
Entomological Society of America Annual Meeting
November 11-14, 2012. Knoxville, TN.
Introduction

- Background on the WSU Wireworm Project initiated in 2008
- Wireworm on-farm tests (OFT) methods and results
- Wireworm spp. In wheat across Washington State
- Small plot wireworm test methods and results
Thiamethoxam Seed Treatment On-Farm Test

Rep 1

Planted: 4/28/2008
Picture: 6/16/ 2008

NTF 10 39 0 20

WSU WIREWORM PROJECT
Background on WSU Wireworm Project

- Misdiagnosis of wireworm damage was very common
  - Poor weed control
  - Soil born diseases
  - Poor seed quality (did it actually get treated?)
  - It can’t be wireworm damage because I have the high insecticide rate
OFT objectives

- 2 objectives
  - Improve grain yield and profitability
  - Reduce wireworm populations in the soil
OFT methods

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<th>2008</th>
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<tr>
<td>Thiamethoxam Seed Treatment OFT (g ai/100 kg)</td>
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- **Location:** Mark Sheffels (Davenport, WA)
- **Crop:** spring wheat seeded at 67 kg/ha
- **Design:** RCBD w 4 replications
- **Plot size:** 10 m x 305 m
- **Note:** treatments were sequential each year
OFT methods

<table>
<thead>
<tr>
<th>Thiamethoxam Seed Treatment OFT (g ai/100 kg)</th>
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- **Location**: Seth Coffman’s (Wilbur, WA)
- **Crop**: spring wheat seeded at 67 kg/ha
- **Design**: RCBD w 4 replications
- **Plot size**: 11 m x 305 m
- **Note**: treatments were sequential each year
High rate of Imidacloprid Seed Treatment OFT

- **Location:** Rob Dewald’s in 2008 (Davenport, WA)
- **Treatment:**
  - 0 g ai Imidacloprid/100 kg
  - 78 g ai Imidacloprid/100 kg
- **Crop:** spring wheat seeded at 67 kg/ha
- **Design:** RCBD w 4 reps
- **Plot size:** 13 m x 305 m

- **Location:** Mike Claussen’s in 2010 (Rosalia, WA)
- **Treatment:**
  - 0 g ai Imidacloprid/100 kg
  - 78 g ai Imidacloprid/100 kg
- **Crop:** spring wheat seeded at 112 kg/ha
- **Design:** RCBD w 6 reps
- **Plot size:** 11 m x 153 m
OFT methods

- Wireworm Population Data Collection
  - Modified Wireworm Solar Bait Traps were used
    - Wheat-corn mixture in nylon stockings
  - The timing was in the spring prior to seeding each year.
  - 4 traps/plot on a symmetrical grid system
No significant difference in population among treatments…uniform!

|     | 0 |   |   | 4 |   | 3 |   | 7 |   | 7 |   | 6 |   | 5 |   | 1 |   | 4 |   | 14 | 0 |   | 1 |   | 1 |   | 0 |   | 6 |   | 0 |   | 4 |   | 1 |   | 11 | 1 |   | 4 |   | 4 |   | 6 |   |
|     | 7 | 12| 23| 16| 17| 6 | 5 | 19| 2 | 3 | 4 | 1 | 8 | 9 | 6 | 12 | 14 | 17 | 20 | 29 | 34 | 11| 39| 16| 25| 30| 24| 29| 12| 22| 19| 4 | 25| 31| 13| 23| 31| 19| 0 | 14| 8 | |
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OFT Results

Sheffels (2008-11) and Coffman (2009-12) Yield Data

† Means separated by different letters are significant (Tukeys $P < 0.05$)
Trt x Location interaction is significant $P < 0.001$
OFT Results

Sheffels (2009-11) and Coffman (2010-12) Wireworm Data

† Means separated by different letters are significant (Tukeys $P < 0.05$)
Trt x Location interaction is significant $P < 0.001$
Hadromorphus glauca (Germar) – 11W002, WA, Klickitat Co., Bickleton, Tex Brown Farm, 2-May-2011, coll. K. Pike, ex winter plant, extremely abundant, 14/ft sampled

Limonius californicus (Mannerheim) – 11W003, WA Lincoln Co., nr Davenport, Sheffels Farm, 25-Apr-2011, coll. A. Esser, ex wheat stubble

Limonius infuscatus Motschulsky – 11W004, WA Lincoln Co., nr Wilbur, Coffman Farm, 28-Apr-2011, coll. A. Esser, ex wheat stubble

Limonius californicus (Mannerheim) – 11W005, WA Whitman Co., nr Rosalia, 28-Apr-2011, coll. A. Esser, ex wheat stubble

Limonius californicus (Mannerheim) – 11W006, WA Lincoln Co., Davenport, Dewald Farm, 4-May-2011, coll. A. Esser, ex wheat stubble

Limonius californicus (Mannerheim) – 11W007, WA Lincoln Co., Davenport, WSU-Wilke Farm, 4-May-2011, coll. A. Esser, ex wheat stubble
OFT Results

Sheffels (2009-11) and Coffman (2010-12) Wireworm Data

Cropping System Treatments

† Means separated by different letters are significant (Tukeys $P < 0.05$)
Trt x Year interactions is N.S.
Trt x Location interaction is N.S.
Stand establishment without and with 78 g ai/100 kg imidacloprid seed applied insecticide

0 g ai/100 kg

78 g ai/100 kg
OFT Results

Prior to harvest without and with 78 g ai/100 kg imidacloprid seed applied insecticide

- 78 g ai/100 kg
- 0 g ai/100 kg
- 78 g ai/100 kg
OFT Results

Wireworm population without and with imidacloprid seed applied insecticide

0 g ai/100 kg
78 g ai/100 kg

† Means separated by different letters are significant (Tukeys $P < 0.05$)
OFT Conclusions

- Thiamethoxam seed applied insecticide significantly increased grain yield at Sheffels’ and decreased wireworm populations at Coffman’s vs. no application
  - Differences in response by location maybe because of wireworm species. Sheffels’ has Limonius californicus (Mannerheim) and Coffman’s has *Limonius infuscatus* Motschulsky

- No-till fallow winter wheat cropping system had reduced wireworm populations 53% compared to continuous cropped spring wheat production

- A high rate of imidacloprid seed applied insecticide significantly increased grain yield (data not presented) and decreased wireworm populations between 41 and 78%
Objectives

- Determine species of wireworms present
- Determine ecology and biology of species
- Examine insecticide-based management

Wireworm Damage, Antelope Flats, ID
Determining species present and their distribution

- Bait ball trapping
- Locations
- DNA profiling (in part) - Montana State University
Wireworm spp. in wheat -- WA

- **Limonius infuscatus**
- **Limonius californicus**
- **Limonius canus**
- **Agriotes obscurus***
- **Aeolus mellillus**
- **Ctenicera pruinina**
- **Hadromorphus glauca**
- **Hypolithus bicolor**
- **Melanotus oregonensis**

*Newly discovered in eastern WA near Pullman*
Limonius spp. (predominate, >14”)

Limonius spp. (predominate, Irrigated lands)

Hadromorphus glauca (predominate <12”)

Map of Canada and British Columbia showing geographical distribution of Limonius spp. and Hadromorphus glauca.
Management methods

- Field trials of insecticides (Multi-site, multi-yr studies)
- Approved Neonicotinoids – label rate performance studies
  - Protected wheat (from wireworm damage) vs. unprotected
    - High pest population presence
    - Low pest population presence
- Value ($) with protection
Neonic x rate trials --
New generation, new chemistry, new combination trials

Variety trials (S.Guy), var. ‘Louise’ @ 0 & 80 g ai/100kg

Trial Locations
Bickleton, WA – 13-Apr-2012
Wireworm Trial, Planting into no-till
Wireworm Approved Seed-Treatments

Label rates evaluated
(g ai / 100kg)

- Clothianidin – 10, 30, 50
- Imidacloprid – 10, 30, 50
- Thiamethoxam – 10, 30, 50

www.lincoln-adams.wsu.edu/agriculture
Effects of insecticides (Wilke Farm, high wireworm feeding) - 2012

- **Clothianidin**
- **Imidacloprid**
- **Thiamethoxam**
- **Check**

Yield (kg/ha)

† Means separated by different letters are significant (Tukeys $P < 0.05$)
Effects of insecticides (Colfax, low wireworm feeding) - 2012

† Means separated by different letters are significant (Tukeys $P < 0.05$)
Protected wheat (from wireworm damage) vs. unprotected

High pest population presence
Effects of insecticides - 2011-12

Yield (kg/ha)

- Protected
- Unprotected

Insecticides (active Ingredient)

- Low Wireworm Feeding
- High Wireworm Feeding

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Effects of insecticides - 2012

Gross Return ($/ha)

<table>
<thead>
<tr>
<th>Low Wireworm Feeding</th>
<th>High Wireworm Feeding</th>
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<tr>
<td>Protected</td>
<td>a</td>
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<tr>
<td>Unprotected</td>
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Insecticides (active Ingredient)
Conclusions

- First distribution data recorded
- Novel insecticide combinations work
- Protected wheat provides significant savings to growers
Aknowledgments

• Collaborators
  – Arron Carter, WSU Wheat Breeder
  – Stephen Guy, WSU Wheat Variety Testing
  – Kevin Wanner, Montana State University
Thank You

Questions