

# **Wheat Insects:**

*Wheat Stem Maggot*  
*Wheat Stem Sawfly*

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# Wheat Stem Maggot

- *Meromyza americana*
- Adult fly
  - 1/8" long
  - Bright green eyes, turn bronze with age
- Larva
  - Maggot
  - Headless/legless
  - 1/16"



# Wheat Stem Maggot

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- Life Cycle (Kansas early 1950's)
- Two Generations per year (?)
- **Early June:** Adults emerge-lay eggs on leaf, larvae tunnel into stem
- **Late July to Early August:** Second generation of adults emerge and lay eggs on grasses or volunteer grain
- Overwinters as maggot in lower parts of grass stems

# Wheat stem maggot

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- Hosts:
  - Wheat spp, Barley, Rye, Brome spp, Wheatgrass spp, quackgrass, foxtail spp
- Larvae rasps/tears at interior stem
- No correlation yet between damage and yield loss



♦ **White Heads:  
Plant Died Early**

• **Favored by wet  
weather followed  
by dry and hot  
conditions**

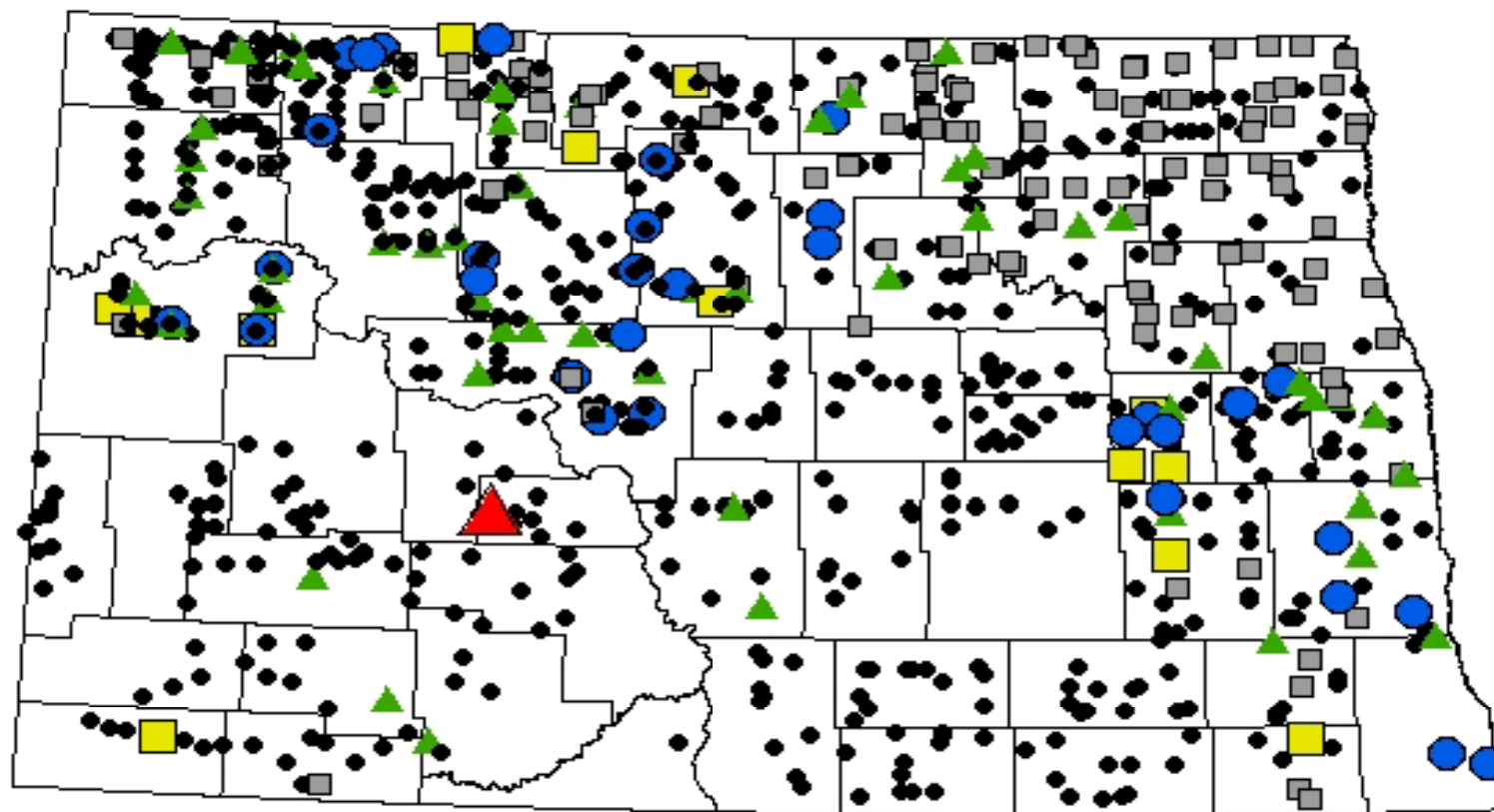
# Root Rot

♦ **Sub-crown  
Internode Dark  
Brown, Dark  
Lesions; Pythium  
also causes stunting**



# Wheat Stem Maggot in Wheat

Field Season 2007



Percentage of Infested Plants

● 0   ■ 1-5   ▲ 6-10   ● 11-20   ■ 21-50   ▲ > 50



# Wheat Stem Maggot - IPM

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- Crop rotation with non-susceptible crops
- Control grassy weeds and volunteers
- No known resistant varieties
- Delayed planting
- Fall or spring tillage?
- Biological control
  - *Bracon meromyzae*
  - *Coelinidea meromyzae*
- Chemical control ??????????

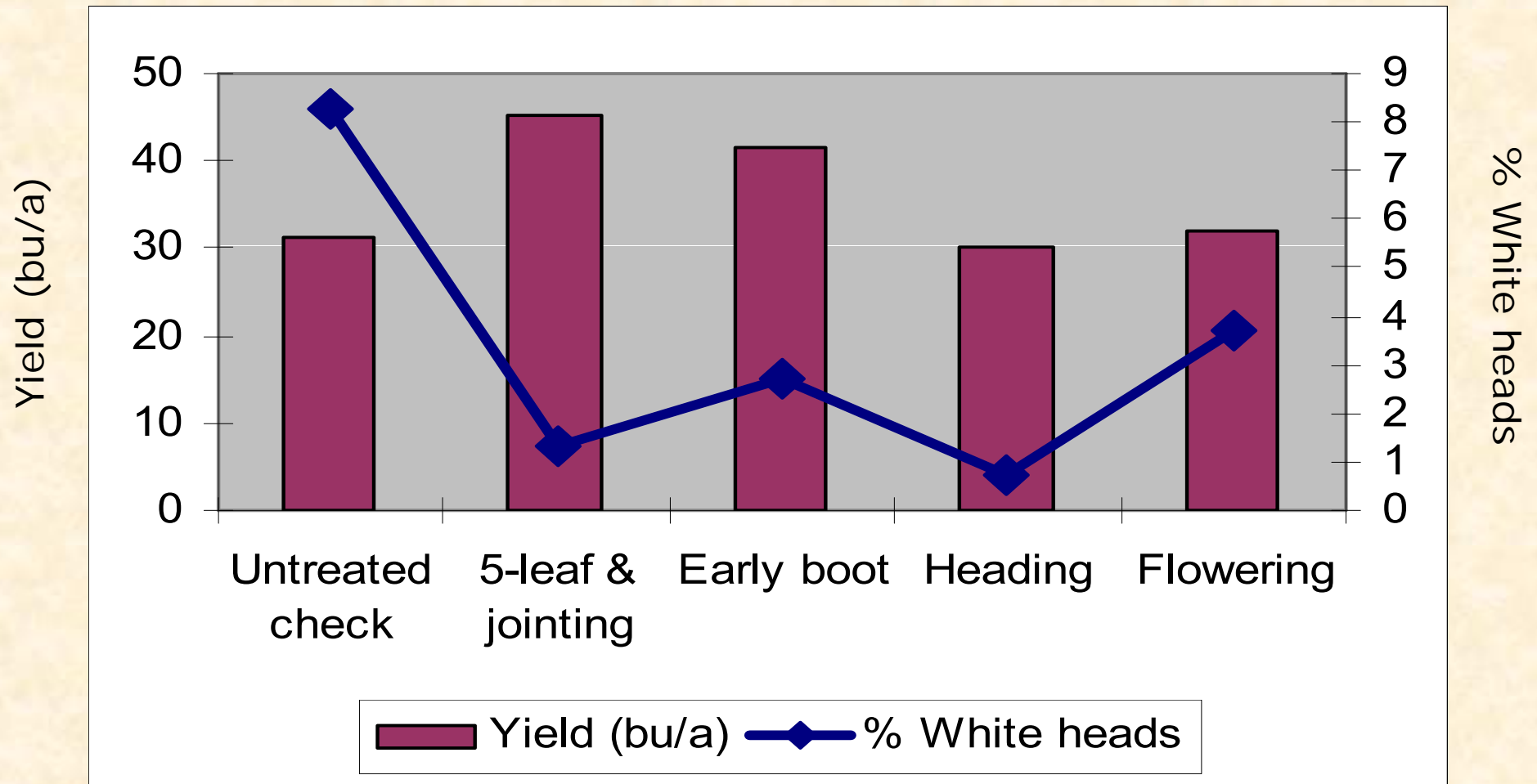
# Insecticide Timing Trial

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- Hettinger REC, Eric Eriksmoen
- HRSW, Variety Reeder, planted on May 1<sup>st</sup>
- Mustang Max insecticide at 3 fl oz/a
- Four spray timings:
  - June 13<sup>th</sup> (5 leaf & jointing)
  - June 20<sup>th</sup> (early boot)
  - June 26<sup>th</sup> (heading)
  - July 5<sup>th</sup> (flowering)
- Counted white head on July 20<sup>th</sup> from 200 heads
- Harvested – July 27<sup>th</sup> (unreplicated strips of 100 ft per plot)

# Wheat Stem Maggot Insecticide Timing - Hettinger



# WSM – Mott

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- Todd Kautsman, Mott Grain
- Parshall HRSW
- Warrior (2.56 fl oz) + Quilt (12 fl oz)
- June 14<sup>th</sup> at flag leaf
- Counted 500 white heads

# Wheat Stem Maggot Insecticide Timing Study – Mott Grain

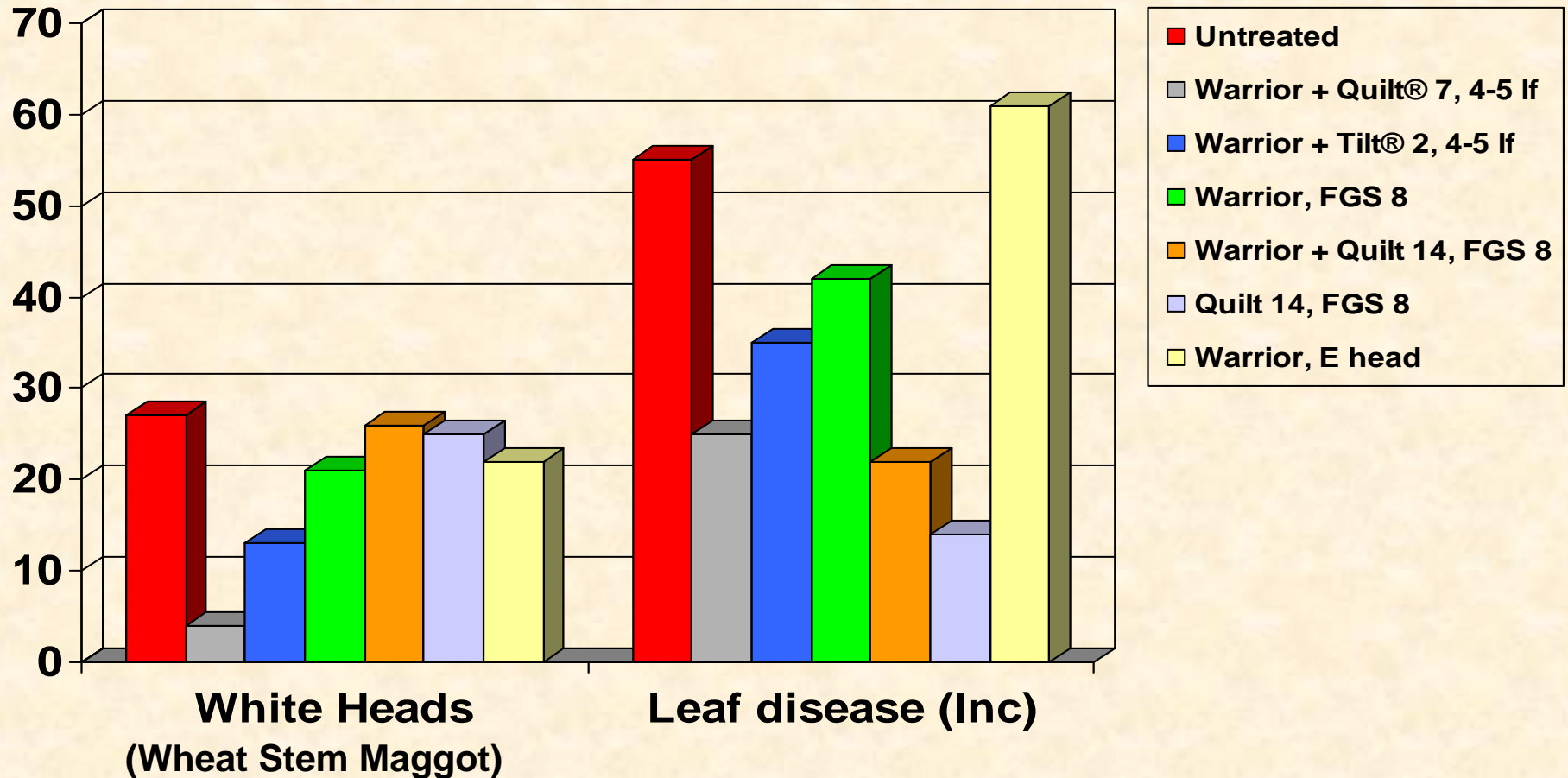
Untreated: >12% White heads

Treated: <1% White heads



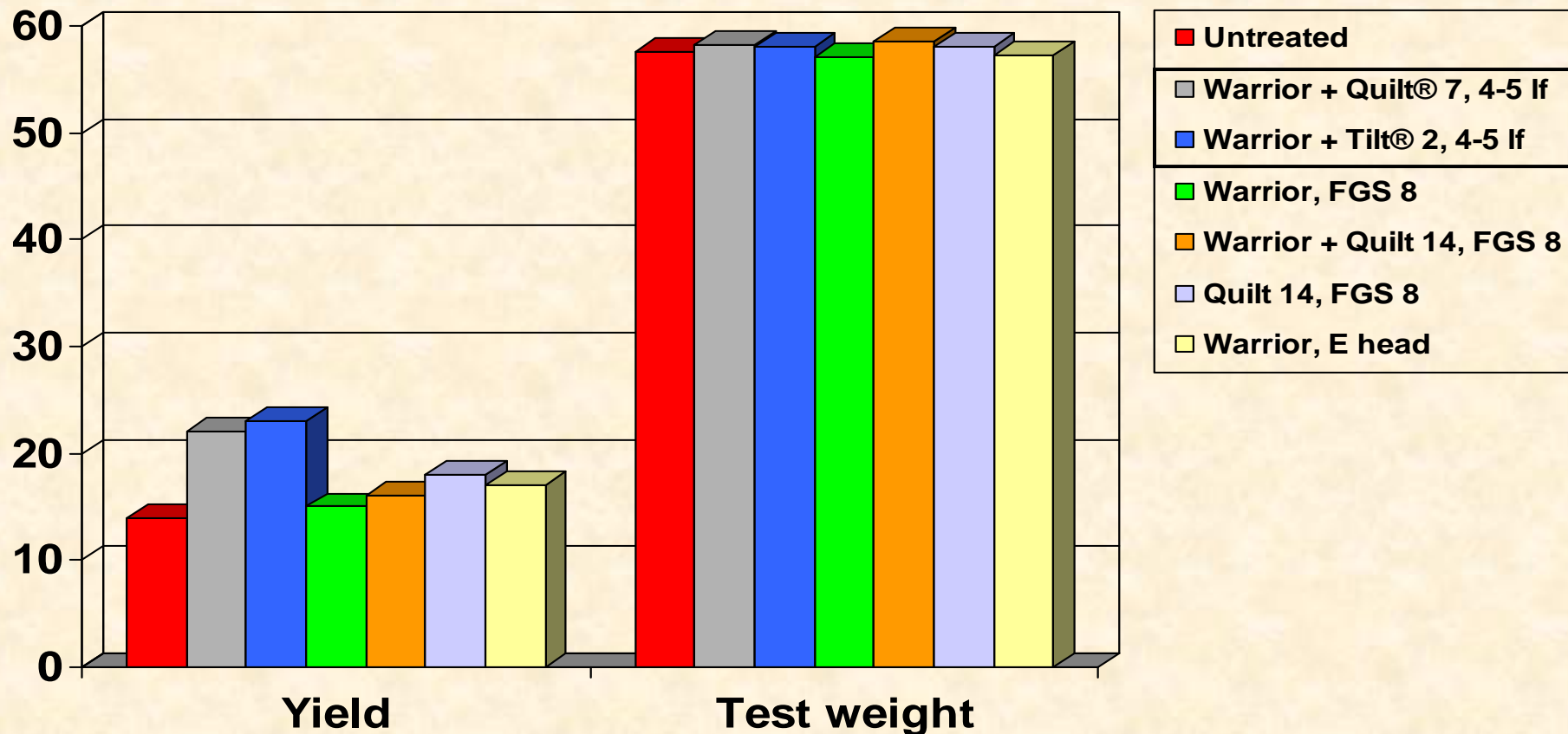
Disease Incidence and Severity?

# Warrior<sup>®</sup> and Fungicide Trial NCREC, Minot, ND 2007



Data source: D. Markle, NDSU, North Central Research Extension Center, Minot, ND. Insecticide fungicide Tank-mix. Minot, ND, 2007. HRSW 'Clearfield' was seeded May 24, 2007. 4-leaf treatments on July 3, flag treatments on July 27, early head July 30. Warrior applied at 2.56 fl oz/A. Leaf rust was primary disease, moderate pressure. LSD<sub>0.05</sub> = Heads: 13; disease: NS. ©2007 Syngenta Crop Protection, Inc., P.O. Box 18300, Greensboro, NC 27419. **Important: Always read and follow label instructions before buying or using these products.** Tilt®, Quilt® and Warrior with Zeon Technology® are trademarks of a Syngenta Group Company. **Warrior is a Restricted Use Pesticide.**

# Warrior<sup>®</sup> and Fungicide Trial NCREC, Minot, ND 2007



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# Research Needs

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- Basic Biology – generations? GDD's
- Monitoring and Scouting techniques / timing
- Economic thresholds
- Plant stage(s) injured
- Planting date/maturity
- Evaluate varieties for resistance
- Chemical control
- Impact on production in the region

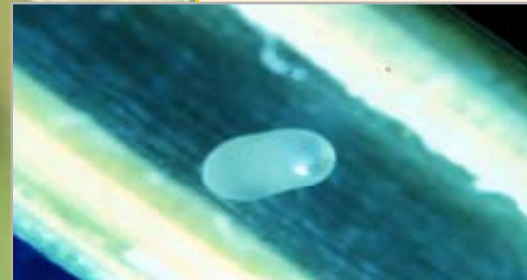
# Wheat Stem Sawfly

## *Cephus cinctus* (Cephididae)

**Adult**



**Egg**



**Pupa**



**Larva**



# Wheat Stem Sawfly Life Cycle

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- *Cephus cinctus* is native to North America and lives in grasses, mostly wheatgrass
- Cultivated hosts include wheat (spring, winter, and some durum), rye, triticale, and some barley (larvae don't live long in barley)
- Oats and broadleaf crops are not suitable hosts



Photo by Dr. Wendell Morrill

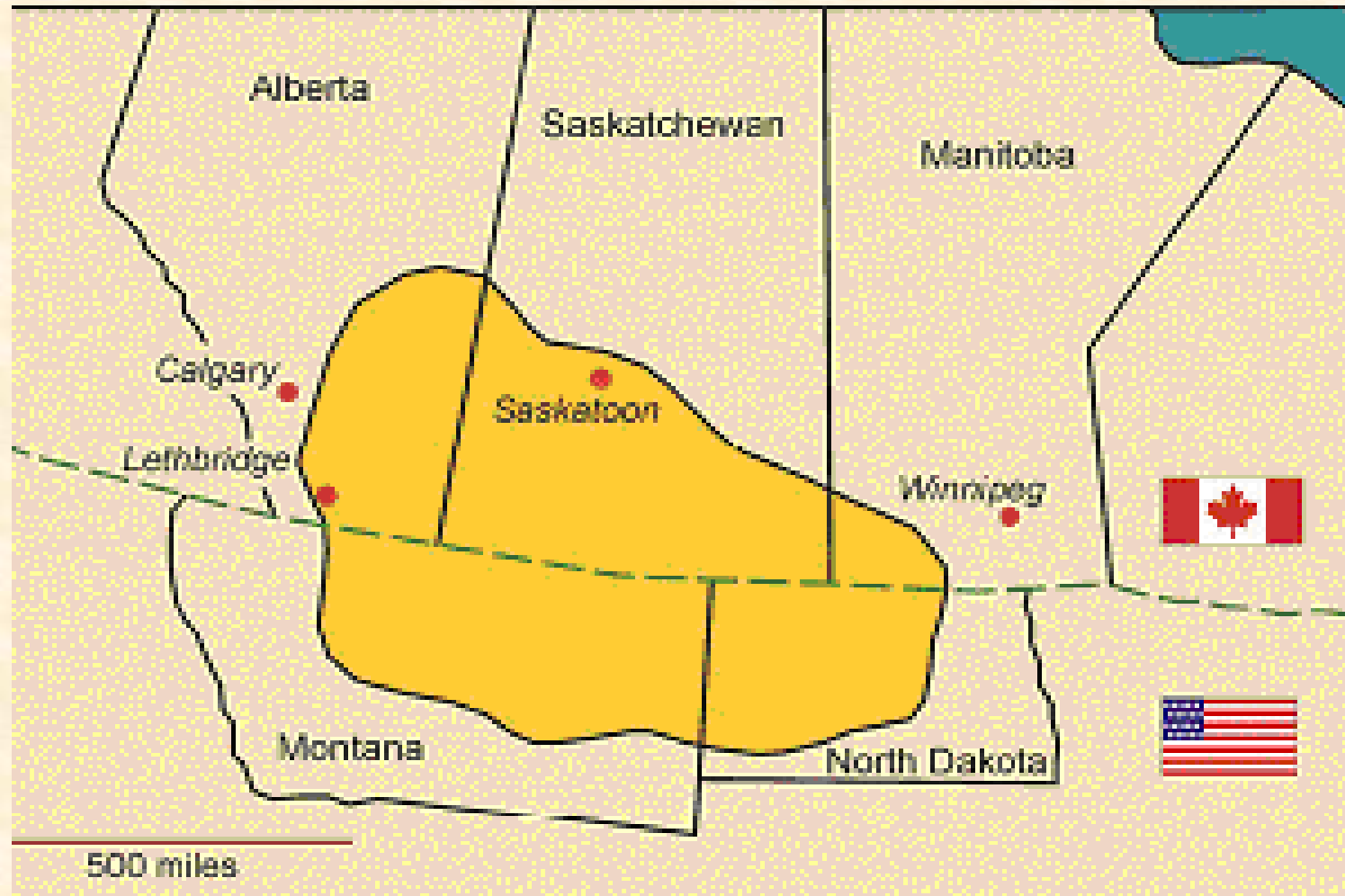
# Life Cycle

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- Adults begin to emerge in late May-June
- Northern MT peak male emergence June 15; female June 25
- Plant age is important to egg-laying females. Plants are susceptible from jointing to prior to boot stage
- Rather inactive, rest on grass; only fly in right conditions
- Larva feed within the stem and burrow below ground level prior to head ripening, then cuts stem about 1" above ground and seals end, spins a cocoon and enters diapause

# Distribution of Wheat Stem Sawfly



# Damage caused by Wheat Stem Sawfly

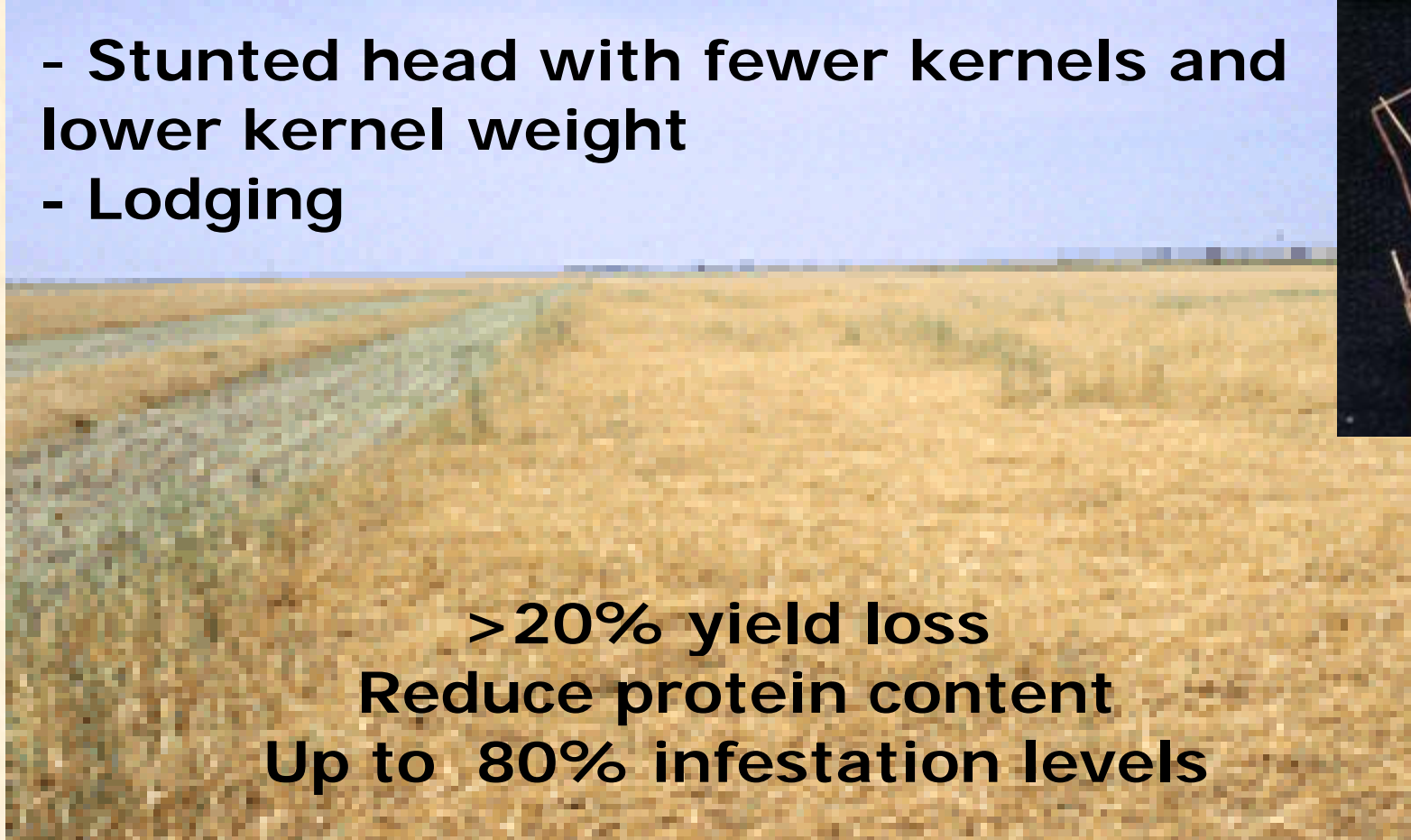
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- Stunted head with fewer kernels and lower kernel weight
- Lodging



**>20% yield loss**  
**Reduce protein content**  
**Up to 80% infestation levels**



# Lodging losses



- Decreased snow retention
- Slower harvest
  - harvest one way
  - more fuel
- Equipment damage

- Lost grain
- Volunteer wheat
  - uses water
  - herbicide



# Weather

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- Good Question
- Drought reduces the number of suitable grass stems, forces the sawfly into cropland
  - Drought conditions may reduce populations by reducing suitable stems therefore increasing cannibalism
- Abundant rainfall increases potential for stem rust which is harmful to sawfly larvae

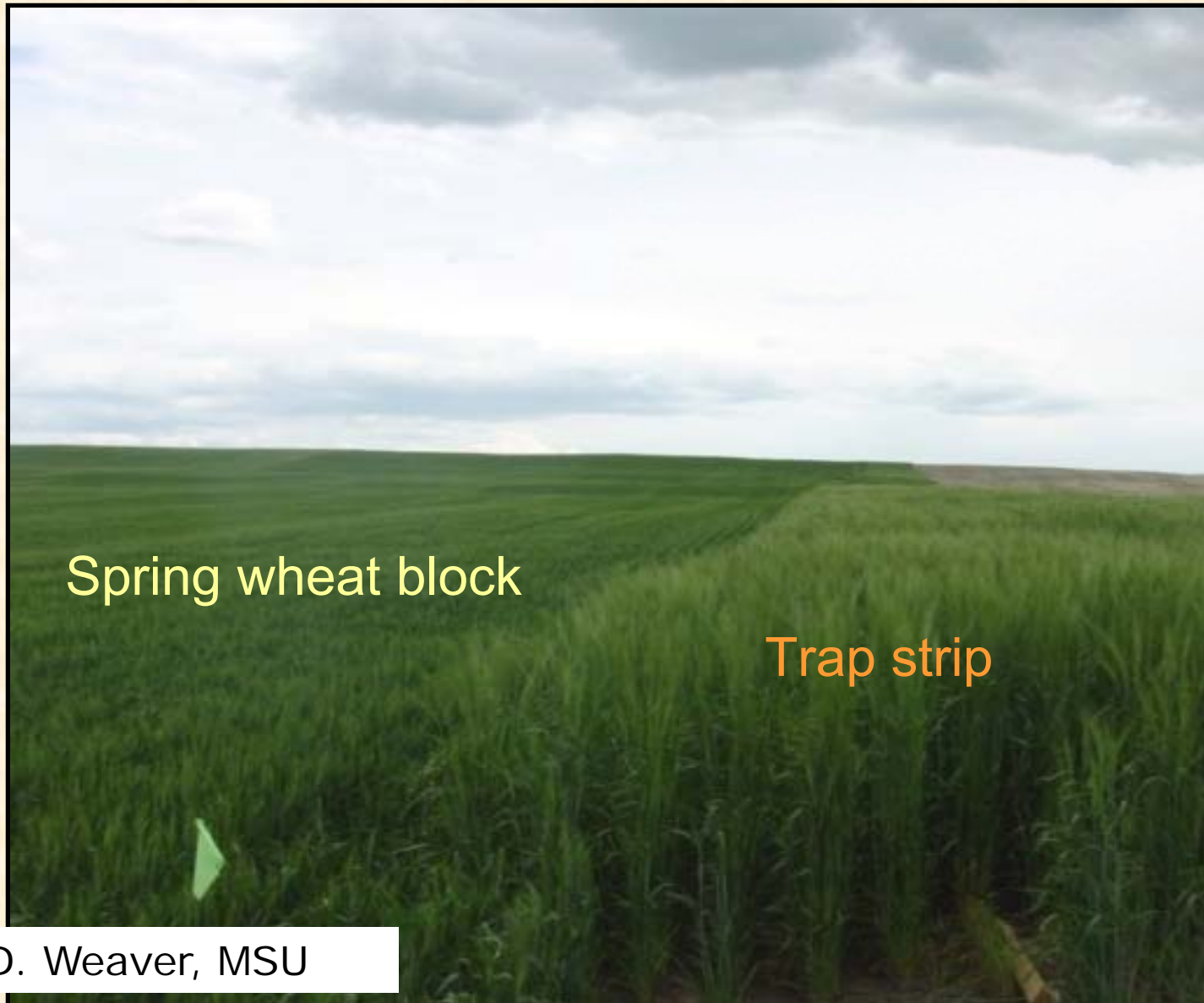
# Management

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- Crop Rotations
  - Broadleaf crops, Flax, Oats - *Durum*, and *Barley*
- Trap Crops
  - Mow or cultivate before sawfly moves down, mid July
  - Bromegrass not suitable host
- Delay seeding - May 20 (when risk is high)
- Swath-Heavily infested fields (>6% infested) –  
at 30-35% moisture to prevent lodging
- Tillage/burning: lose more than you gain
- Chemical control ineffective due to long emergence period, and protected egg/larvae

# Trap crop + cultural control



Spring wheat block

Trap strip

Source: D. Weaver, MSU

# Wheat Stem Sawfly – IPM

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## Evaluation of hybrids for resistance

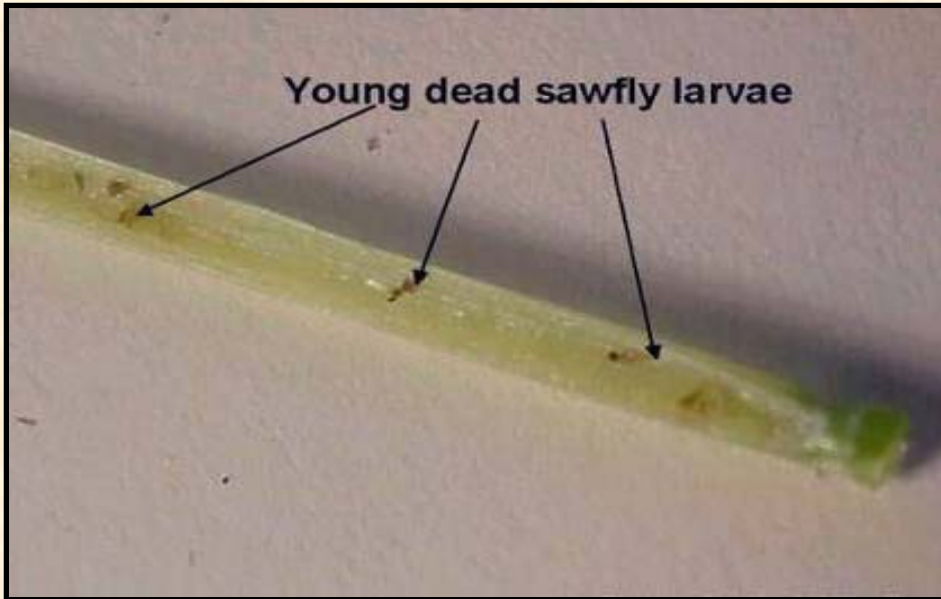
- Sawfly suffer higher mortality in solid stem varieties
- First resistant wheat cultivar ‘Rescue’ in 1946
- Wheat lines with resistance to sawfly:
  - Hard red winter
  - Hard white spring
  - Hard red spring



# Host plant resistance

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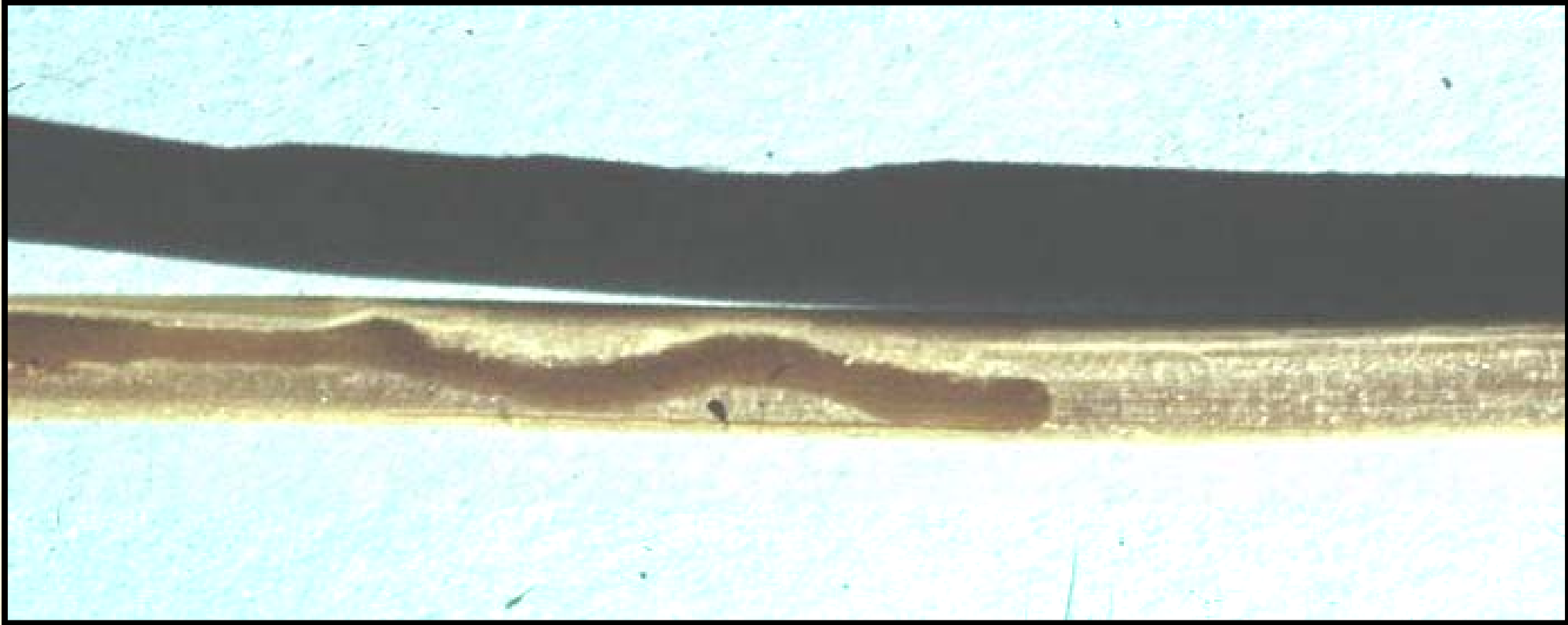
## “Antibiosis”

Mortality of small immatures due to unknown compound(s)

Mortality of later stages due to physical resistance of pith



# Host plant resistance



‘Rescue’ – 1946, ‘Rego’ – 1957

Solid stem wheat

Yield and quality issues

# Resistant Varieties Released after 1990

Variety	Wheat Type	Height	Origin	Year Released	Straw Strength	Yield
Ernest (16)	HRS	standard	NDAES	1995	med	High
AC Eatonia	HRS	standard	AC	1996	med	High
AC Abbey	HRS	standard	AC	1998	med	High
Choteau (21)	HRS	semidwarf	MAES	2003	strong	High
AC Lilian	HRS	standard	AC	2006	med	High
NDSW 0449	HRS	standard	NDAES	2009?	strong	Very High
Vanguard	HRW	standard	MAES	1995	med	High
Rampart	HRW	standard	MAES	1996	med	High
Genou	HRW	standard	MAES	2004	strong	High
Explorer*	HWS	semidwarf	MAES	2002	strong	High
Agawam (22)	HWS	semidwarf	WPB		strong	Very High

# Wheat Stem Sawfly – IPM

- Biological Control

- Parasitoids

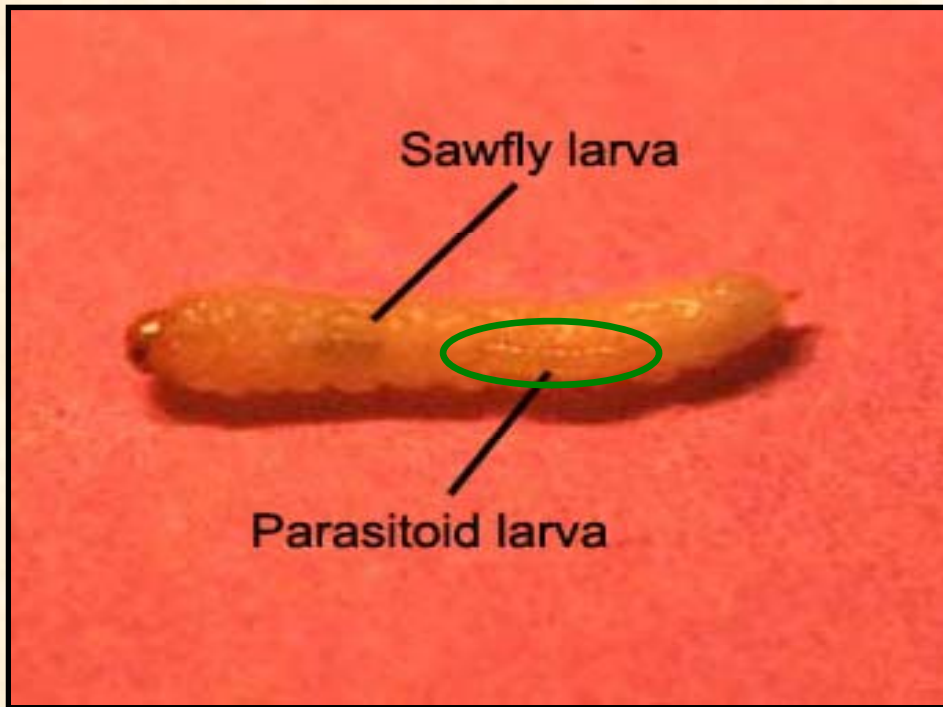
- *Bracon cephi*, native Braconid wasp
    - *Bracon lissogaster*, Braconid wasp
    - ND: <5% of sawfly larvae attacked
    - Infestation level ranged from 0-82%, averaging 7.8% in eastern MT and western ND survey during 1999-2001 (Shanower, USDA)
    - Current solid-stemmed varieties do not negatively impact parasitoids



# Sawfly larvae die

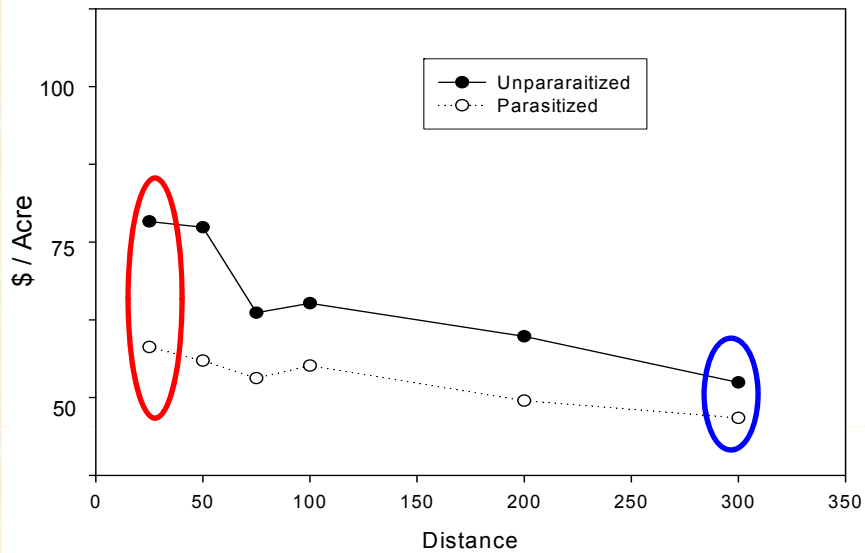
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Source: D. Weaver, MSU

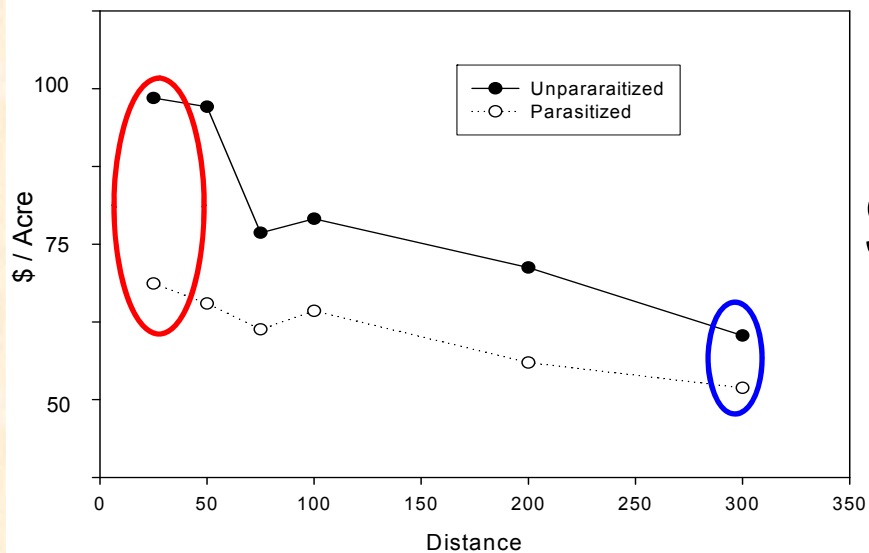
## Least sawfly damage



\$18 → 5

\$ / acre saved  
by parasitoids

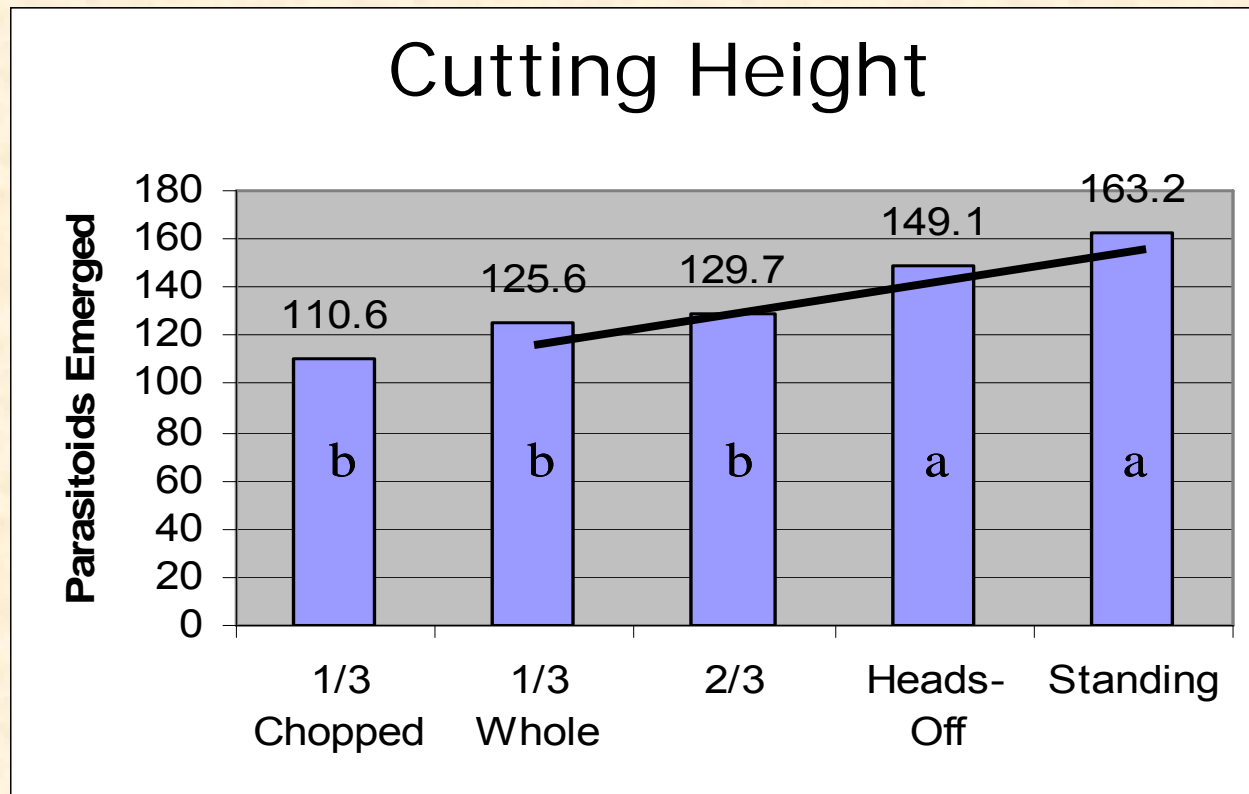
## Worst sawfly damage



\$30 → 9

Source: D. Weaver, MSU

# Parasitoid conservation



Taller residue  
is better

Source: D. Weaver, MSU

## Fallow management

Till or no-till?

$\frac{3}{4}$  of fields sampled had more parasitoids  
and less sawfly in no-till

Source: D. Weaver, MSU

# WSS Research Needs

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- Monitoring/scouting techniques and timing
  - Adult
    - Sweep net
    - Sticky traps?
  - Larvae
    - In split stems
    - % stem with sawfly larvae = infestation level
    - Infestation level  $\neq$  yield loss
- Economic thresholds
- Resistant varieties
  - Degree of solidity necessary for resistance
- Chemical control and timing?
- Impact on production in the region

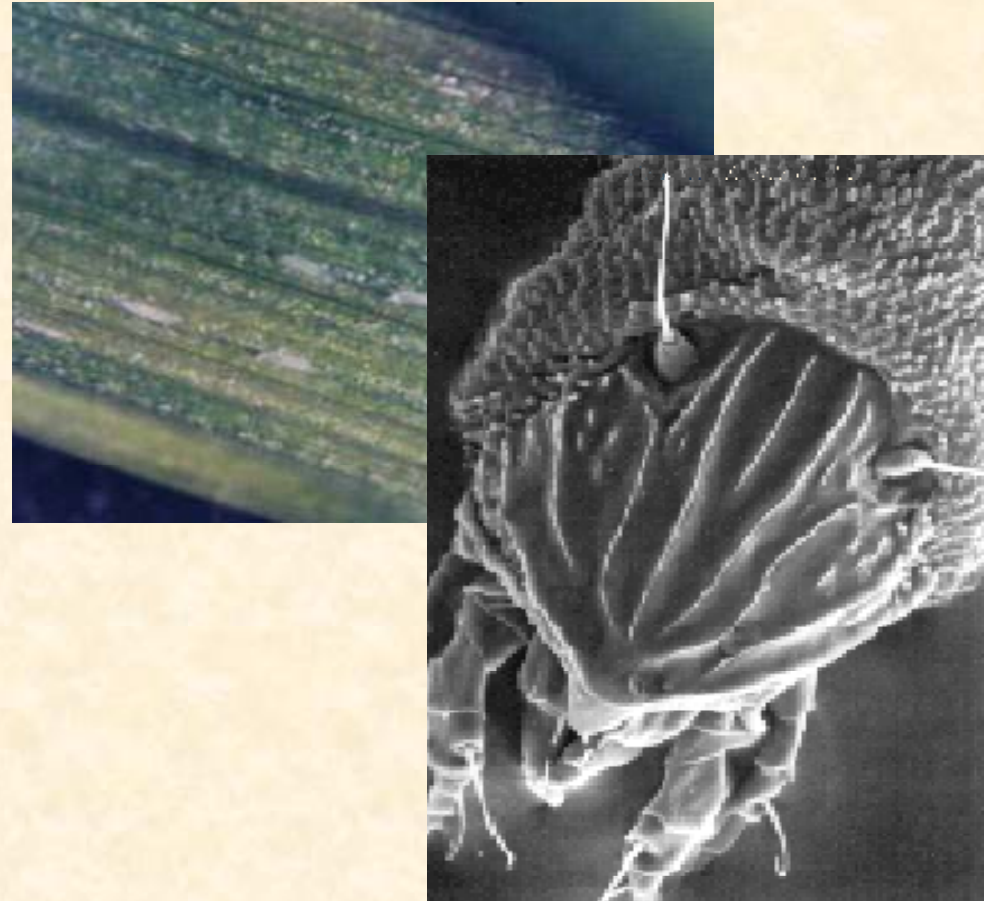


# Wheat Curl Mite

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- Eriophyidae mites
- 1/100<sup>th</sup> inch long
- Feed in protected areas of plant
- Life cycle completed in 8-10 days
- Several alternate grass hosts
  - Corn, wheat, grassy weeds
- Disperse via wind

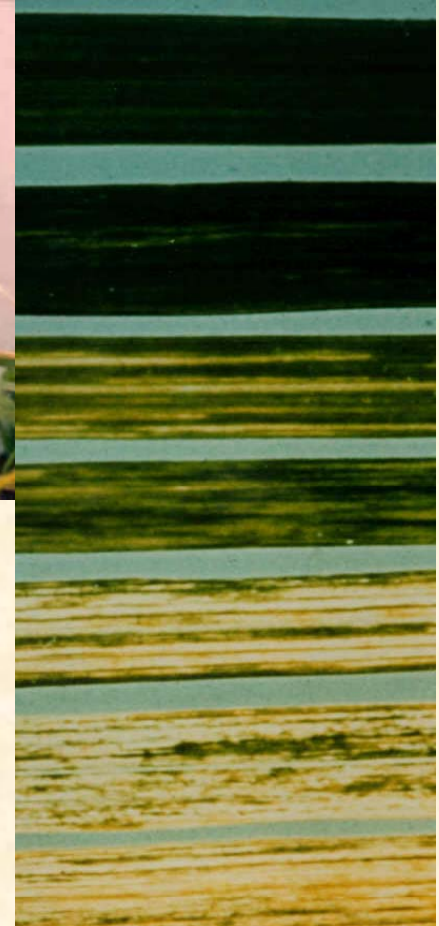


# Wheat Curl Mite Damage

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- Transmit Wheat streak mosaic virus
- Feeding damage causes leaves to curl
- Young plants may be stunted
- Tolerant corn hybrid may be source of infestation

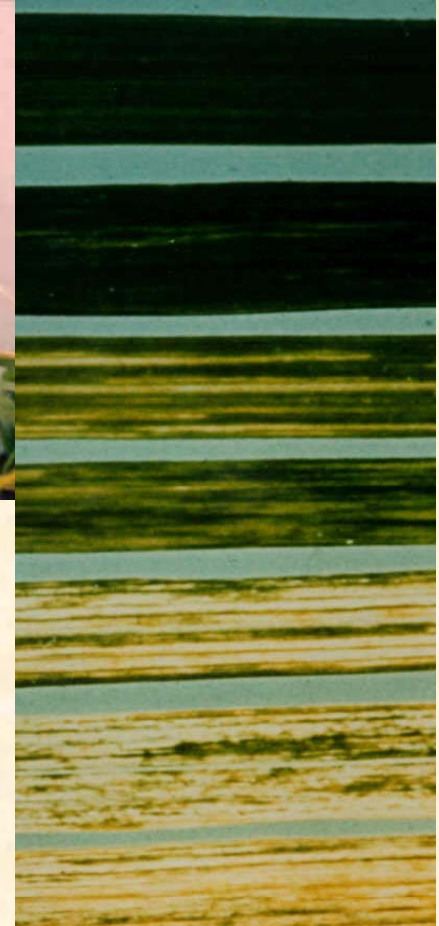


# Wheat Curl Mite Control

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- Break the “green bridge”
- At least two weeks with no green living material
- Control volunteer wheat
- Avoid early planting of winter wheat
- No insecticides work



***QUESTIONS?***