





Esser, A.D., I. Milosavljevic, K.S. Pike. 2012.

Impact and management of infesting wireworms on spring wheat in Washington State

Entomological Society of America Annual Meeting
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WASHINGTON STATE UNIVERSITY

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 I

Planted: 4/28/2008

Picture: 6/16/ 2008

---------- g ai/100 kg ----------

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

Harvesting OFT

OFT methods

Thiamethoxam Seed Treatment OFT (g ai/100 kg)			
2008	2009	2010	2011
NTF	WW	NTF	WW
0	0	0	0
10	10	10	10
20	20	20	20
39	39	39	39

- 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

Thiamethoxam Seed Treatment OFT (g ai/100 kg)			
2009	2010	2011	2012
NTF	WW	NTF	WW
0	0	0	0
10	10	10	10
20	20	20	20
39	39	39	39

- 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

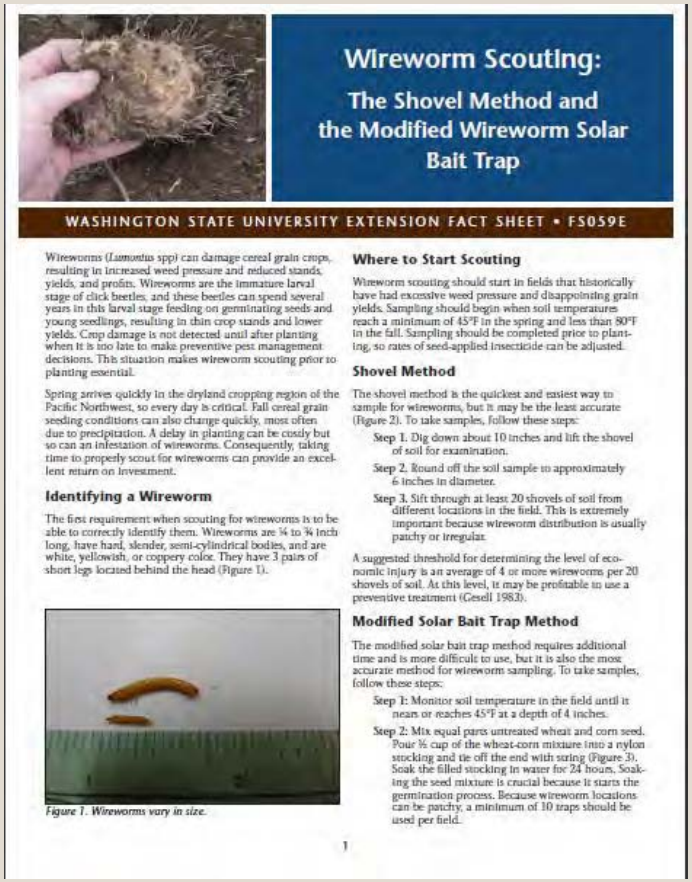
OFT methods

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 Scouting:
The Shovel Method and the Modified Wireworm Solar Bait Trap

WASHINGTON STATE UNIVERSITY EXTENSION FACT SHEET • FS059E

Wireworms (*Lumonius* spp) can damage cereal grain crops, resulting in increased weed pressure and reduced stands, yields, and profits. Wireworms are the immature larval stage of click beetles, and these beetles can spend several years in this larval stage feeding on germinating seeds and young seedlings, resulting in thin crop stands and lower yields. Crop damage is not detected until after planting when it is too late to make preventive pest management decisions. This situation makes wireworm scouting prior to planting essential.

Spring arrives quickly in the dryland cropping region of the Pacific Northwest, so every day is critical. Fall cereal grain seeding conditions can also change quickly, most often due to precipitation. A delay in planting can be costly but so can an infestation of wireworms. Consequently, taking time to properly scout for wireworms can provide an excellent return on investment.

Identifying a Wireworm

The first requirement when scouting for wireworms is to be able to correctly identify them. Wireworms are ¼ to ¾ inch long, have hard, slender, semi-cylindrical bodies, and are white, yellowish, or coppery color. They have 3 pairs of short legs located behind the head (Figure 1).

Figure 1. Wireworms vary in size.

Where to Start Scouting

Wireworm scouting should start in fields that historically have had excessive weed pressure and disappointing grain yields. Sampling should begin when soil temperatures reach a minimum of 45°F in the spring and less than 80°F in the fall. Sampling should be completed prior to planting, so rates of seed-applied insecticide can be adjusted.

Shovel Method

The shovel method is the quickest and easiest way to sample for wireworms, but it may be the least accurate (Figure 2). To take samples, follow these steps:

Step 1. Dig down about 10 inches and lift the shovel of soil for examination.

Step 2. Round off the soil sample to approximately 6 inches in diameter.

Step 3. Sift through at least 20 shovels of soil from different locations in the field. This is extremely important because wireworm distribution is usually patchy or irregular.

A suggested threshold for determining the level of economic injury is an average of 4 or more wireworms per 20 shovels of soil. At this level, it may be profitable to use a preventive treatment (Gesell 1983).

Modified Solar Bait Trap Method

The modified solar bait trap method requires additional time and is more difficult to use, but it is also the most accurate method for wireworm sampling. To take samples, follow these steps:

Step 1: Monitor soil temperature in the field until it nears or reaches 45°F at a depth of 4 inches.

Step 2: Mix equal parts untreated wheat and corn seed. Pour ½ cup of the wheat-corn mixture into a nylon stocking and tie off the end with string (Figure 3). Soak the filled stocking in water for 24 hours. Soaking the seed mixture is crucial because it starts the germination process. Because wireworm locations can be patchy, a minimum of 10 traps should be used per field.

1

- 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

YouTube

WSU WIREWORM PROJECT

No significant difference in population among treatments…uniform!

3	7	7	6	5	1	4	14	0	1	1	0	6	0	4	1	11	1	4	6	**4**
7	12	23	16	17	6	5	19	2	3	4	1	8	9	6	12	14	17	20	29	**11**
34	11	39	16	25	30	24	29	12	22	19	4	25	31	13	23	31	19	0	14	**21**
3	1	0	1	7	1	7	4	4	8	19	10	26	6	2	7	3	11	7	27	**8**
																				11

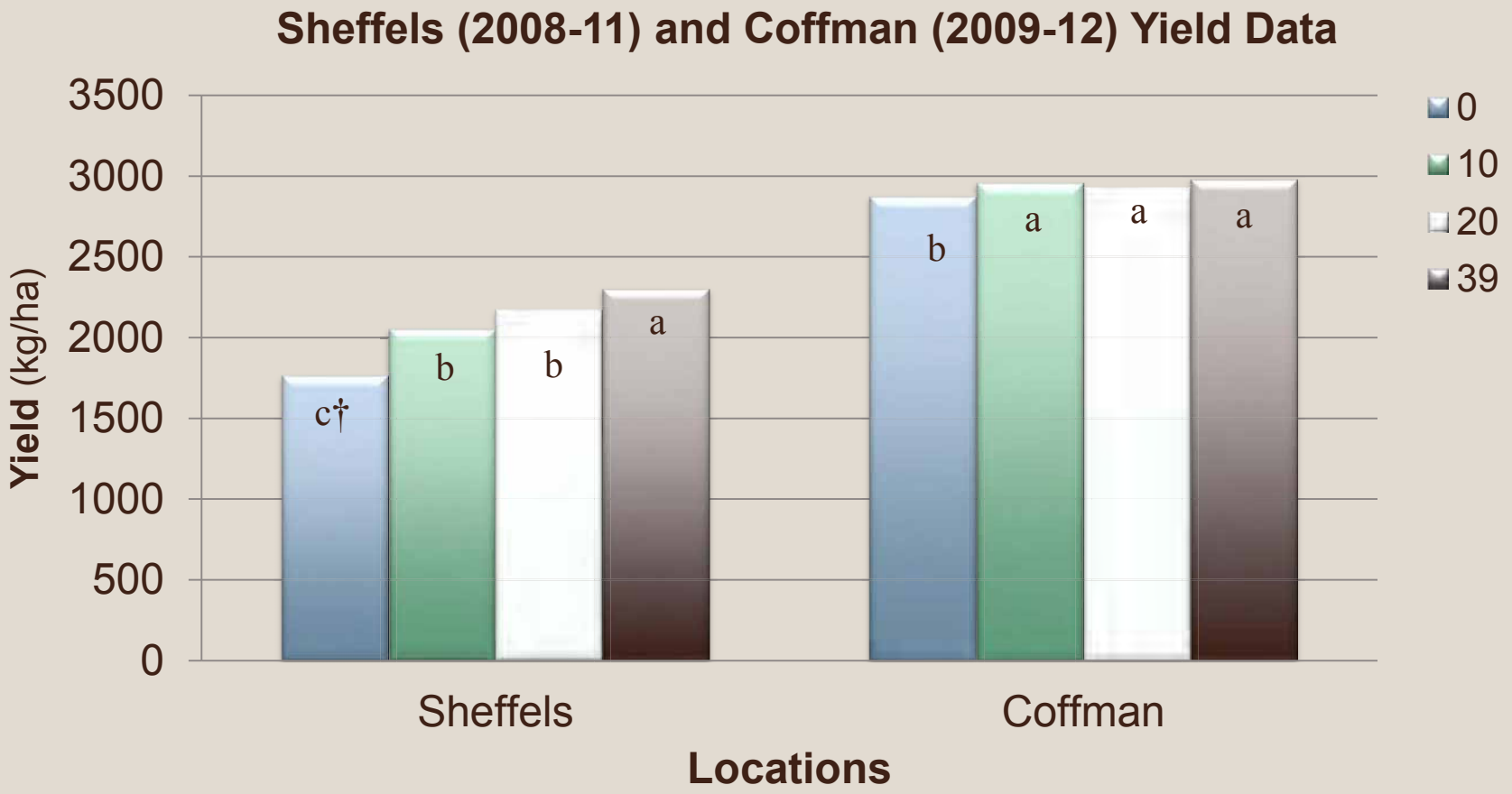
0 - 3

4 - 10

11 - 25

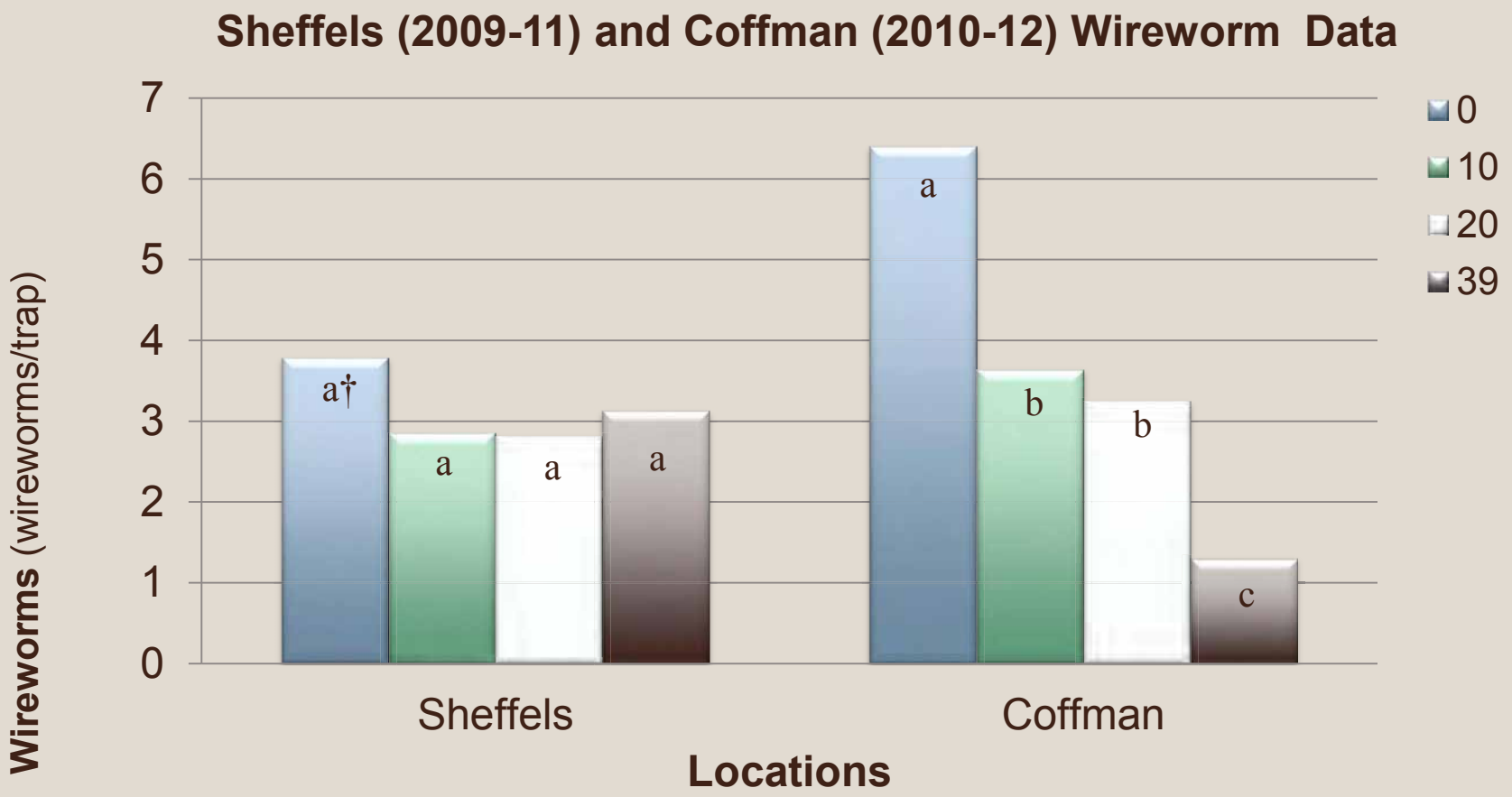
26 - 40

OFT Results



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

OFT Results



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Trt x Location interaction is significant $P < 0.001$

OFT RESULTS

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

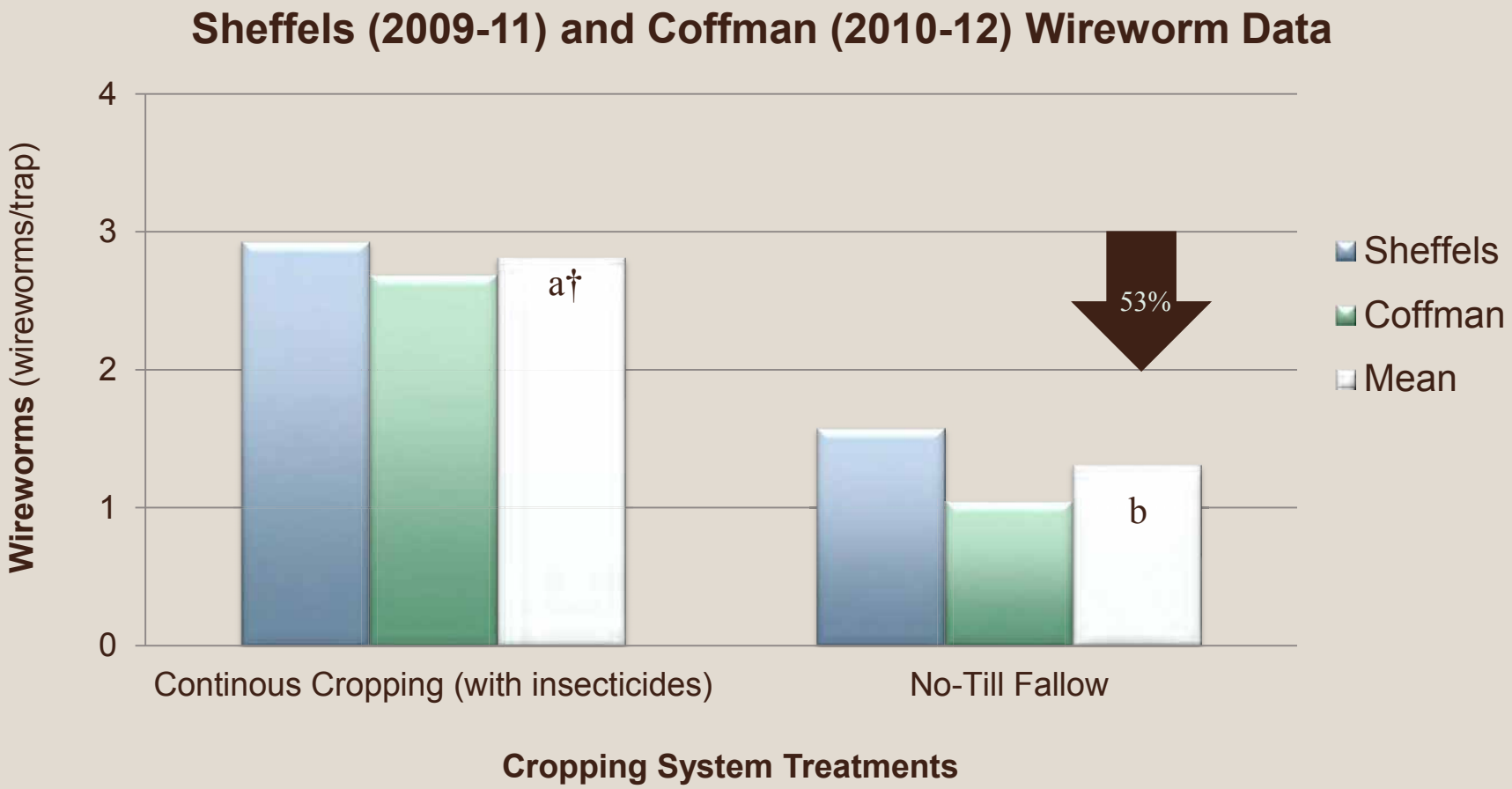
Limonius infuscatus Motschulsky – 11W004, WA Lincoln Co., nr Wilbur, Coffman Farm, 28-Apr-2011, coll. A. Esser, ex wheat stubble

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

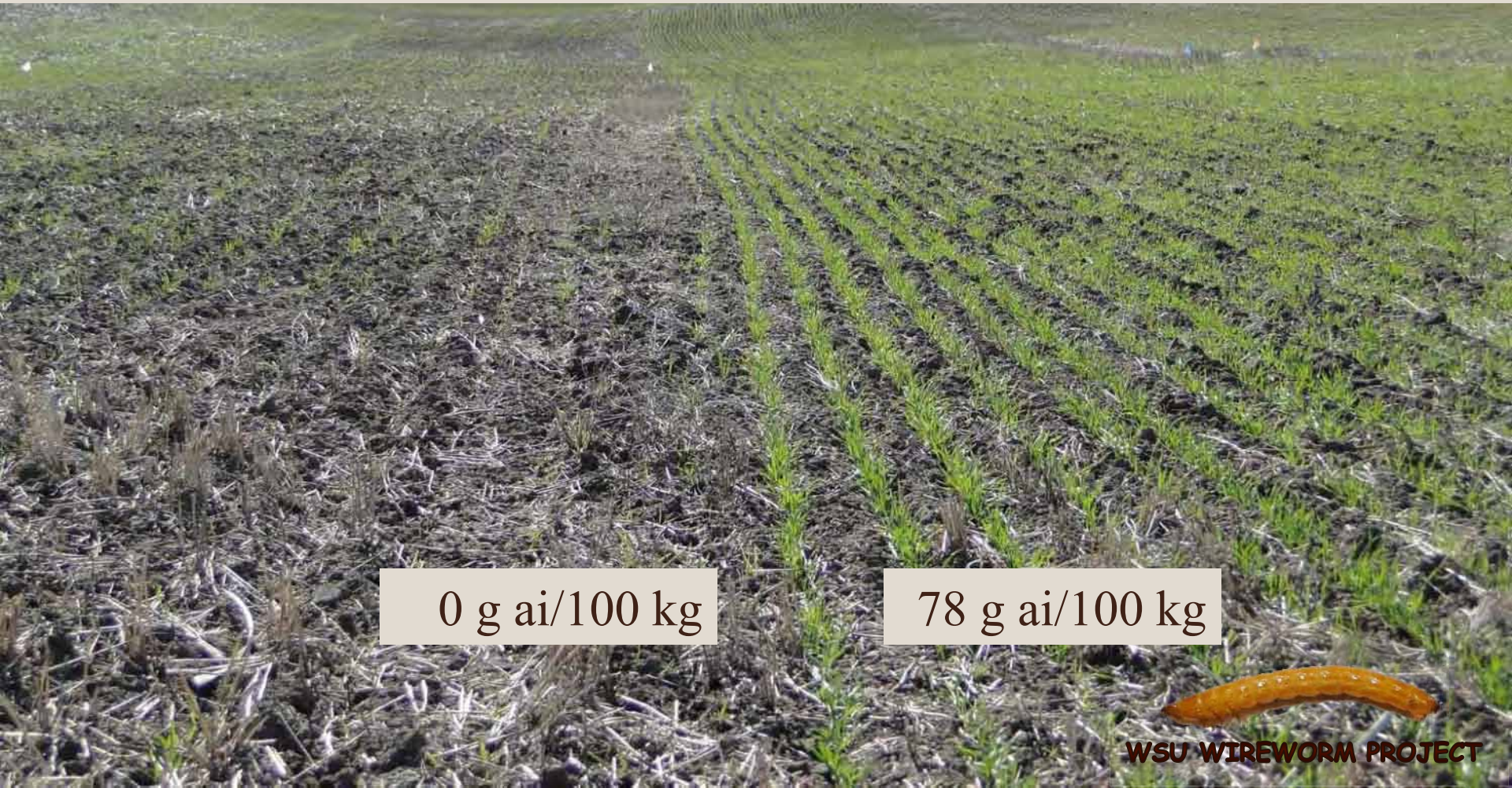


† Means separated by different letters are significant (Tukeys $P < 0.05$)
Trt x Year interactions is N.S.
Trt x Location interaction is N.S.

WSU WIREWORM PROJECT

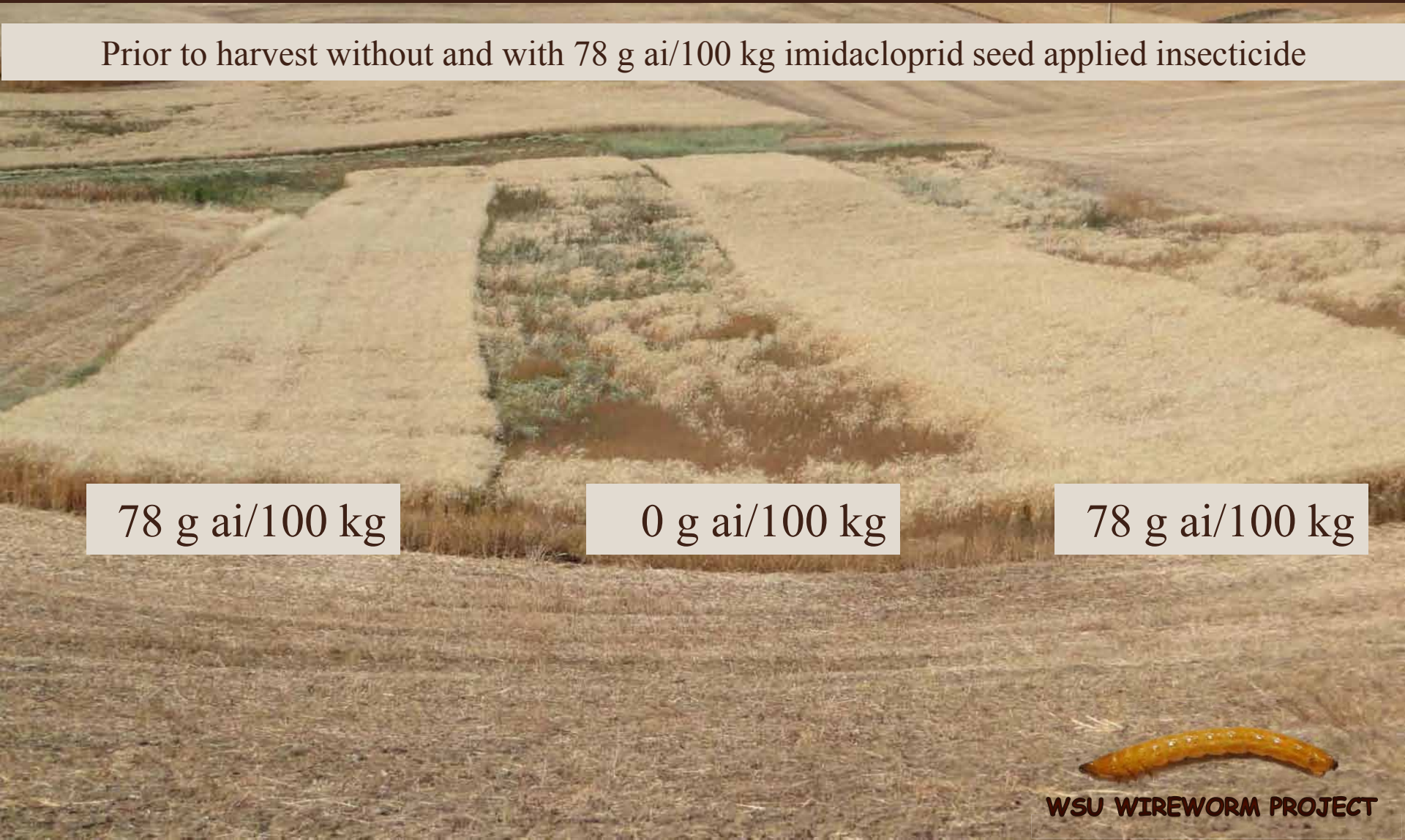
OFT Results

Stand establishment without and with 78 g ai/100 kg imidacloprid seed applied insecticide

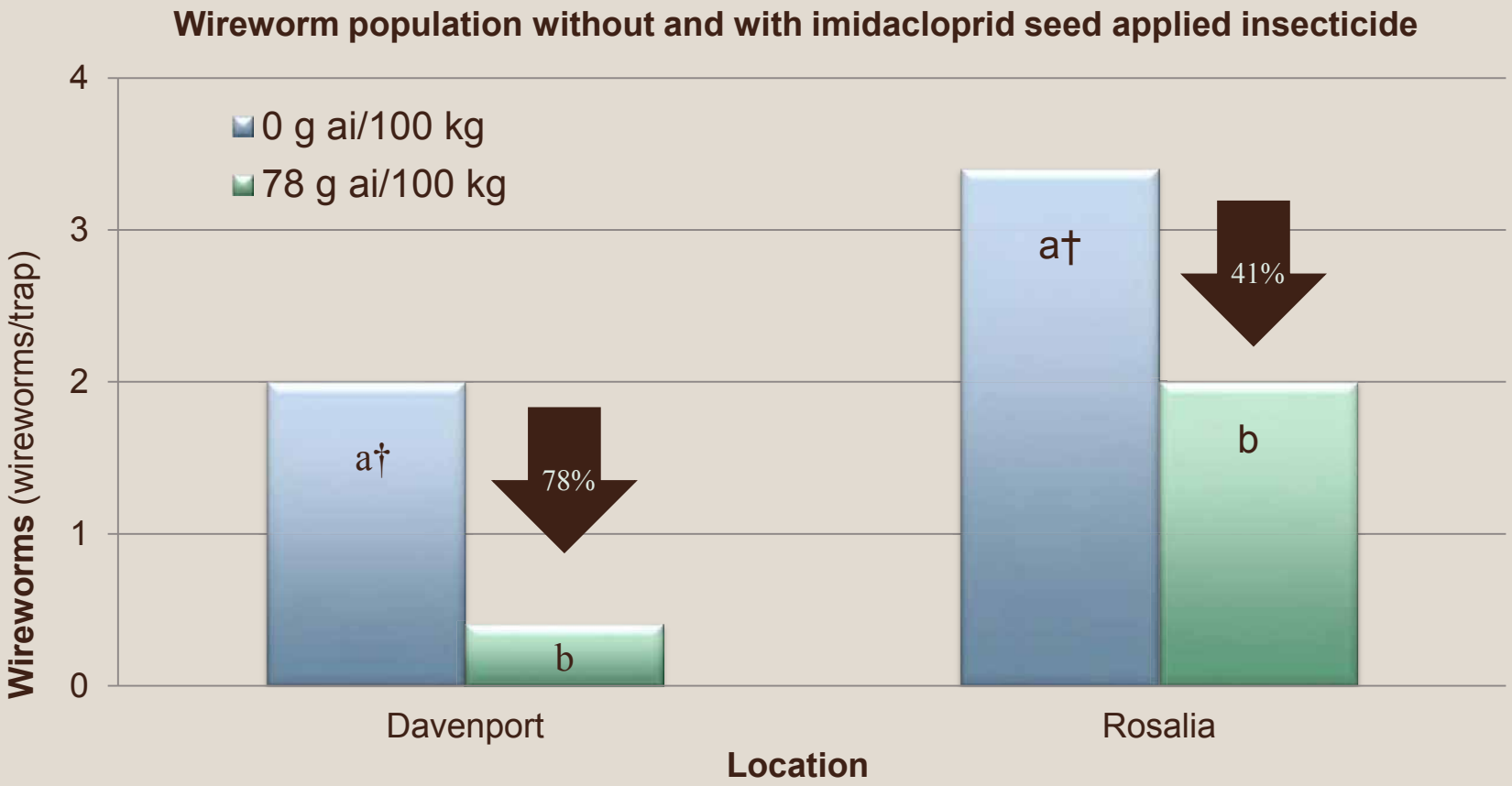


OFT Results

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



OFT Results



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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

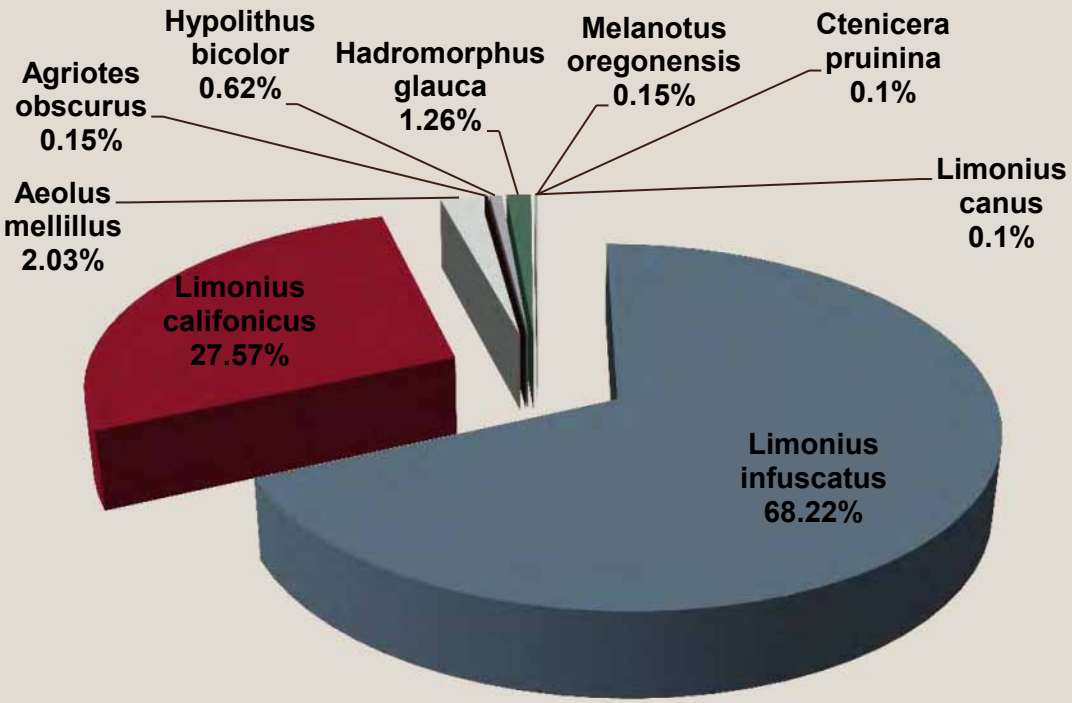
Wireworm Damage, Antelope Flats, ID

Determining species present and their distribtuion

- 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

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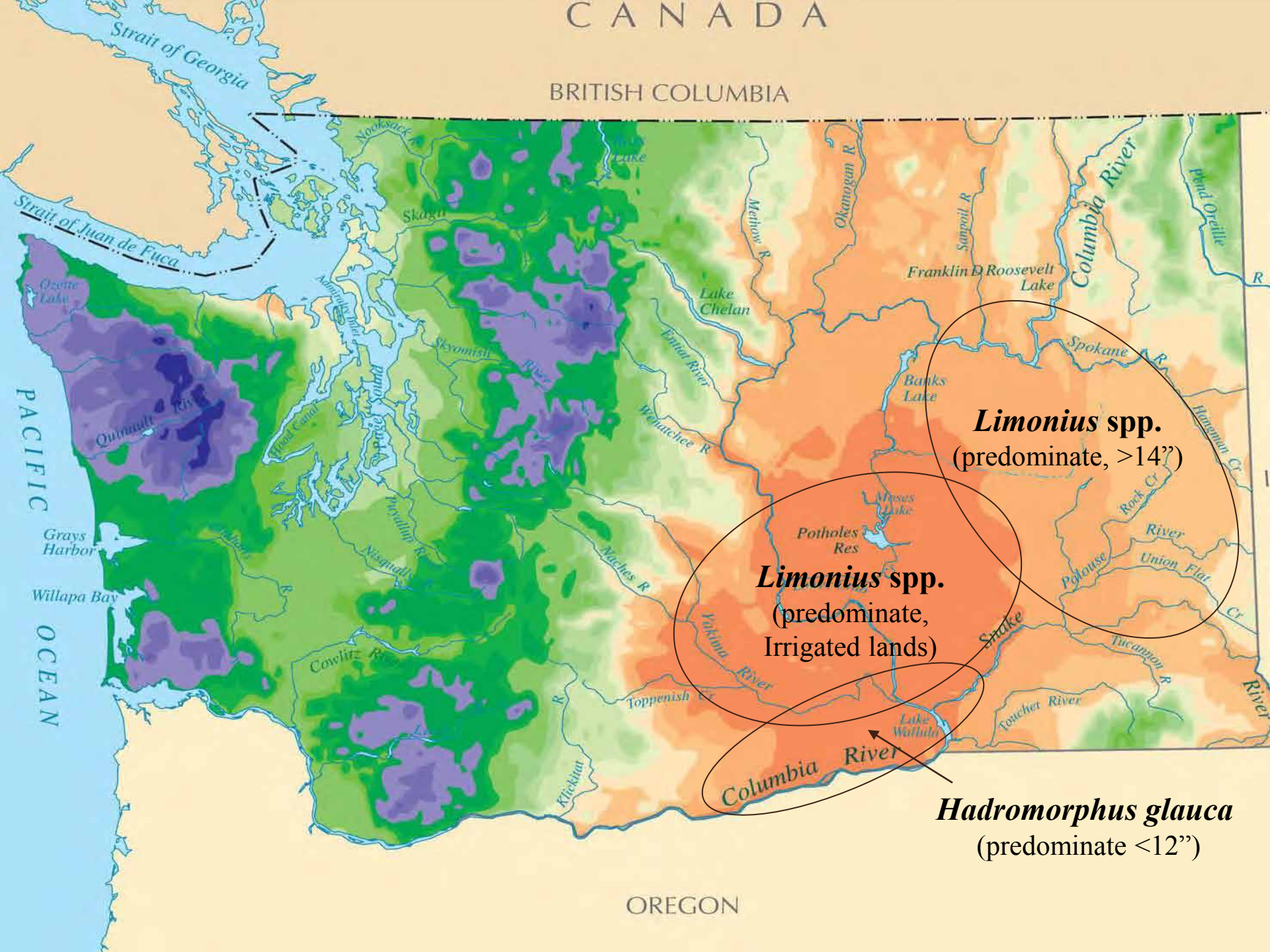


***Limonius* spp.**
(predominate, >14”)

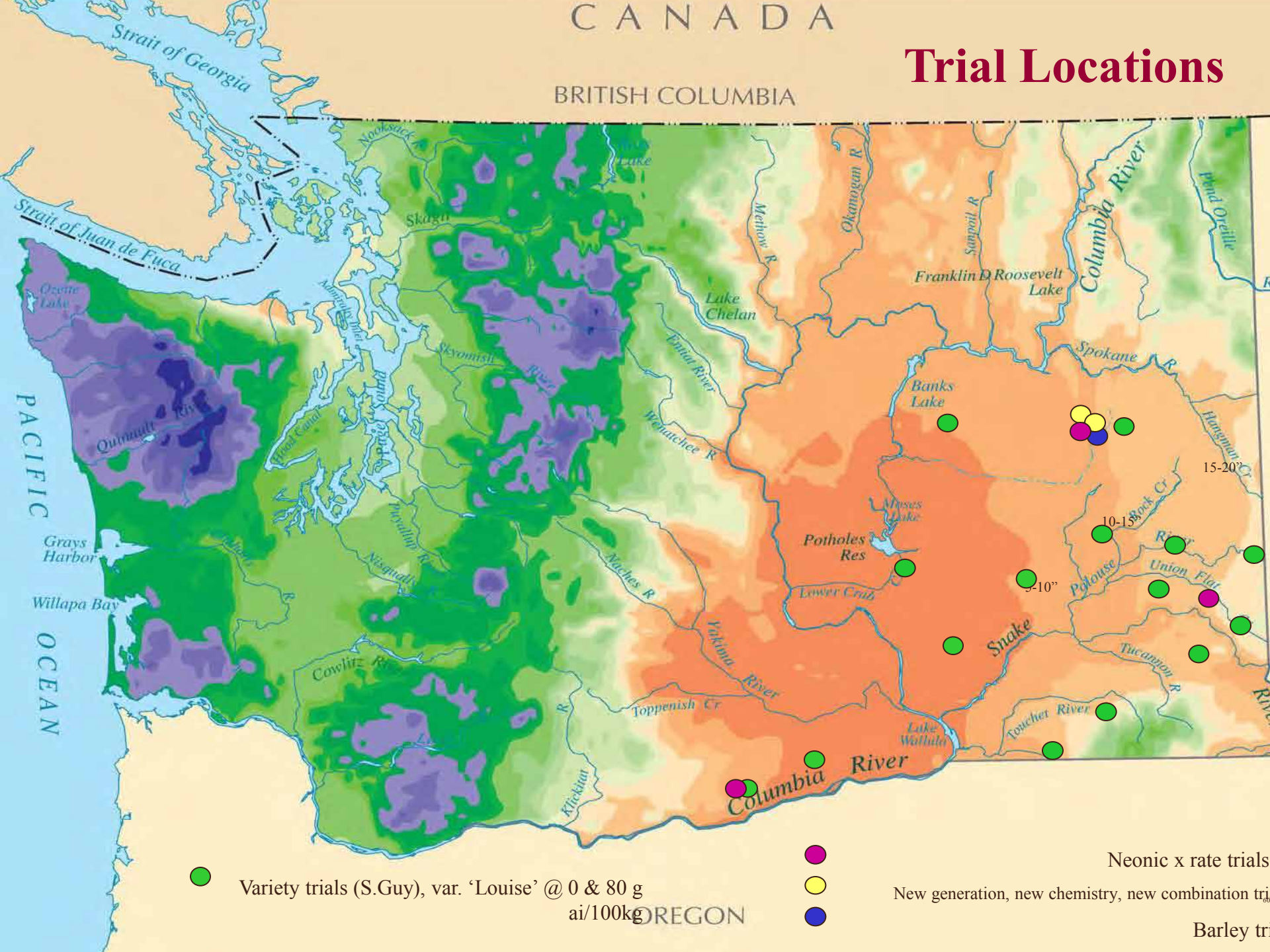
***Limonius* spp.**
(predominate,
Irrigated lands)

Hadromorphus glauca
(predominate <12”)

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

Trial Locations



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

Neonic x rate trials

New generation, new chemistry, new combination tri

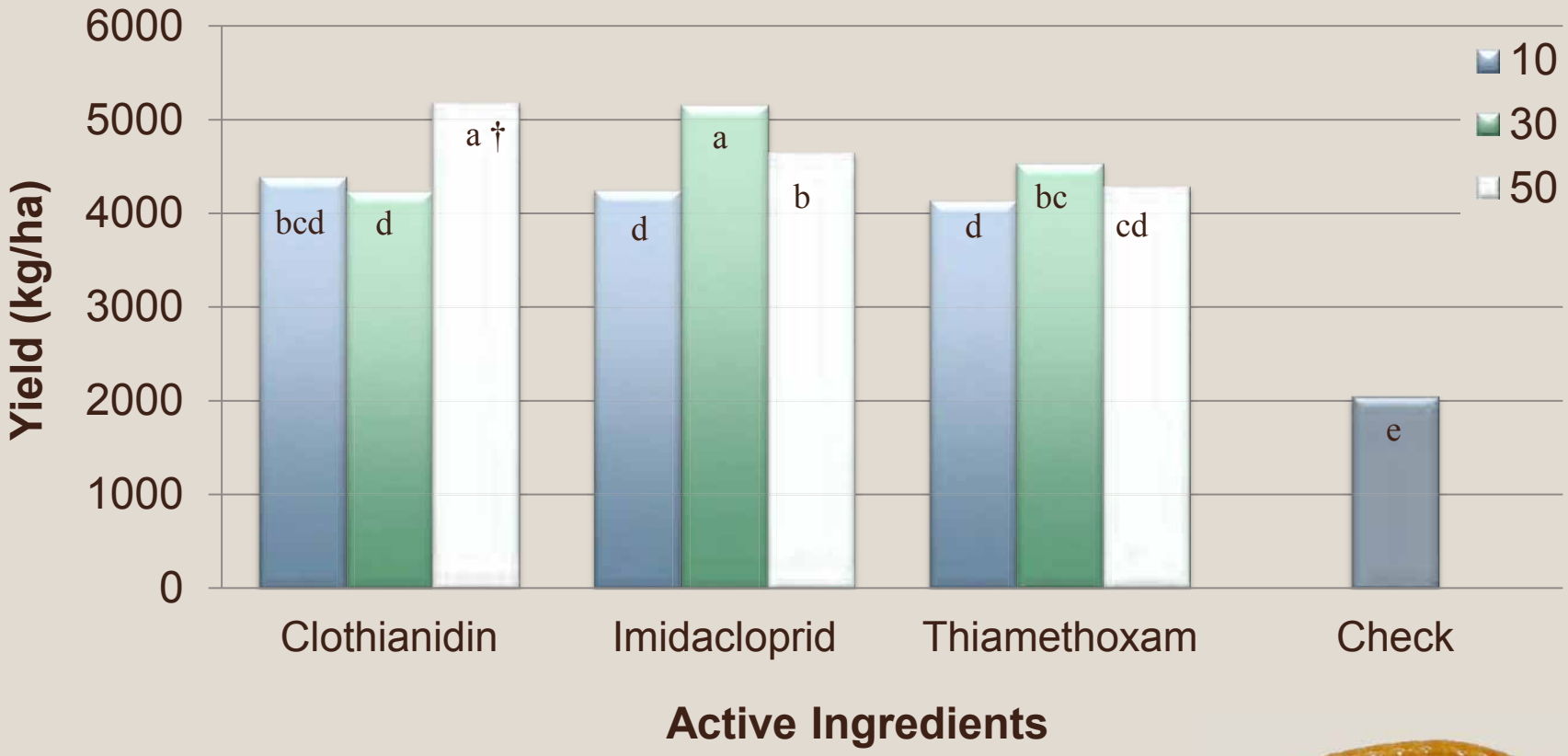
Barley tr


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

Effects of insecticides (Wilke Farm, high wireworm feeding) - 2012



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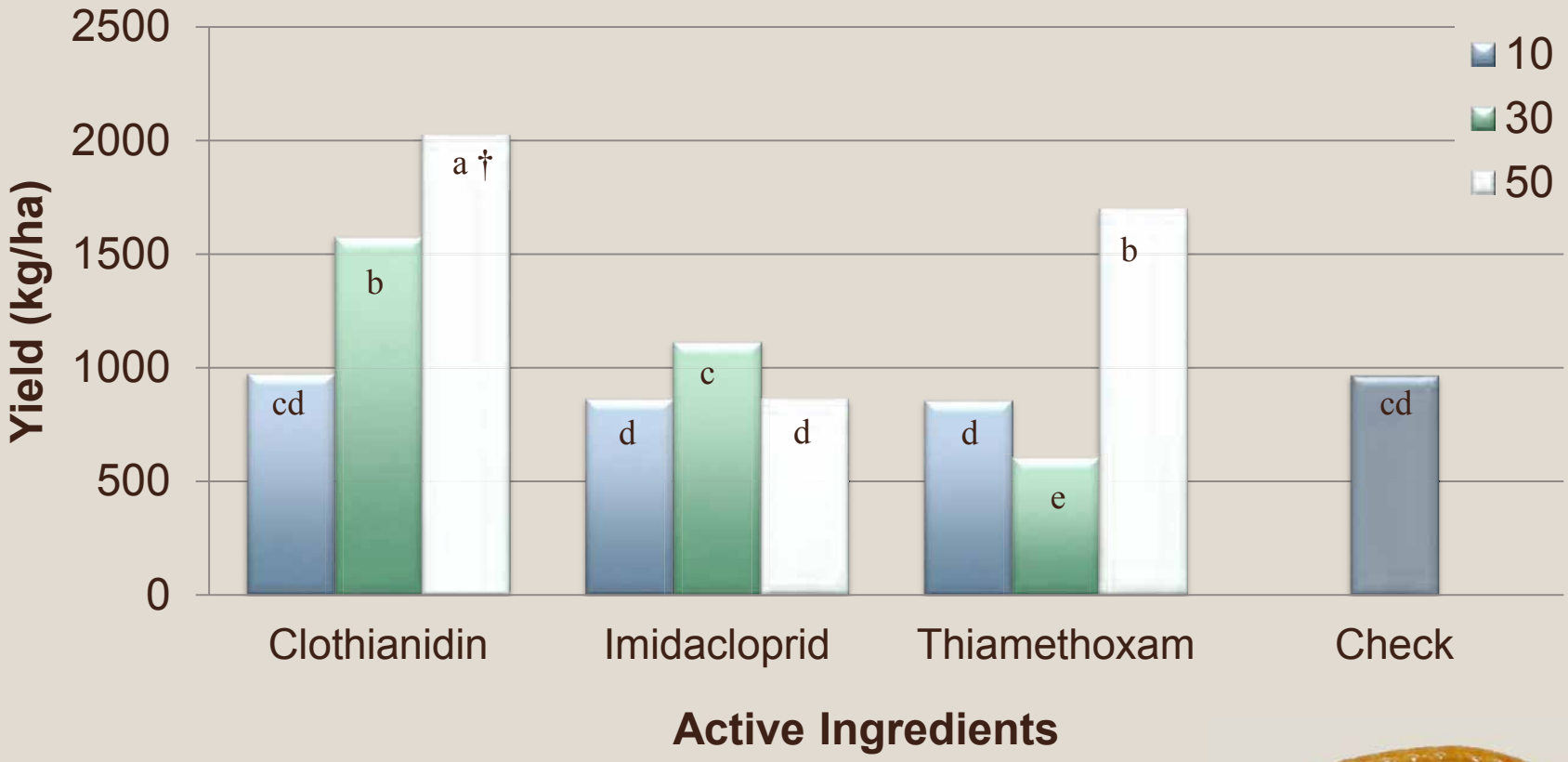
www.lincoln-adams.wsu.edu/agriculture

Effects of insecticides (Colfax, low wireworm feeding) - 2012



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

WSU WIREWORM PROJECT

Protected wheat (from wireworm damage) vs. unprotected

High pest population presence

Protected

13-Jun-2012, Wilke Farm, Davenport, WA

Unprotected

13-Jun-2012, Wilke Farm, Davenport, WA

Effects of insecticides - 2011-12

Effects of insecticides - 2012

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