB, AC® Fieldstar VB, AC® Shaw VB, AC® Utmost VB, AC® Conquer VB, AC® Vesper VB
  – Montana Variety – Egan (released in 2014)

• Midge Tolerant Wheat Stewardship Agreement
RIB...Refuge In Bag

Non-resistance wheat
Egan Wheat Variety

- MSU Spring wheat breeder
  - Dr. Luther Talbert
- Semi-dwarf
- Resistance to strip rust
- High grain protein
- Available at Montana Seed Program for production and certification
  - Certified blend
  - Lake Seed, Inc. in Ronan, MT. (http://lakeseedinc.com)
Stripe Rust Incidence

Source: Bob Stougaard, Montana State University
Northwestern Agricultural Research Center
Off Station, 2016

### Protein (%)

- Mott
- MT 1316
- MT 1401
- MT 1348
- Reeder
- Alum
- SY Tyra
- Choteau
- Oenal
- Egan

### Test Weight (lb/bu)

- Oneal
- WB9879CLP
- Duclair
- Corbin
- SY Soren
- MT 1348
- Egan
- Mott
- Brennan
- Fortuna

Source: Bob Stougaard, Montana State University Northwestern Agricultural Research Center
Effect of Sm1 genetic resistance on OWBM, 2012.

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>OWBM no./spk</th>
<th>Yield bu/A</th>
<th>Protein %</th>
<th>TWT lb/bu</th>
<th>FN sec</th>
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</thead>
<tbody>
<tr>
<td>REEDER</td>
<td>46</td>
<td>34</td>
<td>16.7</td>
<td>59</td>
<td>180</td>
</tr>
<tr>
<td>HANK</td>
<td>102</td>
<td>15</td>
<td>16.1</td>
<td>52</td>
<td>193</td>
</tr>
<tr>
<td>EGAN</td>
<td>0</td>
<td>52</td>
<td>17.8</td>
<td>56</td>
<td>326</td>
</tr>
</tbody>
</table>

Source: Bob Stougaard, Montana State University Northwestern Agricultural Research Center
Spring Wheat Yield Comparison, 2016

Source: Bob Stougaard, Montana State University
Northwestern Agricultural Research Center
Wireworms

- Family Elateridae (click beetles)
- Several species in our area
- 3 to 5 year life cycle
- Adults and larvae overwinter in soil from 9” to 24” deep
Wireworms Life Cycle

- Become active and move towards surface when soil temperature reaches 50F
- Larvae feed in top 6” of soil on roots, germinating seeds and young seedlings
Wireworms

- Plant losses due to wireworm feeding are increasing!
- Stand loss – blank spots or ‘skips’ in the rows
- Make sure the problem is actually caused by wireworms
Wireworm Root Injury

Untreated check
Damaged by wireworm
Rating 10

Insecticide treated
Not damaged by wireworm
Rating 1

Photo by J. Knodel
Wireworms

• Difficult to survey and to predict whether wireworms will be a problem
• Wide host range, but grasses are preferred
• Crops most at risk following small grains, corn or CRP/non-crop
If more than one wireworm per trap, use soil insecticide or insecticide seed treatment!

Insecticide treated seed

No soil insecticides registered in wheat or barley

T-band system
Applications of Mustang Max in the furrow

Contact only Insecticide, keeping the band around the growing seedling free of wireworm and cutworm. It’s a “zone of protection”.

Nozzle for T-band

Mustang Max at 4.0 oz/A at 3-5 gallons/acre

3-7” T-Band of Mustang Max

Seed Furrow

Sunflower seed
Wireworm ‘Control’

• Insecticide use is a preventive strategy – there are no rescue treatment options.

• Insecticide seed treatments and in-furrow pyrethroid applications provide seedling protection – they do not provide significant wireworm mortality.
  – Neonicotinoid seed treatments (such as thiamethoxam) cause ‘temporary’ morbidity.
  – Pyrethroids (such as bifenthrin) are repellents and nonlethal.
In-furrow Pyrethroid and Neonic Seed Treatment Efficacy Trial in Sunflowers

- Cruiser 5FS at 0.25 mg ai/seed
- Cruiser 5FS at 0.375 mg ai/seed
- Mustang Maxx in-furrow at 4 fl oz/acre
- Capture LFR in-furrow at 8 fl oz/acre
- Ethos XB in-furrow at 8 fl oz/acre
- Untreated Check
- All seed treated with Apron XL
In-furrow Pyrethroid and Neonic Seed Treatment Efficacy Trial

<table>
<thead>
<tr>
<th>Treatment</th>
<th>V2</th>
<th>V8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethos XB @ 8 fl oz/acre</td>
<td>20,473 a</td>
<td></td>
</tr>
<tr>
<td>Capture LFR @ 8 fl oz/acre</td>
<td>20,299 a</td>
<td></td>
</tr>
<tr>
<td>Mustang Maxx @ 4 fl oz/acre</td>
<td>19,863 a</td>
<td></td>
</tr>
<tr>
<td>Cruiser 5FS @ 0.375 mg ai/seed</td>
<td>19,428 a</td>
<td></td>
</tr>
<tr>
<td>Cruiser 5FS @ 0.25 mg ai/seed</td>
<td>18,469 a</td>
<td></td>
</tr>
<tr>
<td>Untreated Check</td>
<td>16,466 ab</td>
<td></td>
</tr>
</tbody>
</table>

Note: Values followed by the same letter are not significantly different at the 0.05 level.
Wireworm Stand Loss

Untreated Check

Mustang Maxx

Photo by P. Beauzay
In-furrow Pyrethroid and Neonic Seed Treatment Efficacy Trial

Treatment Means for Wireworm Root Injury Rating at Mohall, 2016

- Cruiser 5FS @ 0.375 mg ai/seed: 1.36c
- Cruiser 5FS @ 0.25 mg ai/seed: 1.48bc
- Mustang Maxx @ 4 fl oz/acre: 1.54b
- Capture LFR @ 8 fl oz/acre: 1.6 b
- Ethos XB @ 8 fl oz/acre: 1.64b
- Untreated Check: 2.38a
Wireworm Management

• Thiamethoxam seed treatment and in-furrow pyrethroid applications provided acceptable protection
• Consider your crop rotation and know your fields
• Weed management
• Adjust seeding rate +10% to compensate for wireworm stand loss
Free to subscribers with email but MUST SIGN-UP ON WEBSITE!!!

–http://www.ag.ndsu.edu/cpr/