Best Practices for Managing Wheat Midge and Wireworm

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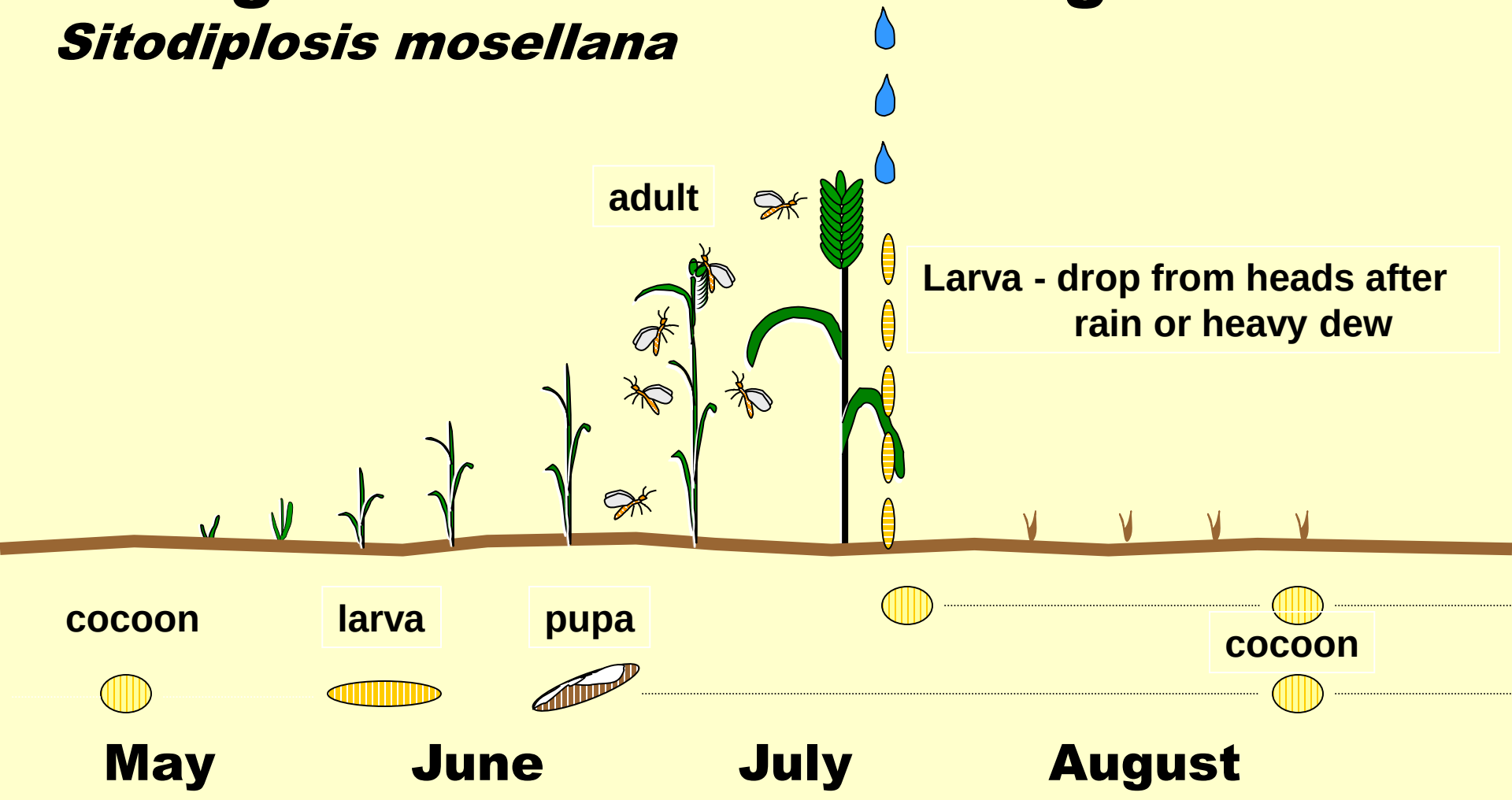
Crop Damage from Wheat Midge

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

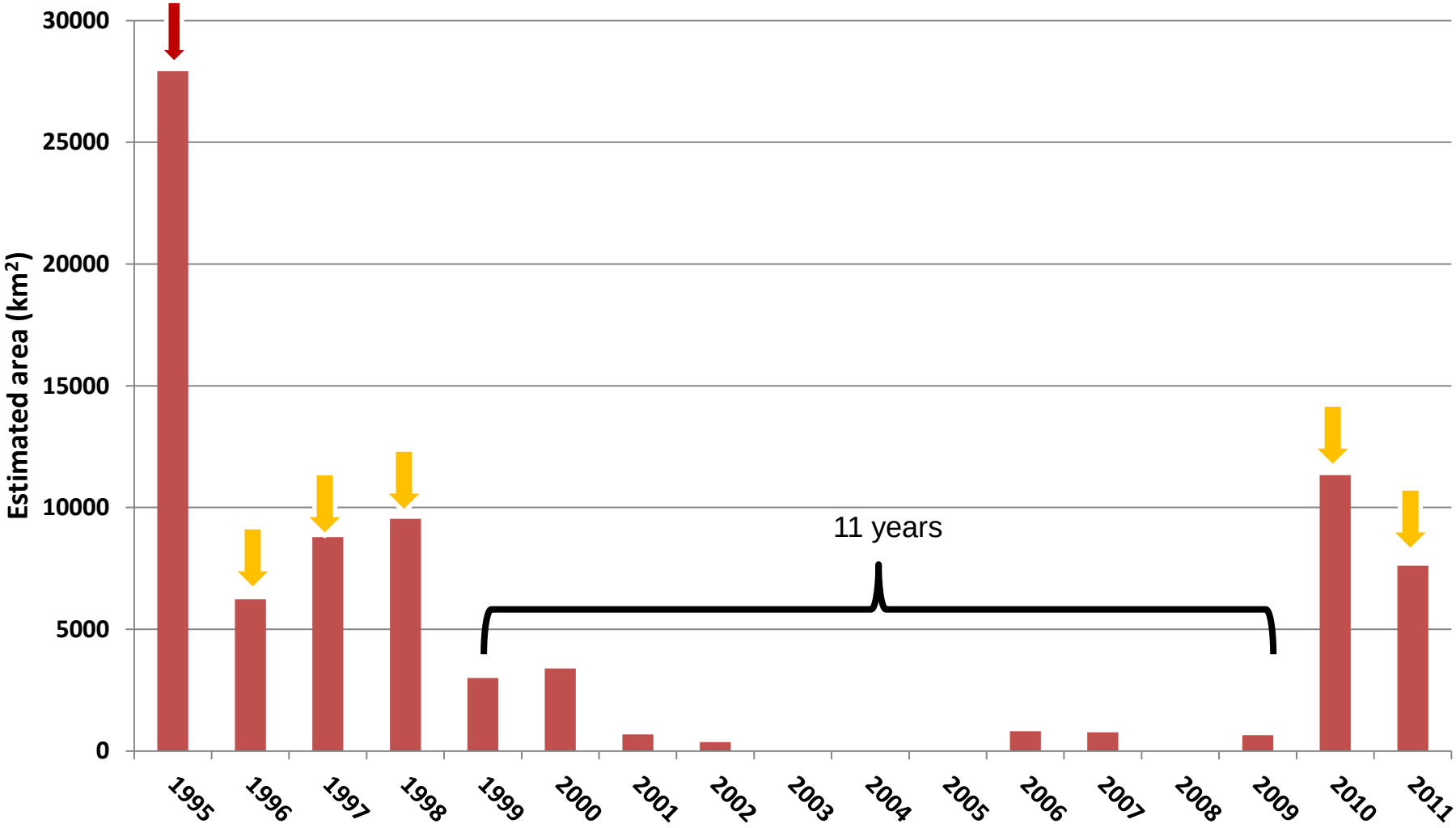
Saskatoon Research Centre, Canada

Life Cycle of Orange Wheat Blossom Midge

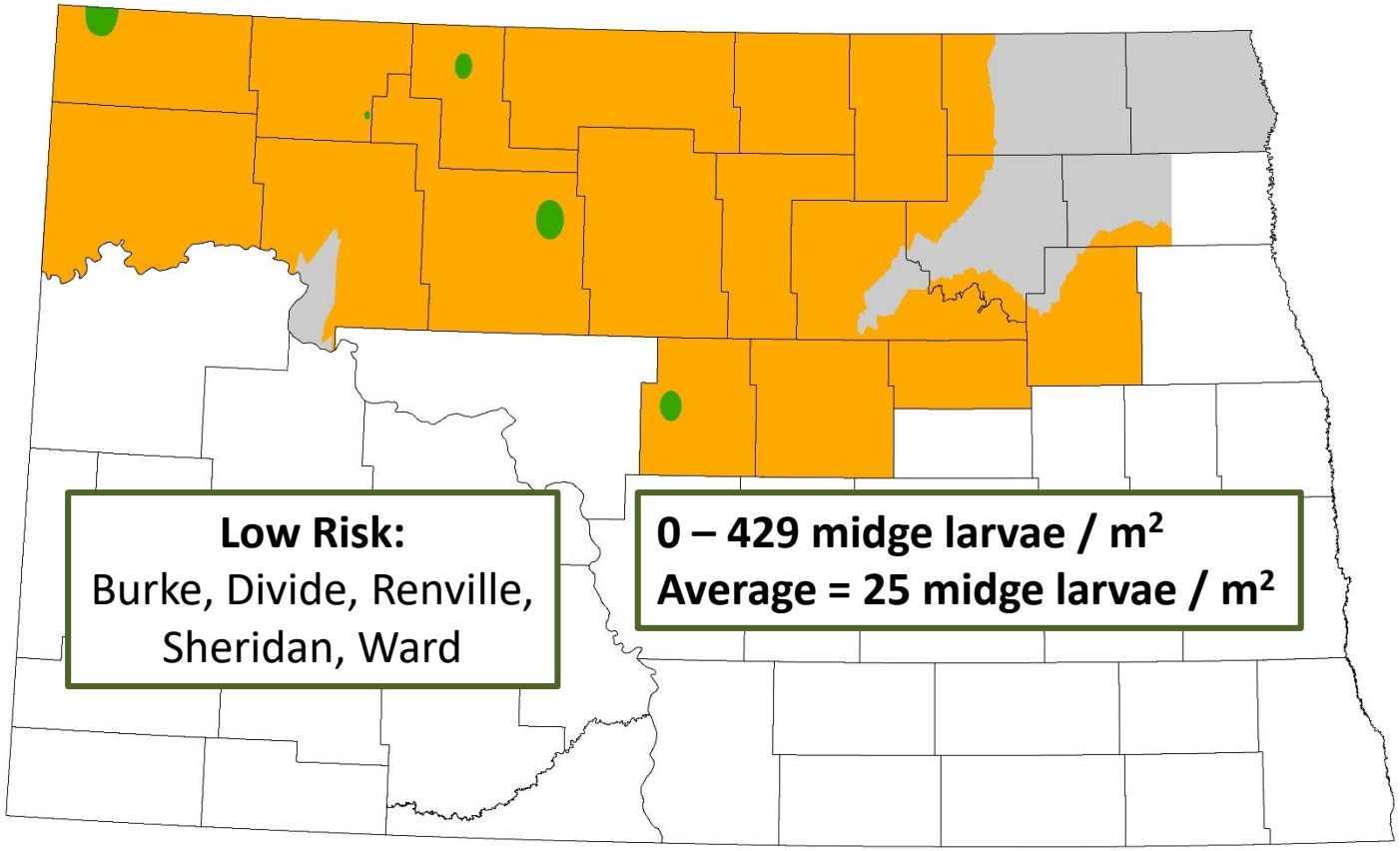
Sitodiplosis mosellana



Estimated area (km^2) where numbers of unparasitized larvae of wheat midge were above 500/m^2 (economic level)



2015 Wheat Midge Larval Survey
North Dakota



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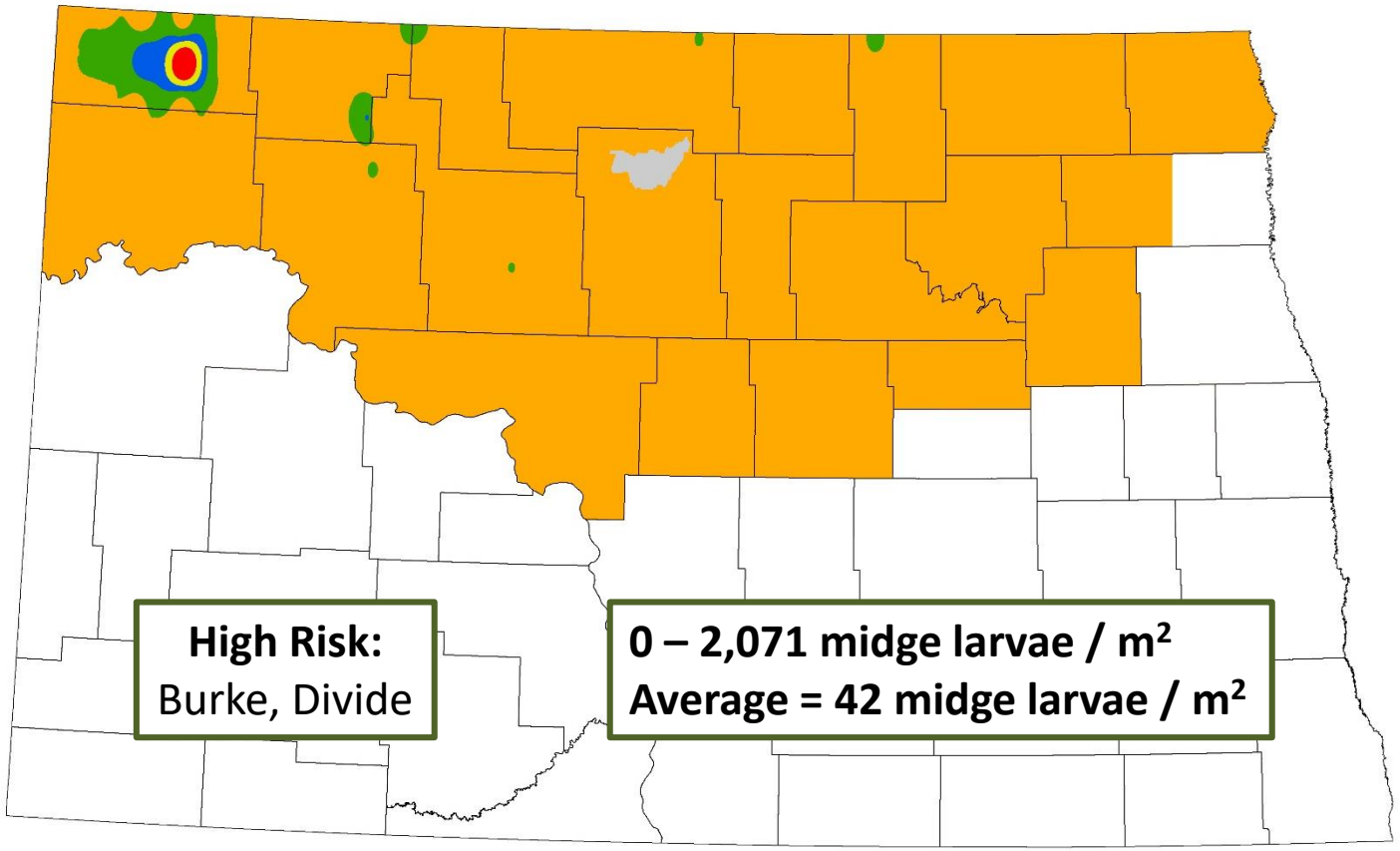
2016 Wheat Midge Larval Survey
North Dakota



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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 [illegible] 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

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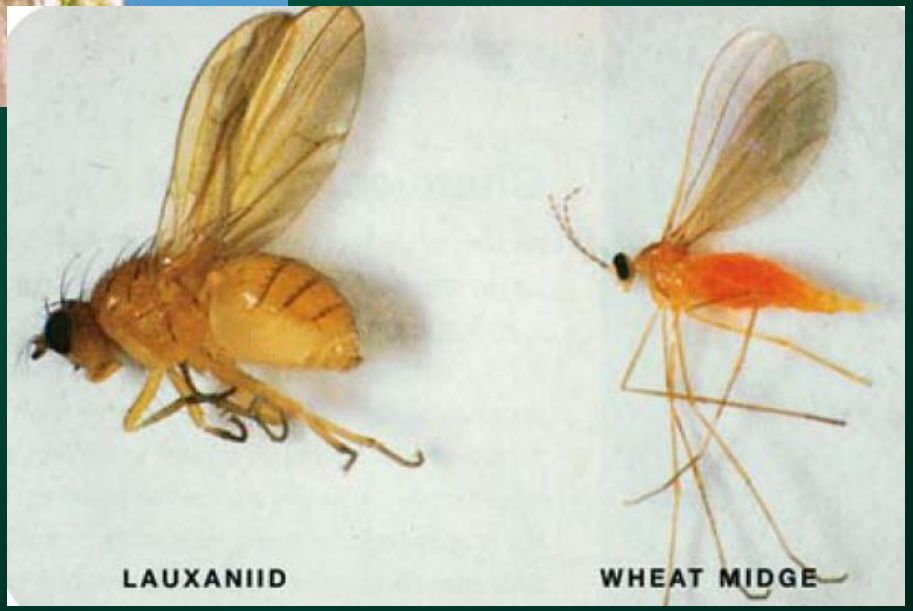
Identification

Lauxanid fly versus
Wheat midge fly



Saskatoon Research Centre, Canada

Degree Days as a Tool for Wheat Midge Scouting

DD	Biological Event
450	Wheat midge breaks larval cocoons and move close to soil surface to form pupal cocoons.
1,300	10 percent of females will have emerged.
1,475	About 50 percent of females will have emerged.
1,600	About 90 percent of females will have emerged.

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/

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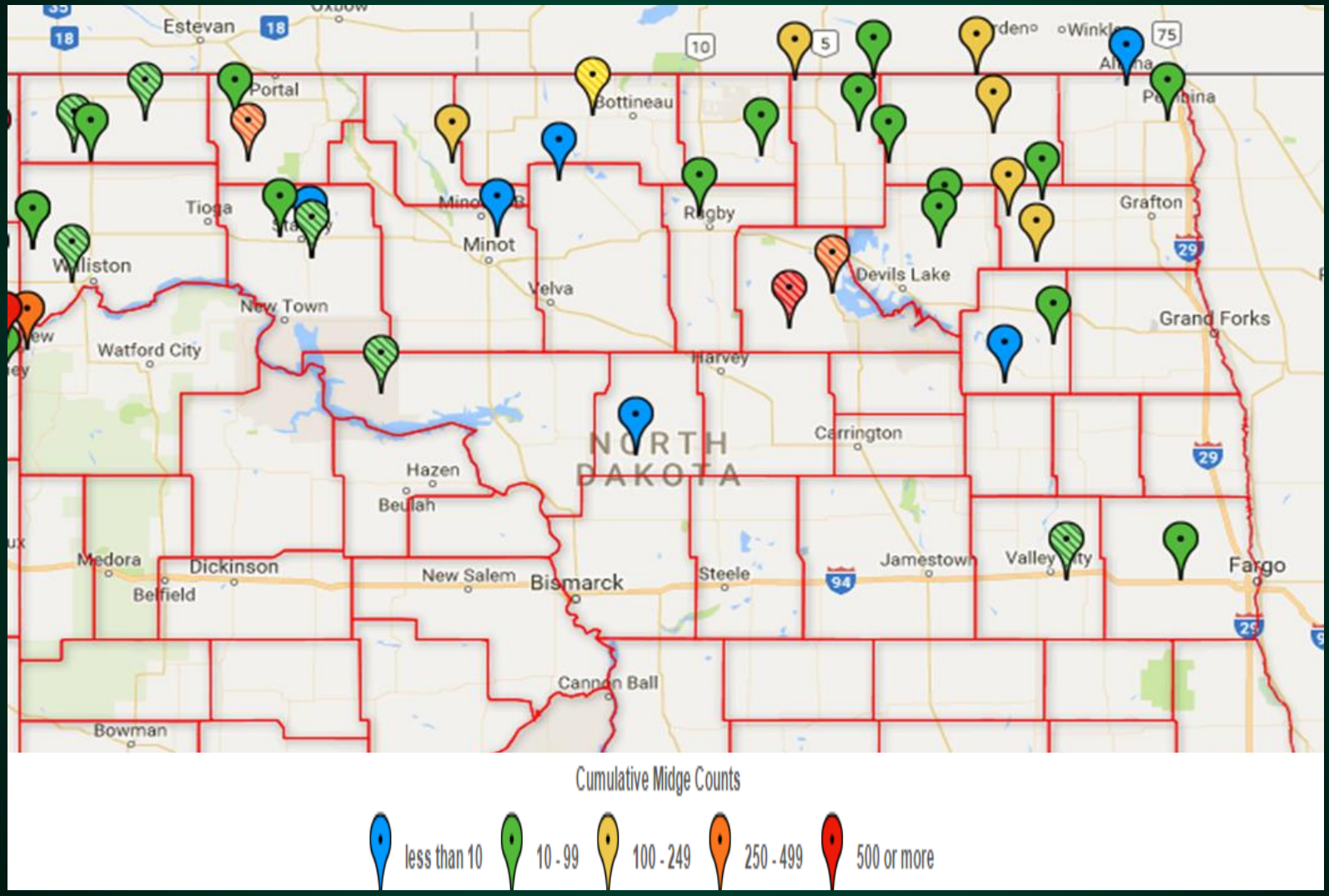
2016 Wheat Midge Trap Monitoring - ND



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https://pestweb.montana.edu/Owbm/Home

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

Small Grain Management Recommendations

Wheat midge

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Registered Insecticides

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*

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**** restricted use insecticide***

Chemical Control Timing

- If 30% of wheat is heading
  - Wait up to 4 days, then treat
- If 70% of wheat is at heading to early flowering
  - Treat immediately
- If 30% to 60% of wheat heads are at flowering
  - Spray immediately, control may be reduced
- If 80% of the heads are flowering
  - Treatment is NOT recommended
  - Larvae protected inside glumes
  - No longer attractive to adult wheat midge for egg laying
  - Kill parasitoid wasp

Ransom, NDSU Extension Service

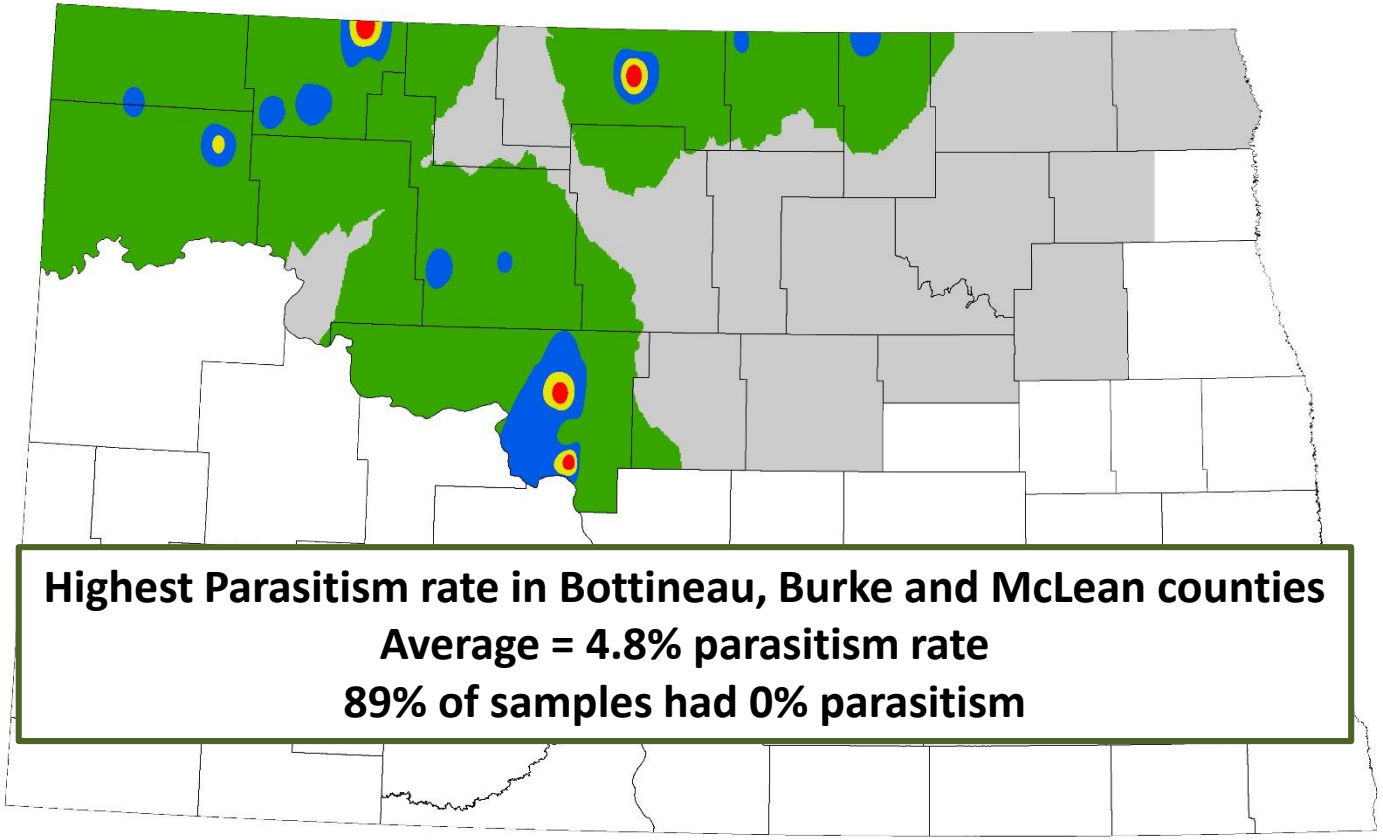
IPM - Biological Control

- *Macroglenes penetrans*
  (Hymenoptera: Pteromalidae)
  - 1-2 mm long and black metallic parasitoid wasp
  - Egg-larval parasitoid of wheat midge

Anderson, NDSU

Saskatoon Research Centre, Canada

2016 Wheat Midge Larval Survey
Percent Parasitism
North Dakota



Highest Parasitism rate in Bottineau, Burke and McLean counties
Average = 4.8% parasitism rate
89% of samples had 0% parasitism

Percent parasitized midge larvae

0 | 1-25 | 26-50 | 51-75 | 76-100 | Not surveyed

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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

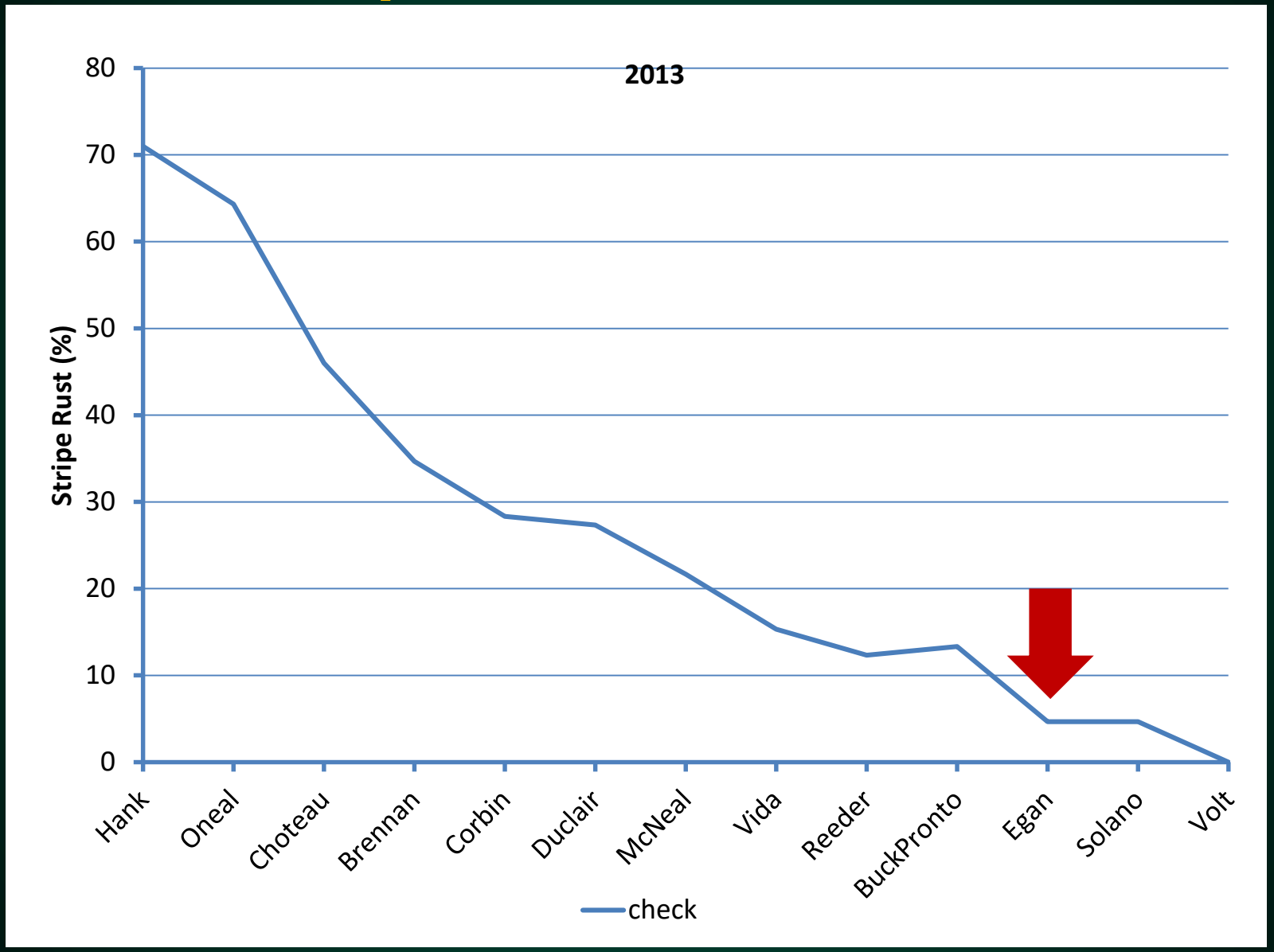
RIB…Refuge In Bag

Egan Wheat Variety

Egan Wheat field near Kalispell, MT.
Photo courtesy of MSU NW Ag. Res. Center

- 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



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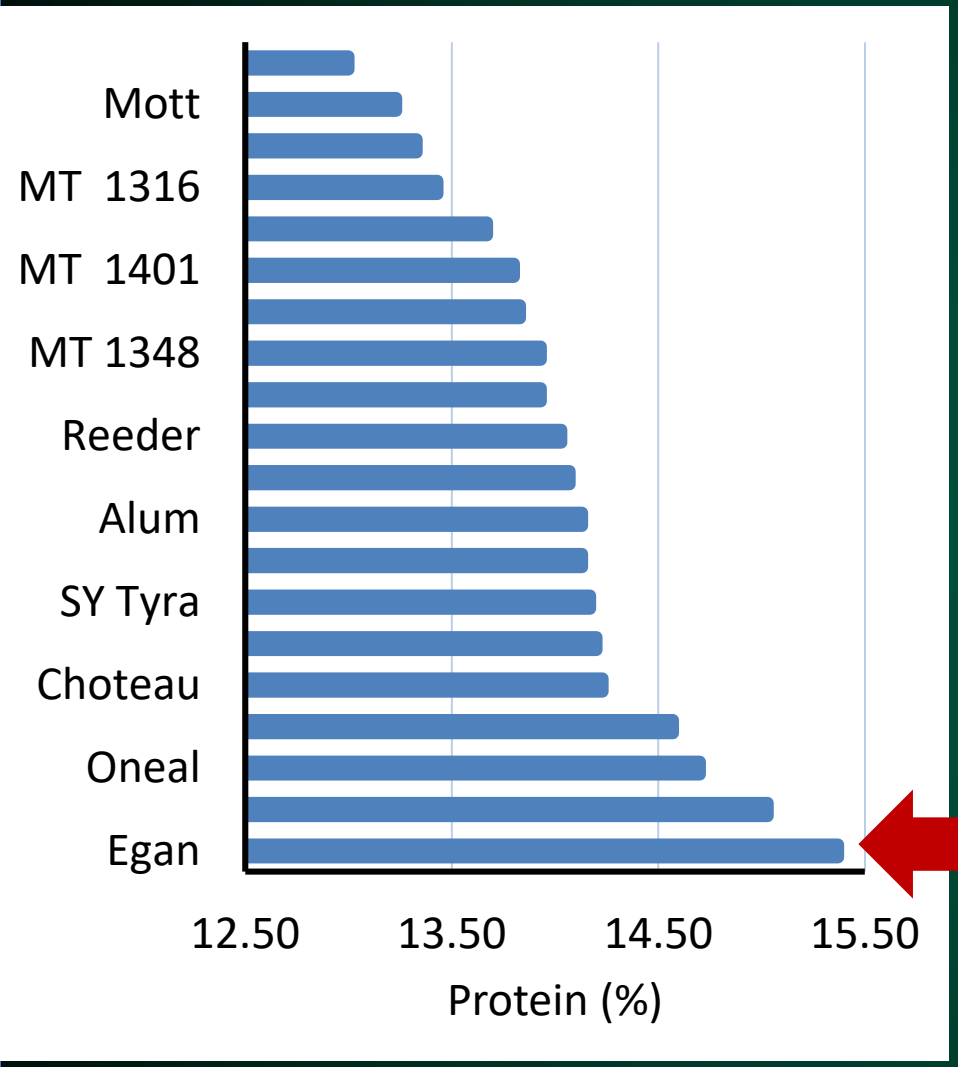
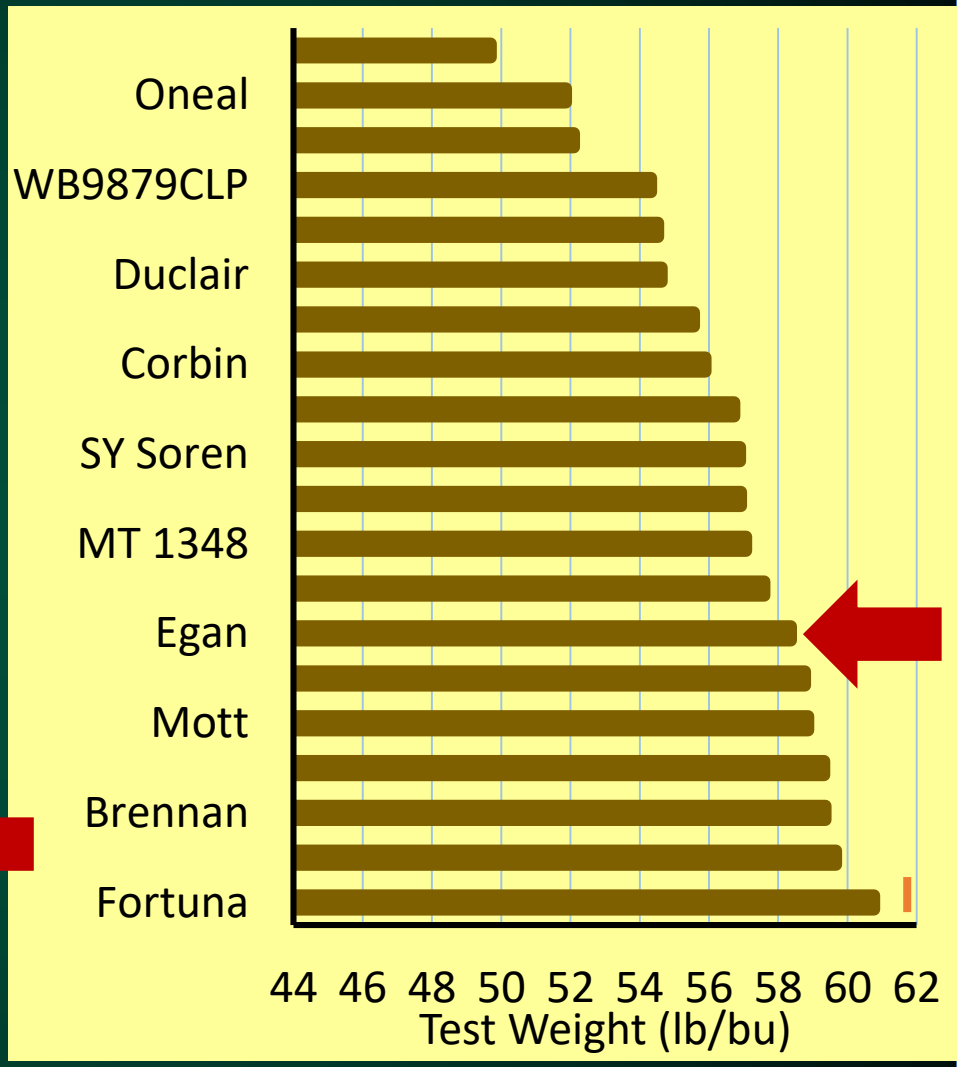
Source: Bob Stougaard, Montana State University Northwestern Agricultural Research Center

Off Station, 2016





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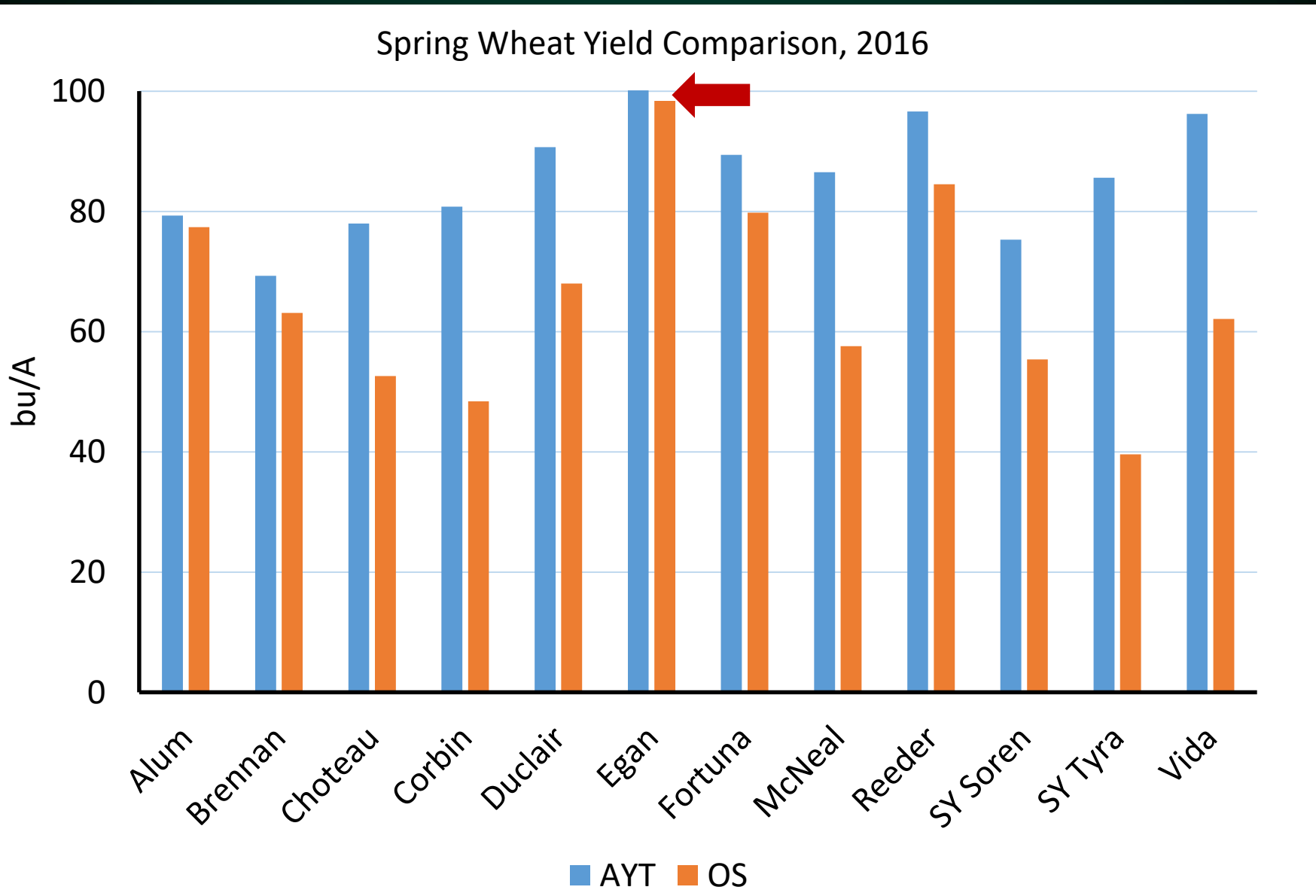
Source: Bob Stougaard, Montana State University Northwestern Agricultural Research Center

Data from MSU - NW Ag. Res. Center

Effect of Sm1 genetic resistance on OWBM, 2012.

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

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



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

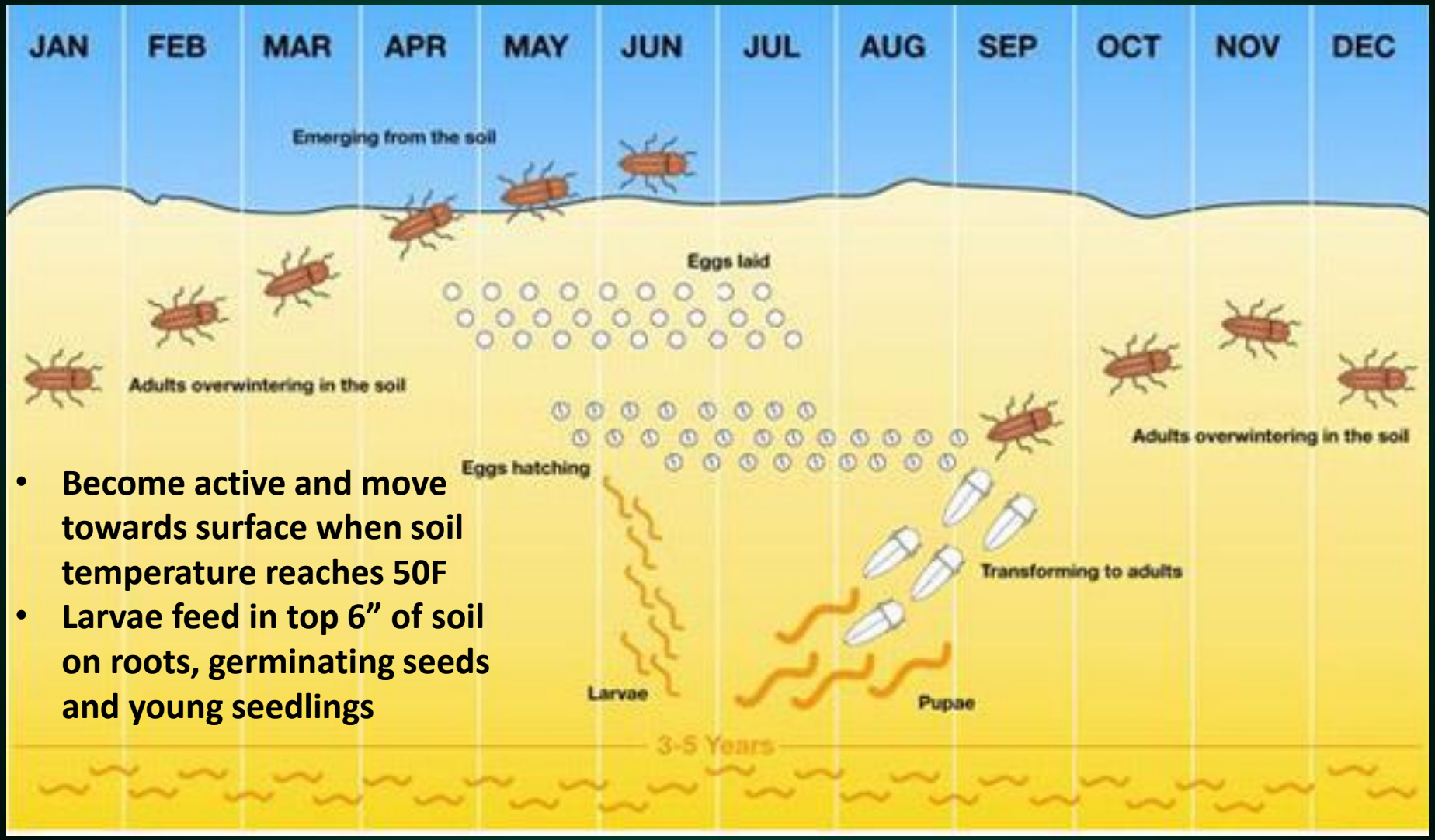
Wireworms

- 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


S. Brown, Univ. GA, bugwood.org


M. Boetel, NDSU

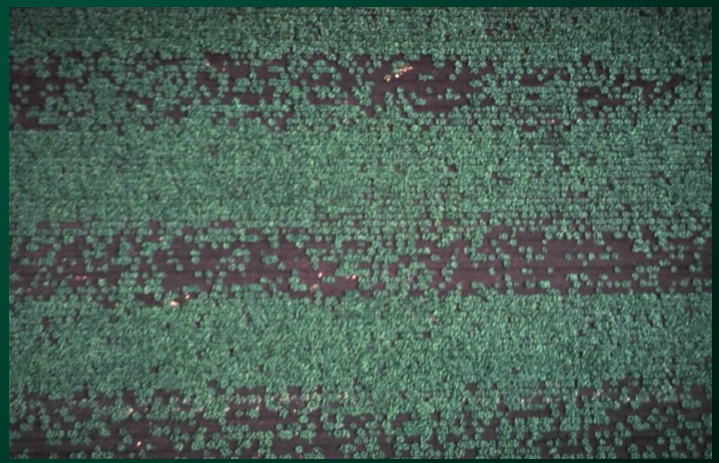
Wireworms Life Cycle



- 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

Photo by J. Knodel

Rating 10

Rating 1

Untreated check
Damaged by wireworm

Insecticide treated
Not damaged by wireworm

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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

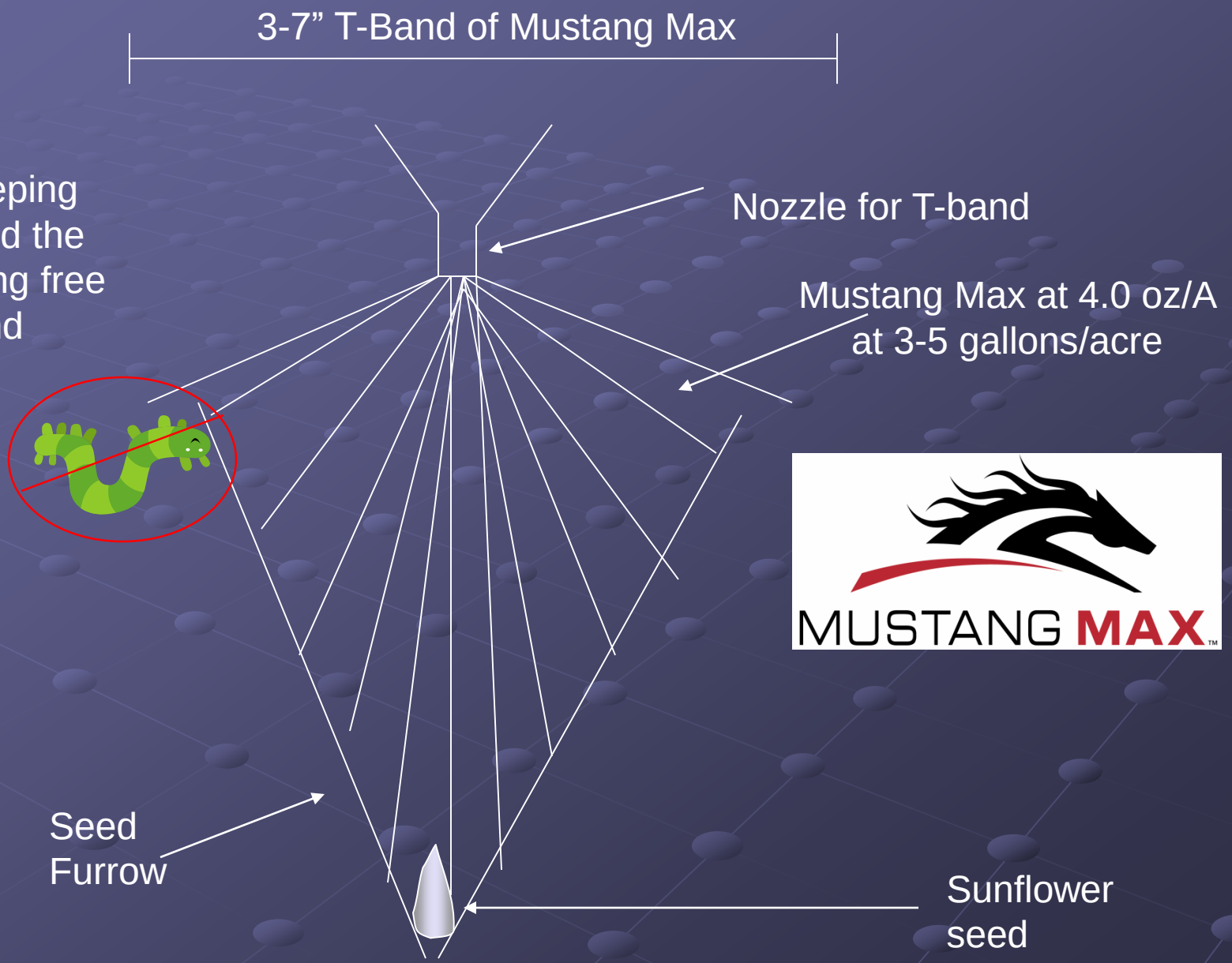
If more than one wireworm per trap, use soil insecticide or insecticide seed treatment!

Insecticide treated seed

No soil insecticides registered in wheat or barley

T-band system

Applications of Mustang Max in the furrow



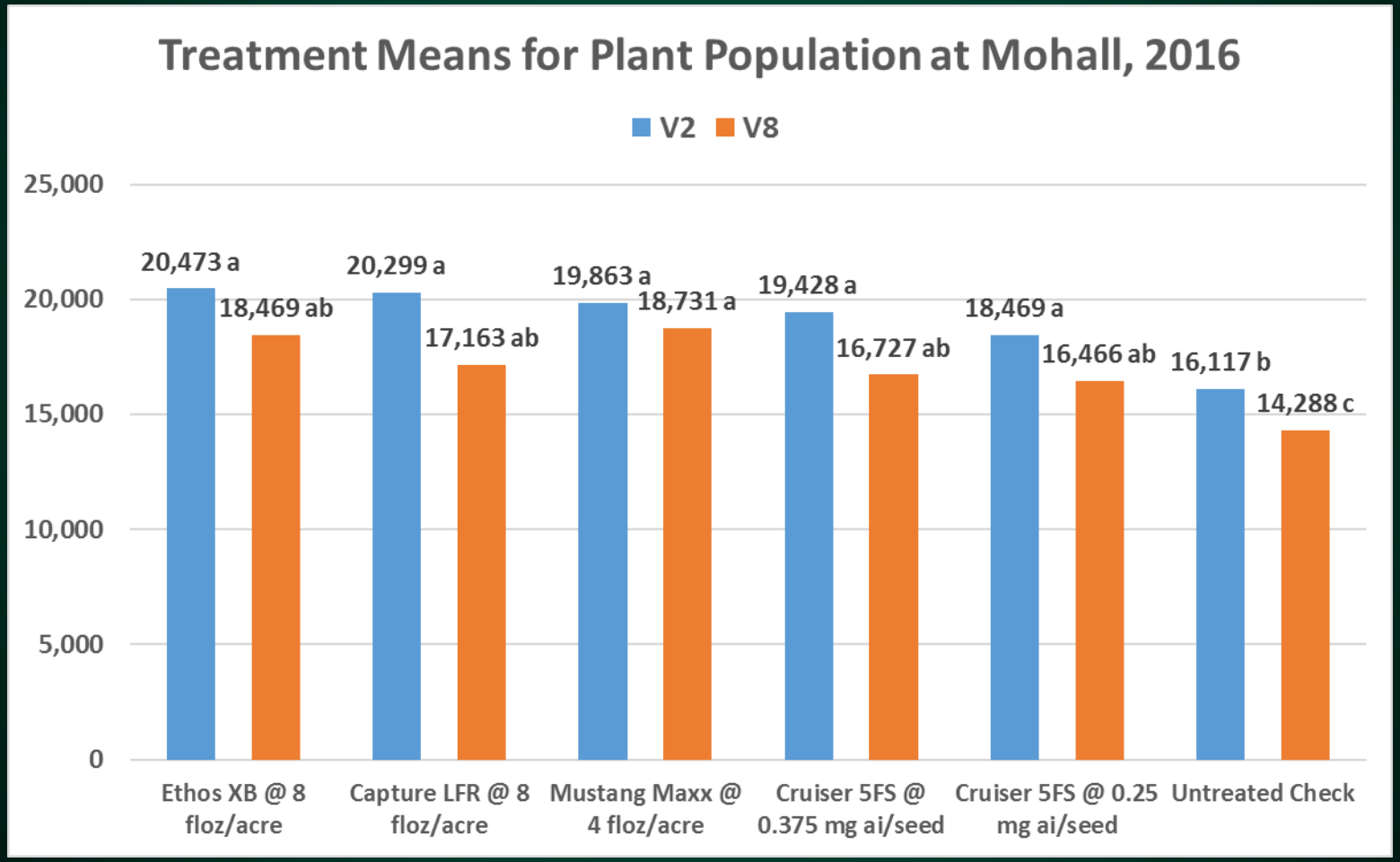
Wireworm 'Control'

- 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



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Wireworm Stand Loss

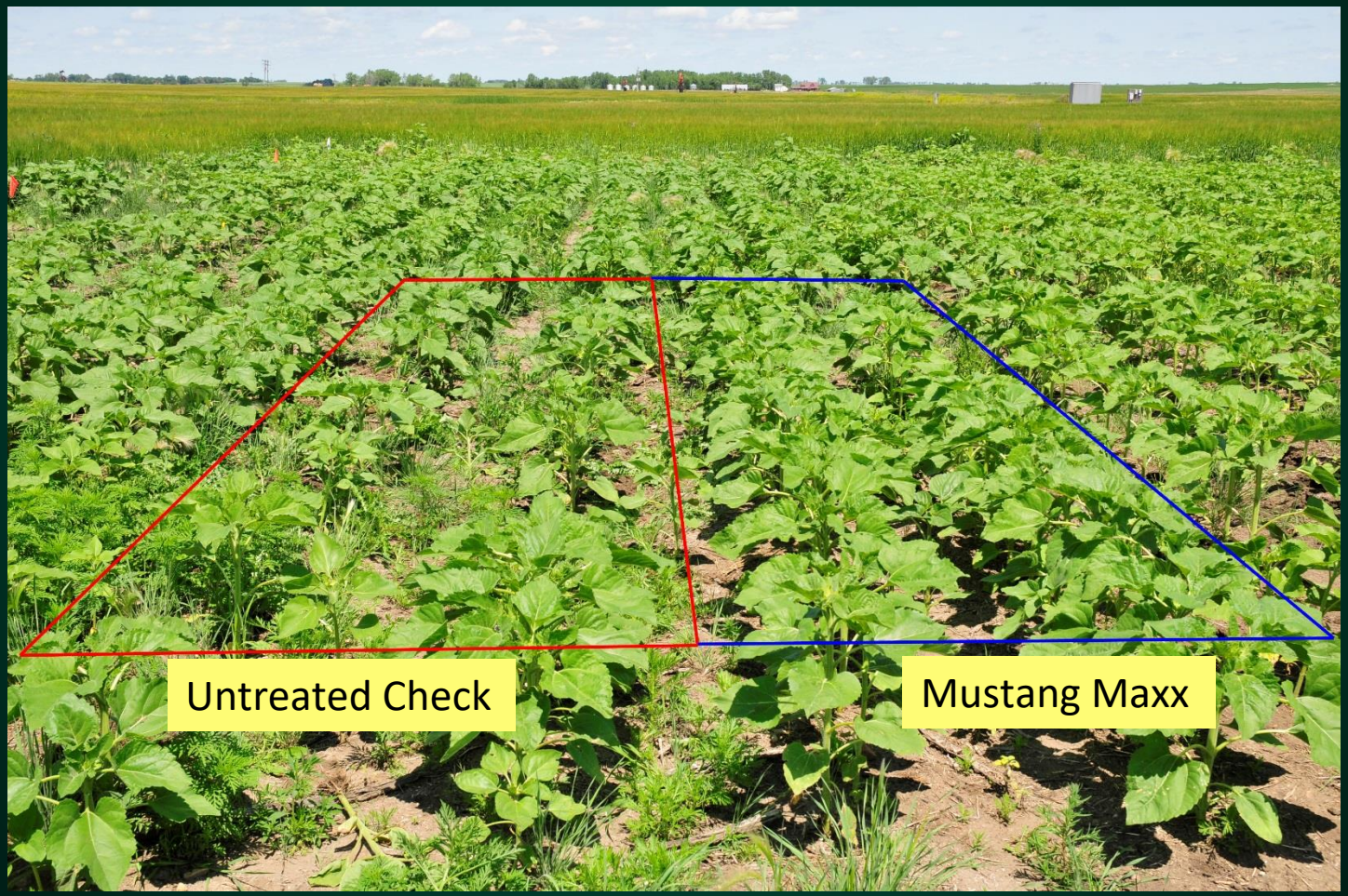

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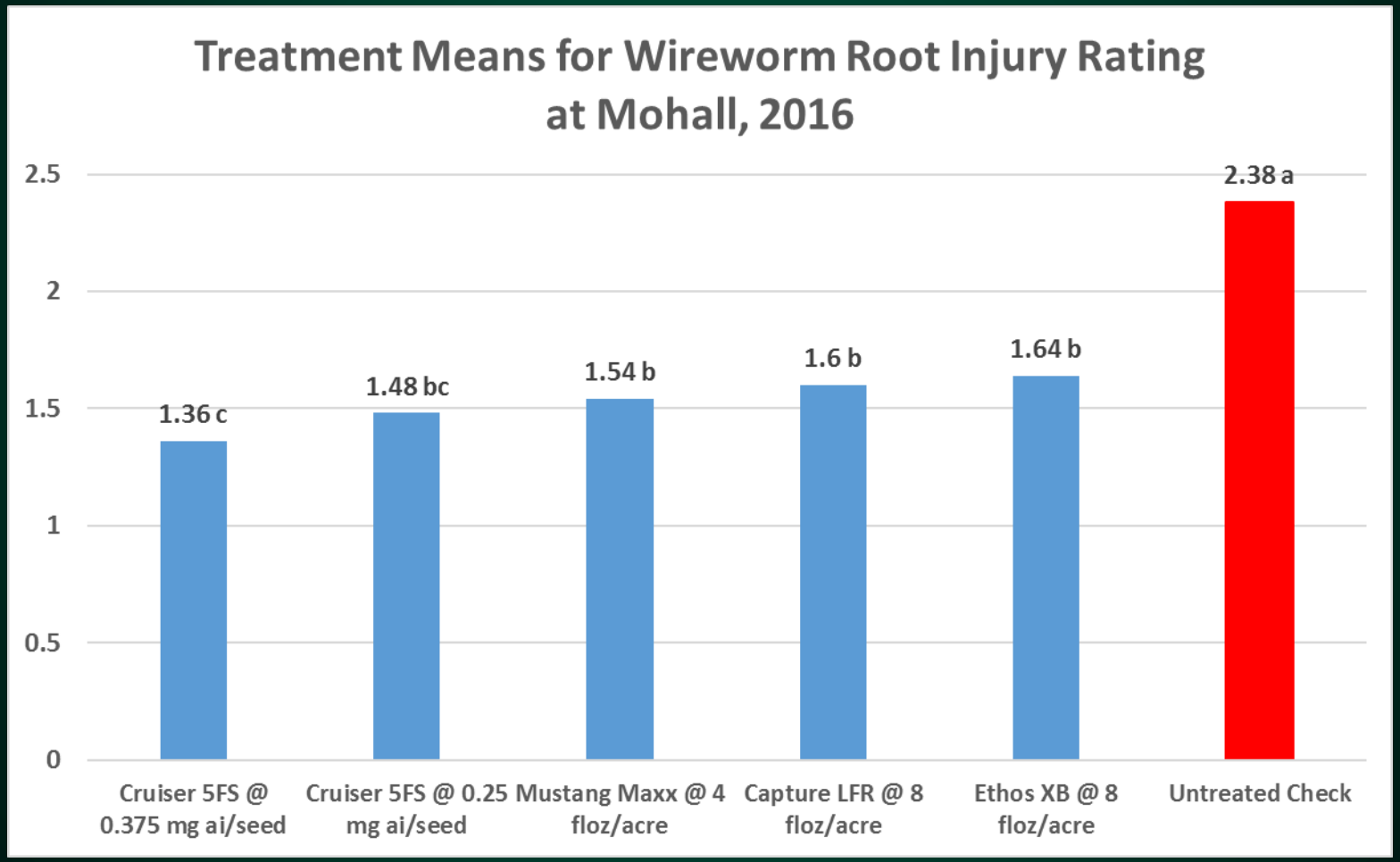
Photo by P. Beauzay

In-furrow Pyrethroid and Neonic Seed Treatment Efficacy Trial



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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

NDSU Crop & Pest Report

- Free to subscribers with email but **MUST SIGN-UP ON WEBSITE!!!**

–http://www.ag.ndsu.edu/cpr/