

Bugs that Bite into your Bottom Line: Bean Leaf Beetle & True Armyworm



***Janet Knodel & Patrick Beauzay
NDSU Extension Entomology***

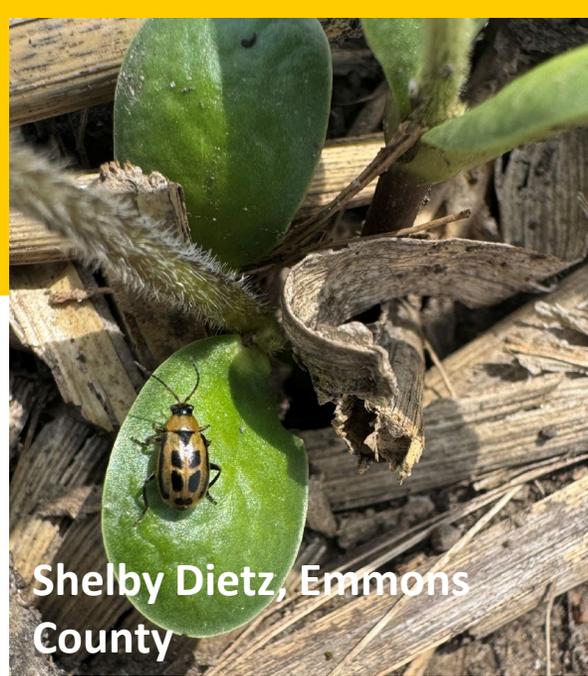


NDSU

EXTENSION

Bean Leaf Beetle

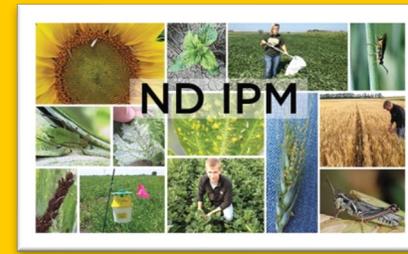
- **Adults**
 - ¼ inch long
 - **Color phases**
 - Red, yellow
- **Larvae**
 - Slender larvae
 - ⅓ inch long (mature)
 - White with brown head and anal plate
 - In soil (egg, larva, pupa)



Larva
Photo by J. Obermeyer

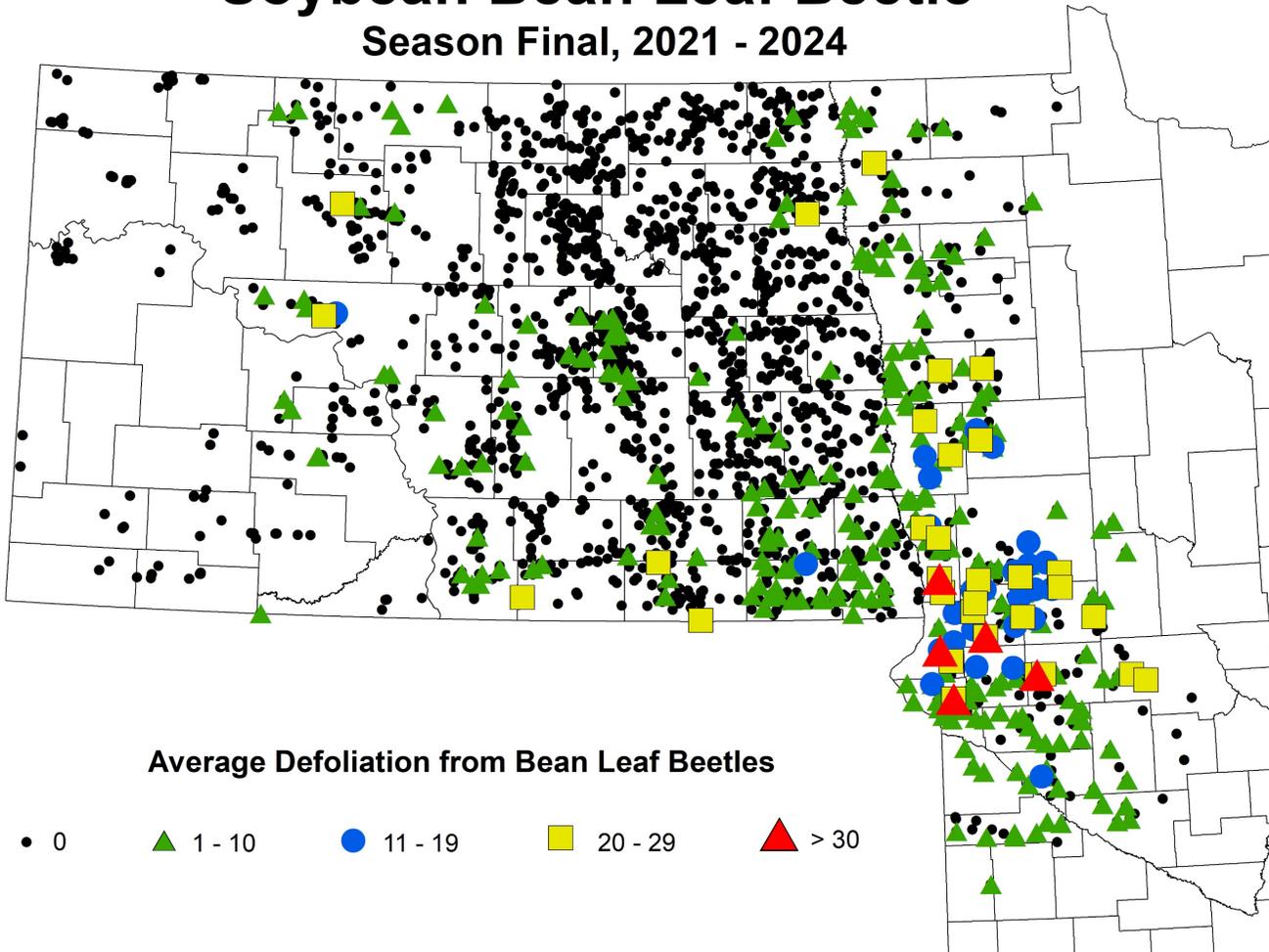


Bean Leaf Beetle 2021-2024 & 2025



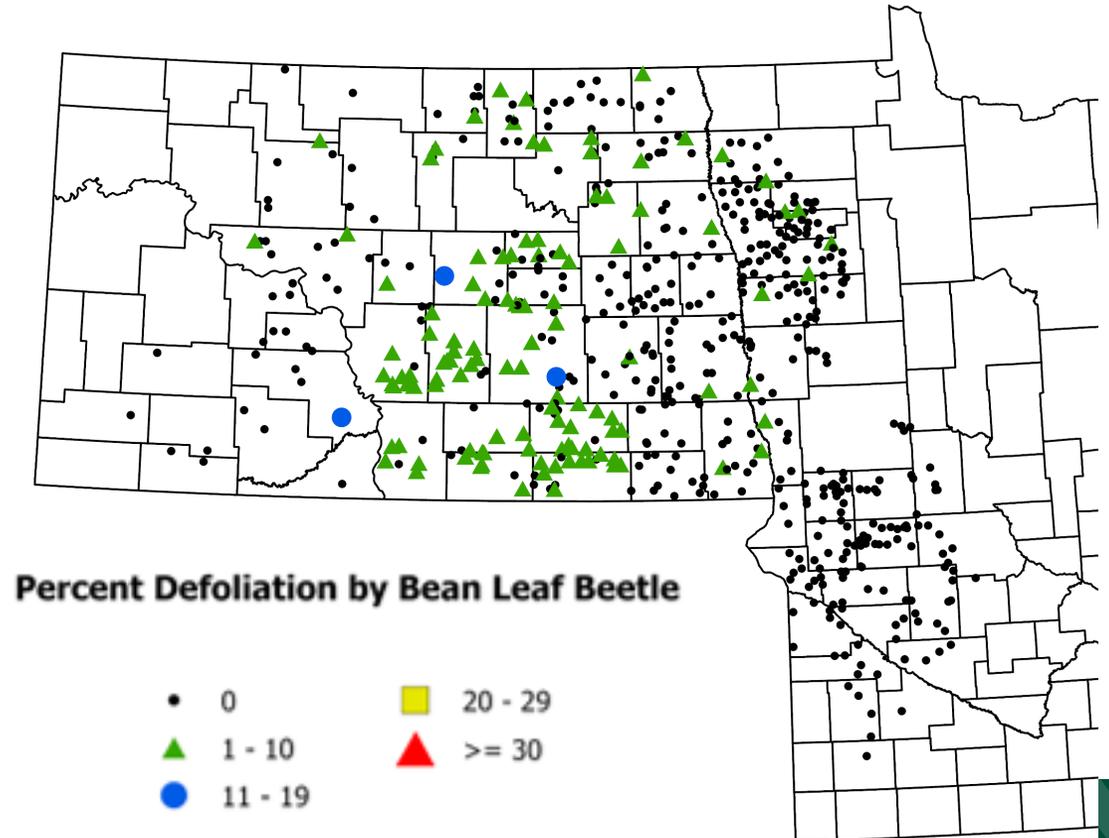
Soybean Bean Leaf Beetle

Season Final, 2021 - 2024



Soybean - Bean Leaf Beetle

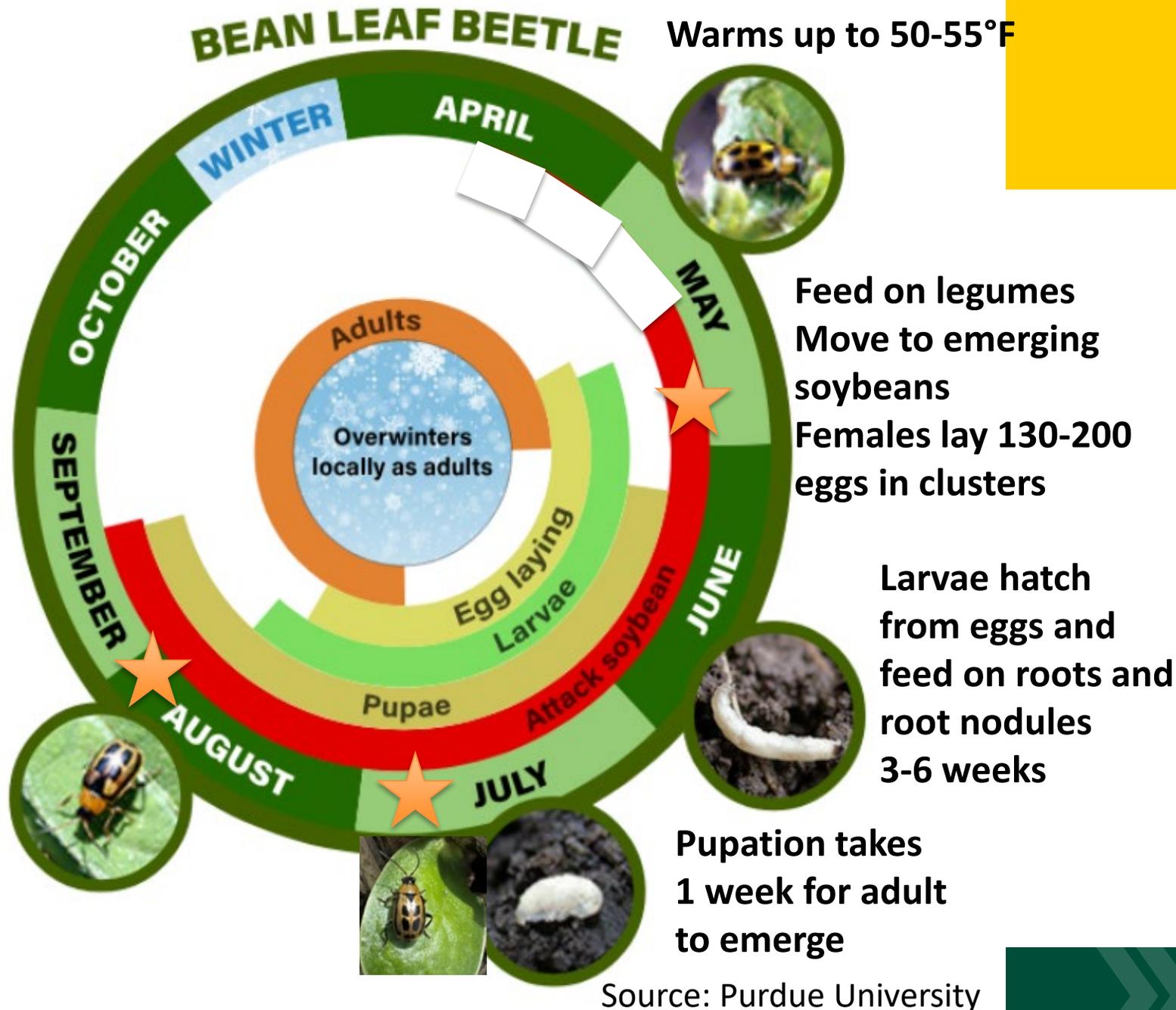
Season Final, 2025



Bean Leaf Beetle Life Cycle

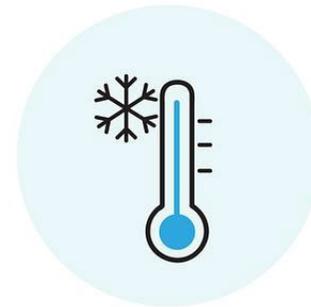
- 2 generations per year
- Adult beetles
 - Overwintering
 - 1st generation
 - 2nd generation

★ Crop damage by BLB



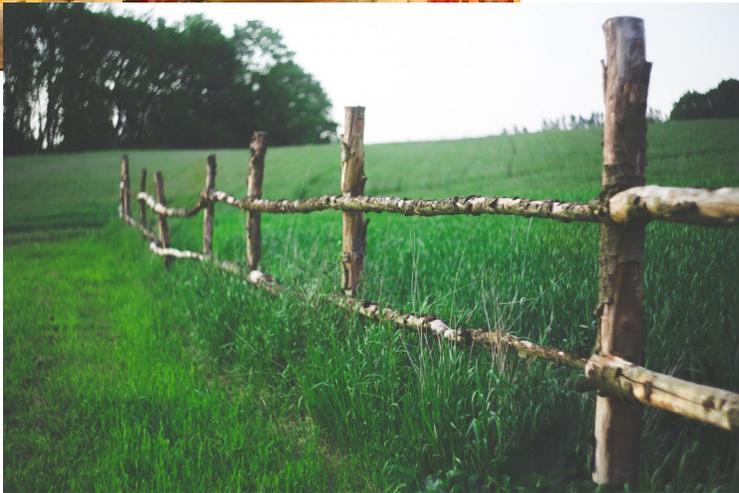
Bean Leaf Beetle – Adult Overwintering Mortality

- Negatively affected by cold air temperatures, particularly those below 14°F (-10°C)
 - Accumulation of sub-freezing temperatures = predictor of mortality
 - Models forecast the potential for early-season bean leaf beetle issues in the spring



Bean Leaf Beetle

Factors Affecting Winter Mortality



- Habitat: woodland leaf litter, grassy fencerows, and heavy crop residue
 - Mortality rates - higher in exposed areas like open soybean fields compared to protected woodland sites.

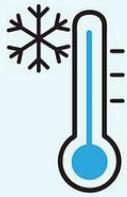
Bean Leaf Beetle – Factors Affecting Winter Mortality

- Snow Cover
 - protects the beetles from harsh air temperatures, allowing them to survive conditions that would otherwise be lethal
- Fluctuating Temperatures
 - negatively impact spring populations, likely by reducing their cold hardiness



Bean Leaf Beetle

Predictive Model for Adult Overwintering Mortality

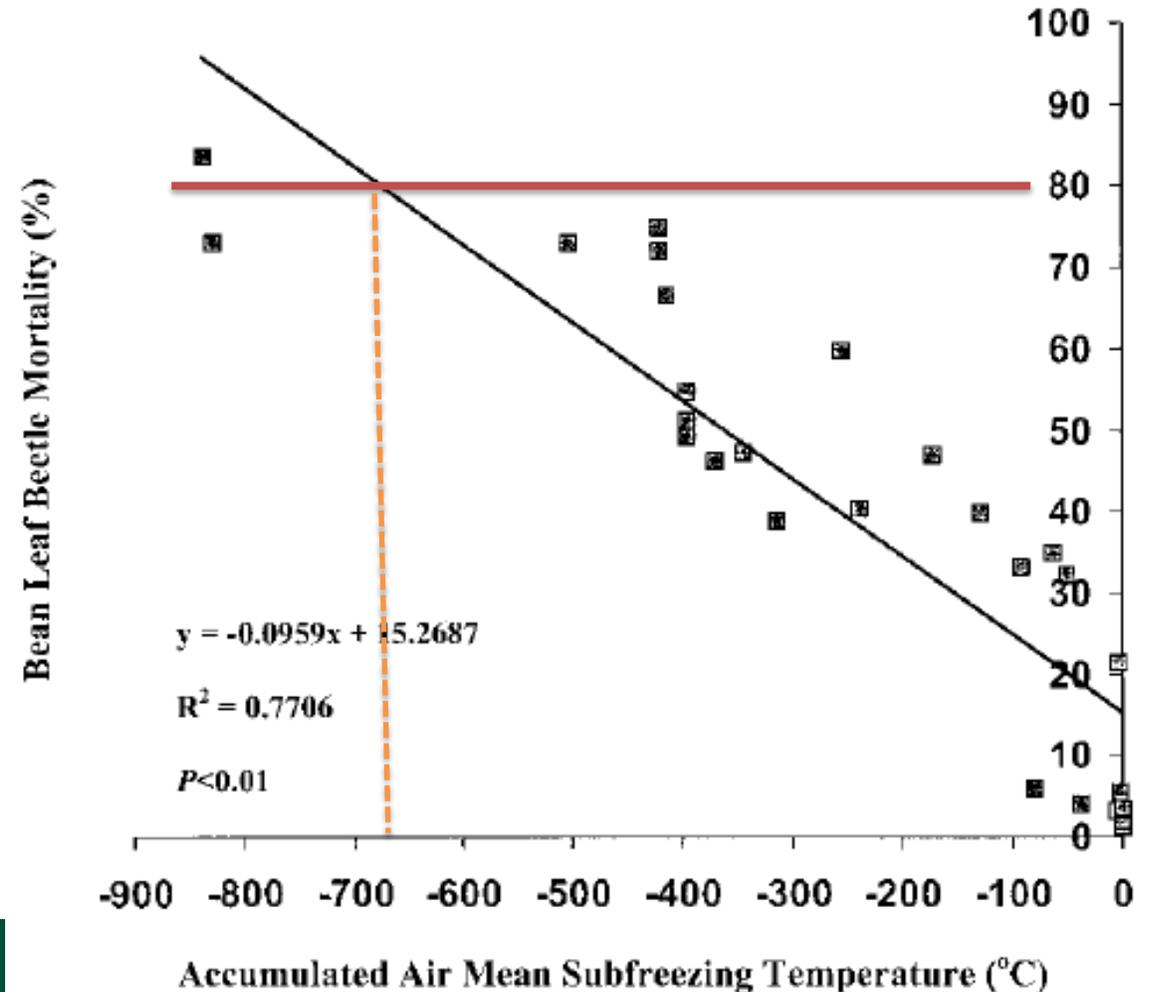


Accumulated Air Subfreezing
Temperature base = 14°F (-10°C)

Bean leaf beetle

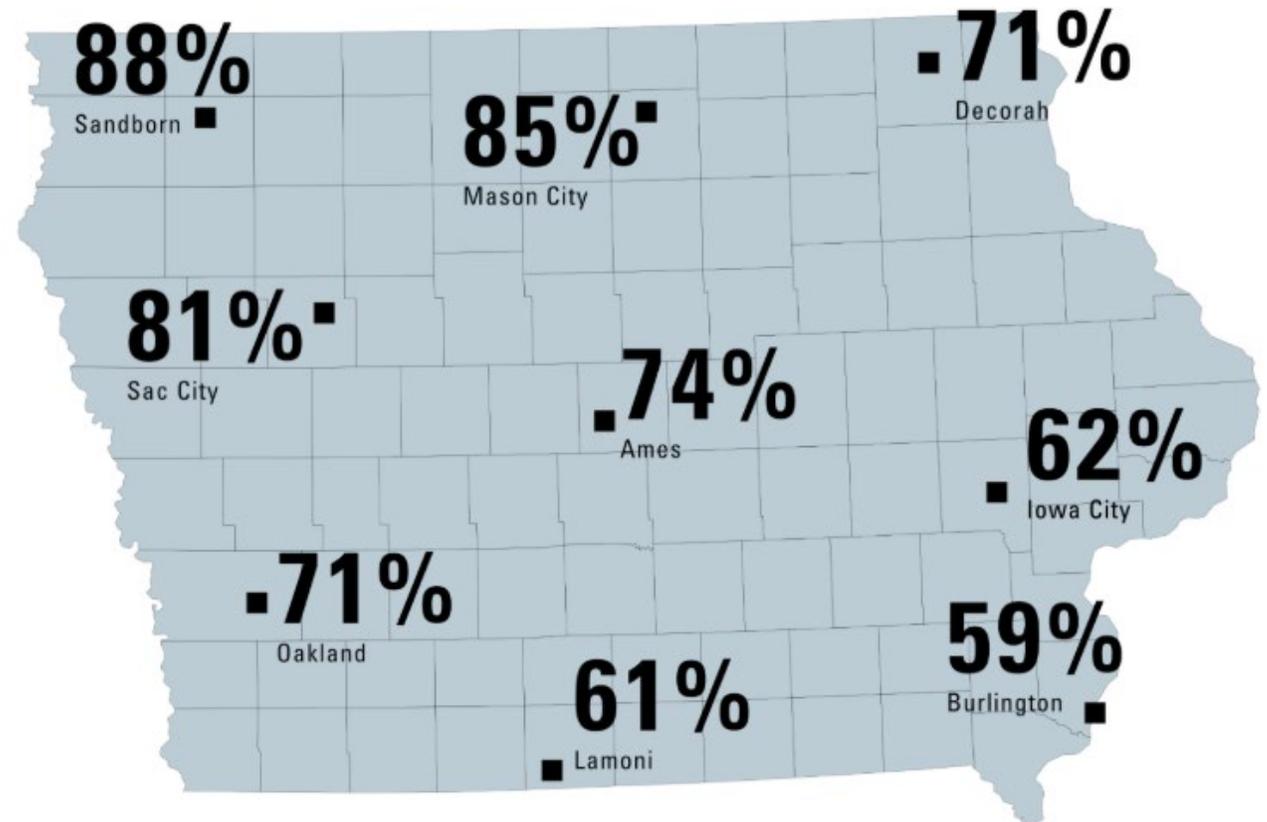


Lam and Pedigo. 2000. Environ. Entomol. 29:800-806.



Predicted Overwintering Mortality of Bean Leaf Beetle, 2024-2025

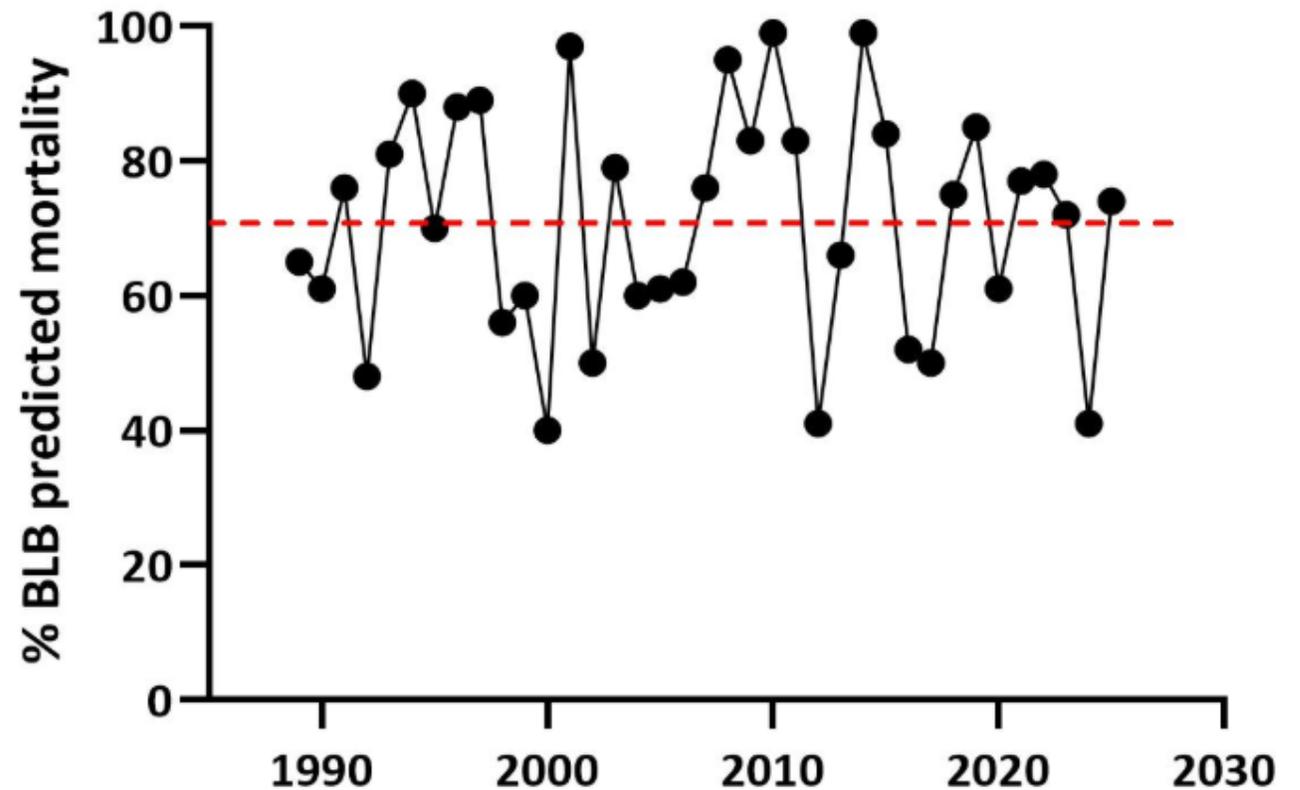
- Based on accumulated subfreezing temperatures during the winter (October 1, 2024 – April 15, 2025)



Source: <https://crops.extension.iastate.edu/cropnews/2025/04/near-average-bean-leaf-beetle-mortality>

Predicted Bean Leaf Beetle Mortality by Year for central Iowa

- Red dashed line = average mortality rate (71%)



Source: <https://crops.extension.iastate.edu/cropnews/2025/04/near-average-bean-leaf-beetle-mortality>

Bean Leaf Beetle – Crop Damage

- **Adult**

- Chewing mouthparts
- Foliage and pods
 - Shot holes in leaves (round holes)
 - Reduce photosynthetic area
 - Seedling - Plant stunting or death



Larva
Photo by J. Obermeyer



Bean Leaf Beetle – Crop Damage

- **Adult Beetle Pod Chewing**
 - **Vector Bean Pod Mottle Virus (BPMV)**
 - Adult beetles can overwinter with BPMV
 - **Entry point for Pathogens**
 - **Reduced seed quality – discolored, shriveled and moldy**



Figure 36.2. Bean pod mottle virus symptoms: (Left) leaf mottling and (Right) leaf yellowing. (Photos courtesy of Connie L. Strunk, SDSU Extension)

Bean Leaf Beetle – Crop Damage

- **Bean Pod Mottle Virus in seeds**

- Lower yield by 3-52% depending on cultivars and time of infection
- Increase risk of Phomopsis seed infection
- Concern for food-grade or seed soybeans



Seed coat of (A) healthy and (B) BPMV infected seeds. (Photo courtesy of Connie L. Strunk, SDSU Extension, Bugwood.org)

SDSU Plant Virology
UGA5077088

Bean Leaf Beetle – Economic Thresholds

- **Early feeding of the overwintering generation**
 - Difficult to scout for “sneaky”
 - Seedling stage
 - *5 or more BLB per foot of row (Purdue University)*
 - 2 to 8 beetles/plant (Iowa)
 - Controlled by insecticidal seed treatments

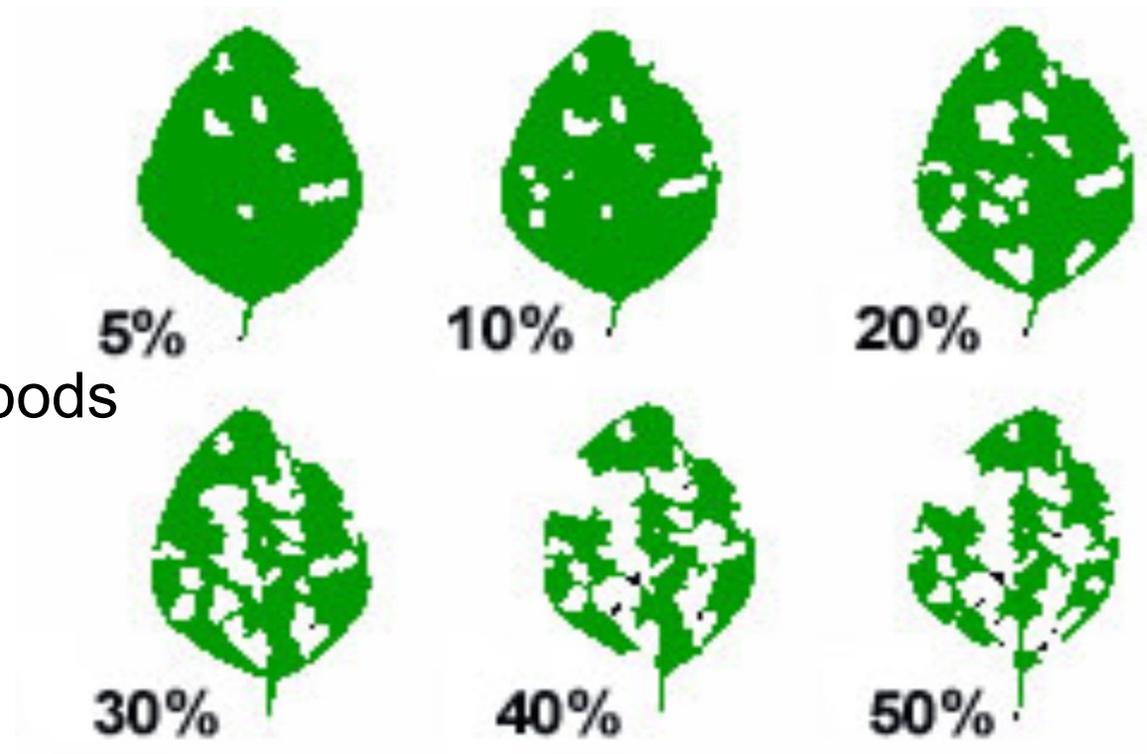


Bean Leaf Beetles - Soybean Insecticide Seed Treatments

| Insecticide | Example Trade Names |
|---|--|
| Neonicotinoids (Group 4A) | |
| Clothianidin | Intego Suite Soybeans, Poncho XC, Poncho Votivo, NipsIt Inside |
| Imidacloprid | Gaucho 600, Enhance AW |
| Thiamethoxam | Cruiser 5FS, Cruiser Maxx Vibrance, Lumisena Prime, Soystar Elite ST |
| Thiamethoxam + Abamectin (Groups 4A, 6) | Avicta 500FS, Avicta Complete Beans 500 |
| Diamides (Group 28) | |
| Cyantraniliprole | Lumiderm, Fortenza |

Bean Leaf Beetle Adults – Economic Thresholds

- **Past seedling stage to pre-bloom**
 - 30% defoliation
- **Bloom R1 to early seed R5**
 - 20% defoliation
 - 10% of pods are injured
 - Treat aggressively if BLBs are clipping pods
- **Full seed R6 to maturity**
 - 30% defoliation
 - Treatment is rarely justified



Soybean Insect Defoliation Training



Soybean Insect Defoliation Training

Soybeans

[Back](#)



Question

Please select the percentage that most closely reflects the image. Correct answers fall within an appropriate margin of error.

- 0%
- 1%
- 2%
- 5%
- 7%
- 10%
- 12%
- 15%
- 20%
- 25%
- 30%
- 40%
- 50%
- 60%
- 75%

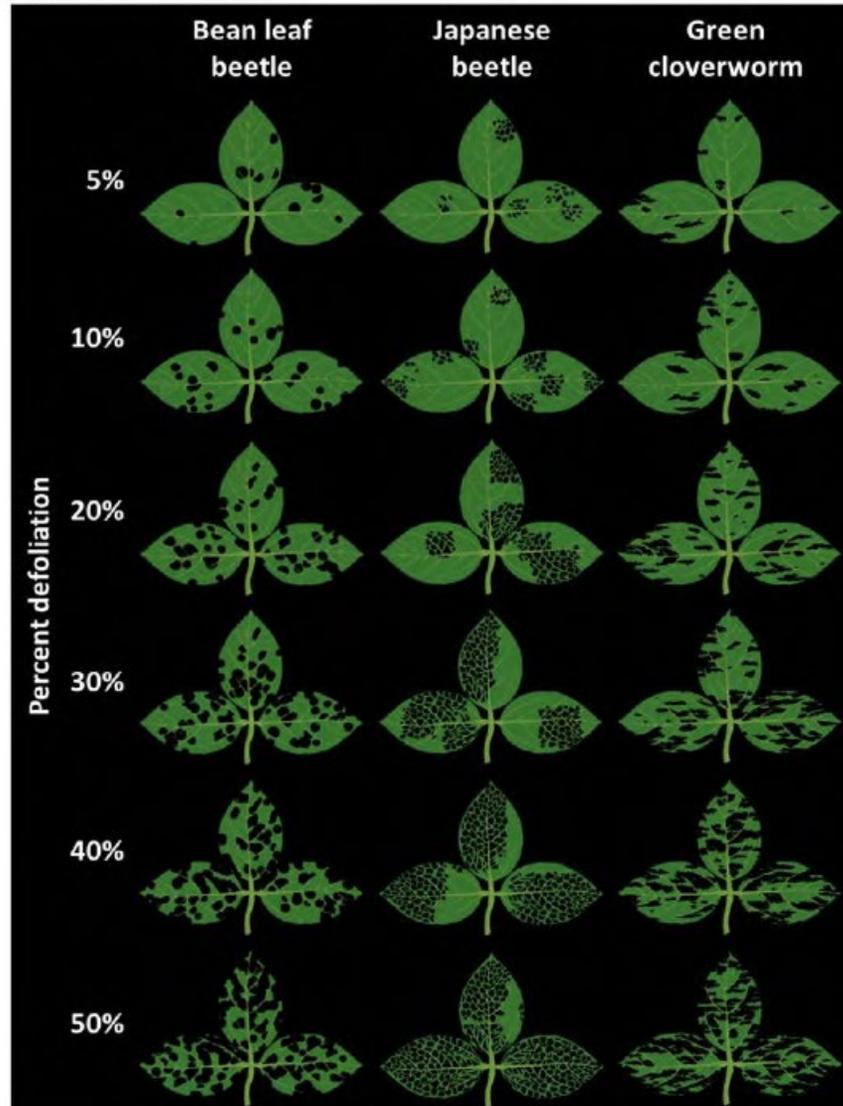
Nice Work!

22%

[Next Question](#)

Visual Guide for Estimation of Defoliation

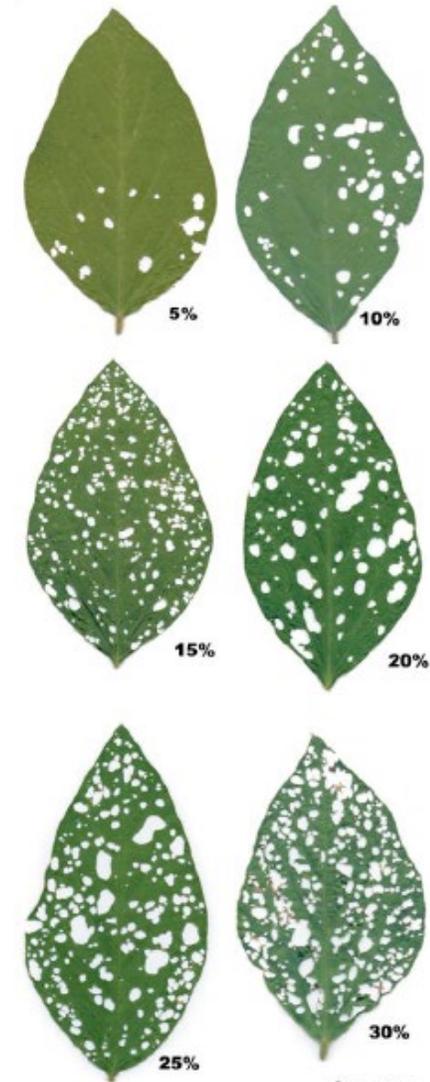
Robert Koch, Extension Entomologist



This visual guide was created to facilitate more accurate estimation of defoliation, which is often overestimated in soybean. Leaf images are from Defoliation.Pro.

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IOWA STATE UNIVERSITY Soybean Defoliation Estimation Sheet



©MARCUS E. RICK

From the Integrated Crop Management Newsletter IC-488(19), page 154.
Website: <http://www.ipm.iastate.edu/ipm/icm/> July 29, 2002

Bean Leaf Beetles

Soybean Foliar Insecticides

| Insecticide | Example Trade Names |
|---|---|
| Carbamates (Group 1A) Carbaryl Methomyl | Sevin XLR Plus Lannate LV |
| Organophosphates (Group 1B) Acephate Chlorpyrifos Chlorpyrifos + Lambda-cyhalothrin (Groups 1B, 3A) Dimethoate | Acephate 97UP Govern, Pilot 4E, Warhawk Clearform Lambdafos Dimate 4E, Dimethoate 400 |
| Pyrethroids (Group 3A) Alpha-cypermethrin Alpha-cypermethrin + Afidopyropen (Groups 3A, 9D) Beta-cyfluthrin Beta-cyfluthrin + Imidacloprid (Groups 3A, 4A) Bifenthrin Bifenthrin + Imidacloprid (Groups 3A, 4A) Bifenthrin + Chlorantraniliprole (Groups 3A, 28) Bifenthrin + Sulfoxaflor (Groups 3A, 4C) Bifenthrin + Zeta-cypermethrin Cyfluthrin Deltamethrin Esfenvalerate Lambda-cyhalothrin Lambda-cyhalothrin + Chlorantraniliprole (Groups 3A, 28) Lambda-cyhalothrin + Thiamethoxam Permethrin Zeta-cypermethrin | Fastac EC Renestra Baythroid XL Leverage 360 Brigade 2EC, Fanfare EC, Sniper Helios, Tundra EC Brigadier, Skyraider Elevest, Naxypro Plus Ridgeback Hero Tombstone Helios Delta Gold Asana XL Warrior II, Grizzly Too, Lambdastar Plus, Ravage II Besiege Endigo ZCX Arctic 3.2EC, Perm-UP 3.2EC Mustang Maxx |
| Neonicotinoids (Group 4A) Clothianidin Imidacloprid | Belay Admire Pro, Nuprid 4F Max |
| Meta-diamides (Group 30) Isocycloseram | Vertento |

New Insecticide in Soybeans – Vertento

- Plinazolin technology
 - Active ingredient - Isocycloseram

7.4 Soybean

| Crop | | | |
|---|----------------|--|---|
| Soybean | | | |
| Target Pest | Rate (fl oz/A) | Application Timing | Use Directions |
| Bean leaf beetle Green cloverworm Potato leafhopper Spider mites | 1.1 – 2.0 | Time applications to the most susceptible insect or mite pest life-stage at locally determined action thresholds before populations reach damaging levels. | Under high pest populations or when using aerial application, apply a higher rate within the labeled rate range. Apply this product, by ground or air, diluted in a minimum volume of 5 gal/A. |
| Brown stink bug Green stink bug | 1.6 – 2.0 | For stink bug control, apply when populations are high. | Under conditions such as high pest populations, dense foliage, or adverse weather conditions, apply a higher rate. |



2.6.2 POLLINATOR PRECAUTIONS

This product is highly toxic to bees and other pollinating insects exposed to direct treatment, or blooming crops or weeds. Protect pollinating insects by following label directions intended to minimize risk to these organisms.

The RT₂₅ (Residual Time to 25% mortality; the length of time over which field weathered foliar residues remain on the plant) for this product is ≤ 3 hours.

ISOCYCLOSERAM GROUP 30 INSECTICIDE

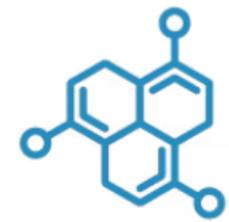
Vertento®

Escanee QR para Español

Insecticide

PLINAZOLIN® technology*
 For control of mites, thrips, true bugs, lepidopteran larvae, and other pests of the following crops: Bulb Vegetable Group, Crop Group 3-07; Cotton; Soybean

Active Ingredient:
 Isocycloseram**



Belongs to IRAC Group 30 with no known resistance or cross-resistance with other chemistries

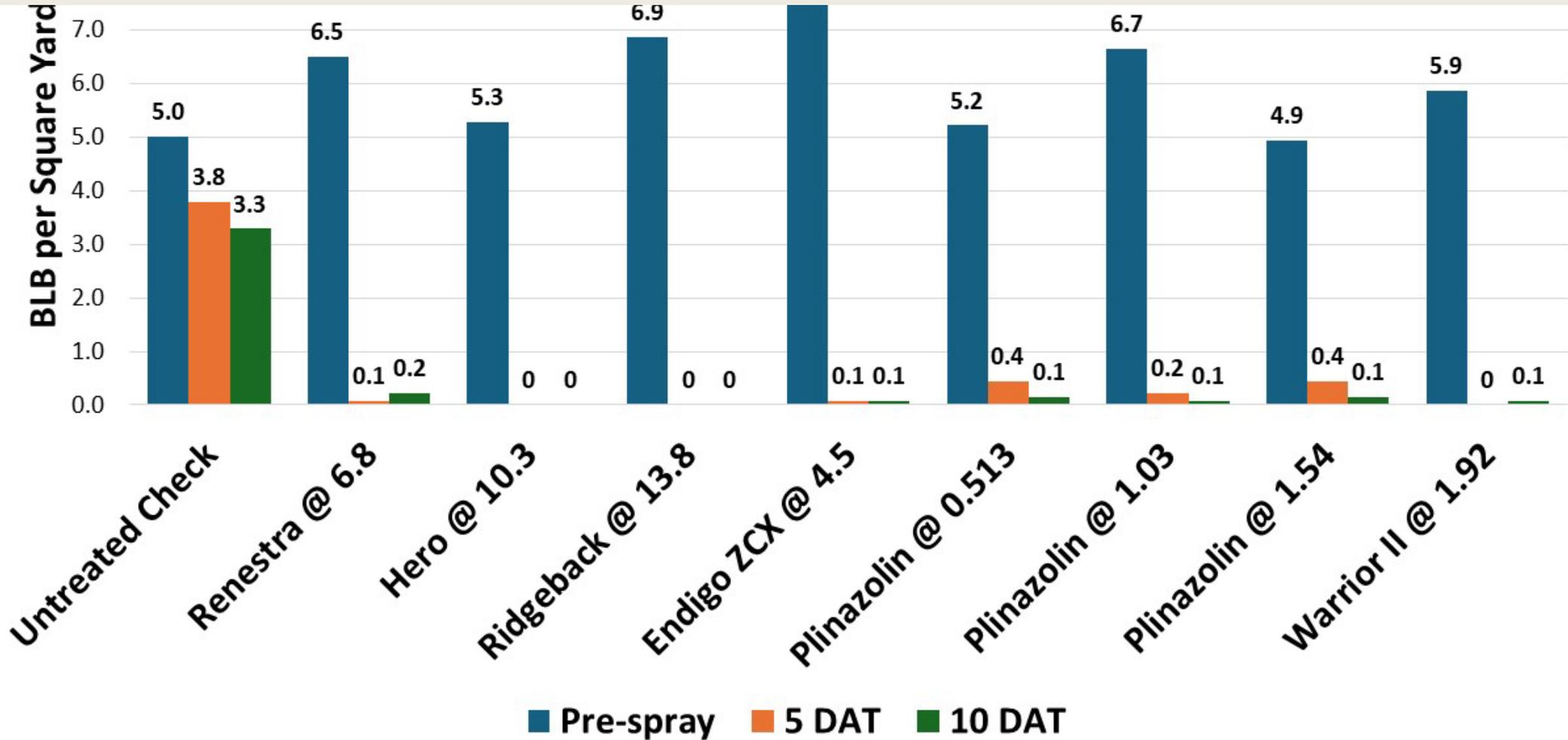
2022 Insecticide Trial

Bean Leaf Beetles in Soybeans

| Treatment Name | Active Ingredient(s) | IRAC Group | Rate(s) | Cost |
|--------------------------|------------------------------------|------------|---------------------------------|---------|
| Untreated Check | --- | | --- | --- |
| Renestra (BASF) | afidopyropen alpha-cypermethrin | 9D + 3A | 6.8 fl oz/acre | \$6.60 |
| Hero (FMC) | bifenthrin zeta-cypermethrin | 3A + 3A | 10.3 fl oz/acre | \$22.15 |
| Endigo ZC (Syngenta) | lambda-cyhalothrin thiamethoxam | 3A + 4A | 4.5 fl oz/acre | \$9.18 |
| Ridgeback (Corteva) | bifenthrin sulfoxaflor | 3A + 4C | 13.8 fl oz/acre | \$12.83 |
| Warrior II (Syngenta) | lambda-cyhalothrin | 3A | 1.92 fl oz/acre | \$5.91 |
| Plinazolin (Syngenta) | isocycloseram | 30 | 0.513, 1.03, 1.54 fl oz/acre | UNK |

Bean Leaf Beetle Insecticides, 2022

Excellent efficacy for all premixes and Plinazolin, and comparable to standard pyrethroid



NDSU Extension Soybean Insect Pubs



E1143-25

Please do not use beyond 12/31/2025

2025

North Dakota Field Crop Insect Management Guide

Prepared by
Janet Knodel, Professor and Extension Entomologist
Patrick Beauzay, Extension Entomology Research Specialist
Mark Boetel, Research and Extension Entomologist
Anitha Chirumamilla, Extension Cropping Systems Specialist

On the Web:

North Dakota State University Extension
ndsu.edu/agriculture/extension

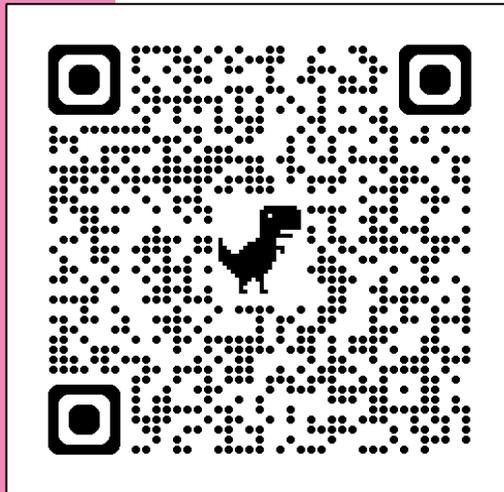
NDSU Extension Publications – Crops
www.ndsu.edu/agriculture/ag-hub/ag-topics/crop-production/crops

NDSU Extension Crop and Pest Report
ndsu.edu/agriculture/ag-hub/ag-topics/crop-production/crop-pest-report

Web Publication
www.ndsu.edu/agriculture/extension/publications/north-dakota-field-crop-insect-management-guide

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North Dakota State University
 Fargo, North Dakota



NDSU EXTENSION EXTENDING KNOWLEDGE CHANGING LIVES

E1678 (Revised, August 2025)

Management of Pyrethroid-resistant Soybean Aphids

Robert Koch, University of Minnesota
 Janet Knodel, North Dakota State University
 Erin Hodgson, Iowa State University
 Adam Varenhorst, South Dakota State University

Soybean aphids, *Aphis glycines* (Figure 1), are the most significant insect pest of soybean in Minnesota, Iowa, North Dakota and South Dakota. Insecticide resistance in this pest creates challenges for effective management and profitable soybean production. Resistance is defined as a decrease in susceptibility of a pest population to an insecticide that may result in failures when the product is used according to label recommendations for that pest. Pyrethroid-resistant populations of soybean aphids have been confirmed in Minnesota, Iowa, North Dakota and South Dakota. Field trials, laboratory bioassays and molecular testing have verified resistance to the pyrethroids bifenthrin and lambda-cyhalothrin. Growers have observed reduced effectiveness of these insecticides in commercial soybean fields.

Due to the mobility of winged aphids, resistant populations may spread to new areas. Extension entomologists recommend using insecticides with other modes of action instead of relying solely on pyrethroids to manage this threat and slow resistance development.



Figure 1. Soybean aphid infesting a soybean leaf. (Photo courtesy of R. Koch, University of Minnesota)

Management Strategies for Resistant Soybean Aphids

In response to the challenge that pyrethroid-resistant soybean aphids pose, we encourage growers, consultants and applicators to evaluate their soybean aphid management practices carefully. Best management practices include the following:

- Treat fields only when needed to reduce insecticide exposure to soybean aphids. This will reduce the selection pressure for further development of resistance.
 - ◆ Fields should be scouted on a regular schedule (every seven to 10 days).
 - ◆ Use the economic threshold (average of 250 aphids per plant with infestations increasing, and present on 80% of plants in the field) to determine when to apply insecticides.
 - ◆ Speed Scouting is another sampling method to determine if foliar insecticides are necessary. A tally threshold of 40 or more soybean aphids means plants are infested, and then the number of infested plants is used to make a treatment decision. A Speed Scouting form must be used (see weblink on last page).
 - ◆ Treat within five to seven days of reaching the economic threshold to protect yield.
 - ◆ Avoid treating after soybeans reach the full seed set stage, unless aphid populations are extremely high and plants are under stress (such as drought) in early R6.
- If a field exceeds the threshold, ensure the insecticide is applied correctly.
 - ◆ Use an effective (and labeled) insecticide at the full labeled rate.
 - ◆ Use proper nozzles, spray volume (15 to 20 gallons per acre by ground; 3 to 5 gallons per acre by air) and pressure (40 pounds per square inch).

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NDSU EXTENSION EXTENDING KNOWLEDGE CHANGING LIVES

E2006 (December 2020)

Common Arthropod Pests of Soybeans in North Dakota

Janet J. Knodel, Professor and Extension Entomologist
 Veronica Calles-Torrez, Post-doctoral Scientist

Foliage Feeding Caterpillars

Green Cloverworm

Caterpillar (larva, Figure 1): Mature larva about 1 1/4 inches long. Pale green, with one long narrow white stripe on each side, three pairs of fleshy prolegs at the corner part of the body and one pair of prolegs at the rear end. Moves in a looping behavior.

Soybean Aphid

Nymph (Figure 5): Similar to adult, but smaller and wingless.
Adult (Figure 6): Small, about 1/4 inch long, light yellowish-green pear-shaped body, black cornicles (look like talpae on posterior end), either winged or wingless.
 Both nymphs and adults feed on plant juices.

NDSU EXTENSION EXTENDING KNOWLEDGE CHANGING LIVES

E2006 (December 2020)

Soybean Gall Midge and White-mold Gall Midge in Soybean

Veronica Calles-Torrez, Post-doctoral Scientist
 Patrick B. Beauzay, Integrated Pest Management Coordinator and Research Specialist
 Alexander H. Knudsen, Extension Entomological Diagnostician
 Janet J. Knodel, Professor and Extension Entomologist

Two fly midges are associated with soybeans: the soybean gall midge, *Resseliella maxima* Gagné (Figure 1), and the white-mold gall midge, *Acanthomyia caulecola* (Coquillett) (Figure 2).

The soybean gall midge is a new economic insect pest of soybeans, which first was reported causing yield losses in Nebraska, Iowa and South Dakota soybean fields in 2018. This pest also was detected in Minnesota in 2018 and Missouri in 2019. The known distribution of soybean gall midge continues to expand in the five infested states, and infestations in South Dakota and Minnesota border southeastern North Dakota.

Soybean gall midge has not been detected in North Dakota based on our 2019-2020 surveys. A total of 78 fields in 11 counties in 2019 and 605 fields in 47 counties in 2020 were surveyed. Continued monitoring for this pest is crucial to detect its arrival in our state in order to be proactive in its pest management.

During 2019 soybean surveys, the white-mold gall midge was found in Minnesota and North Dakota; however, it is widespread in the northern region of the U.S. This tiny gall midge usually is associated with the fungus *Sclerotinia* spp. or white mold. **The white-mold gall midge is not an insect pest of soybeans,** and it primarily has been reported as a white mold fungus feeder.



Figure 1. Adult female (left) and male (right) soybean gall midge (© Helen, Iowa State University)



Figure 2. Adult white-mold gall midge (© Alison De Torres, Laboratoire d'Expertise de Diagnostic en Phytoprotection, Ministère de l'Agriculture, Québec, Canada)

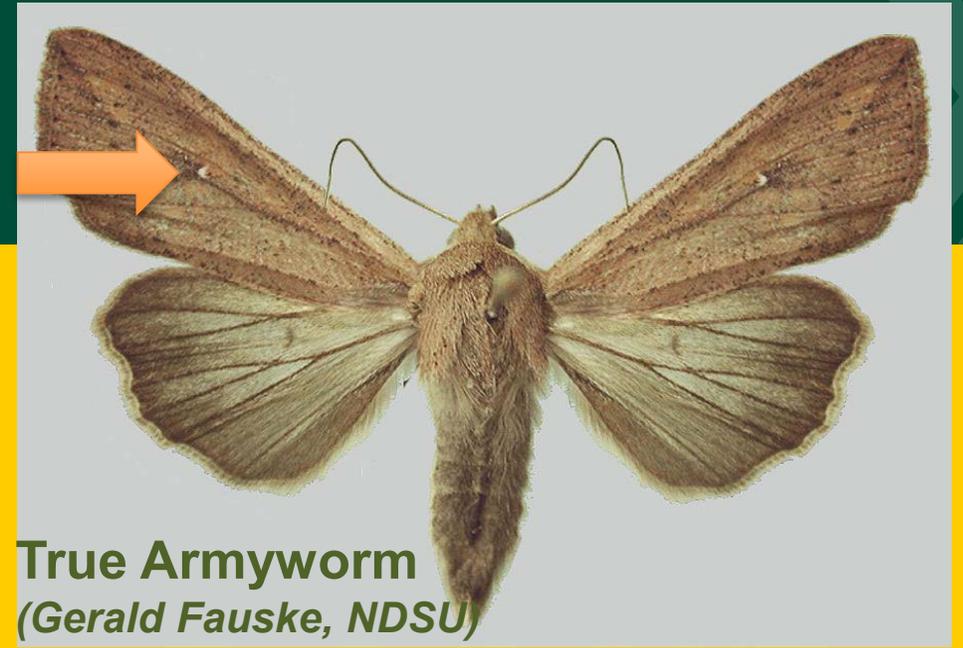
NDSU EXTENSION

North Dakota State University
 Fargo, North Dakota

True Armyworm (*Mythimna unipuncta*)

Identification

- Noctuidae insect family
- **Adults:**
 - 1½ wing span
 - Pale brown moth with a small white spot on each forewing
- **Larvae: Caterpillars**
 - 1.5” long, with a series of alternating dark and light stripes along the body
 - Light yellowish-brown head capsule, often with a net-like pattern
 - 5 pairs of fleshy prolegs with a dark band



True Armyworm
(Gerald Fauske, NDSU)

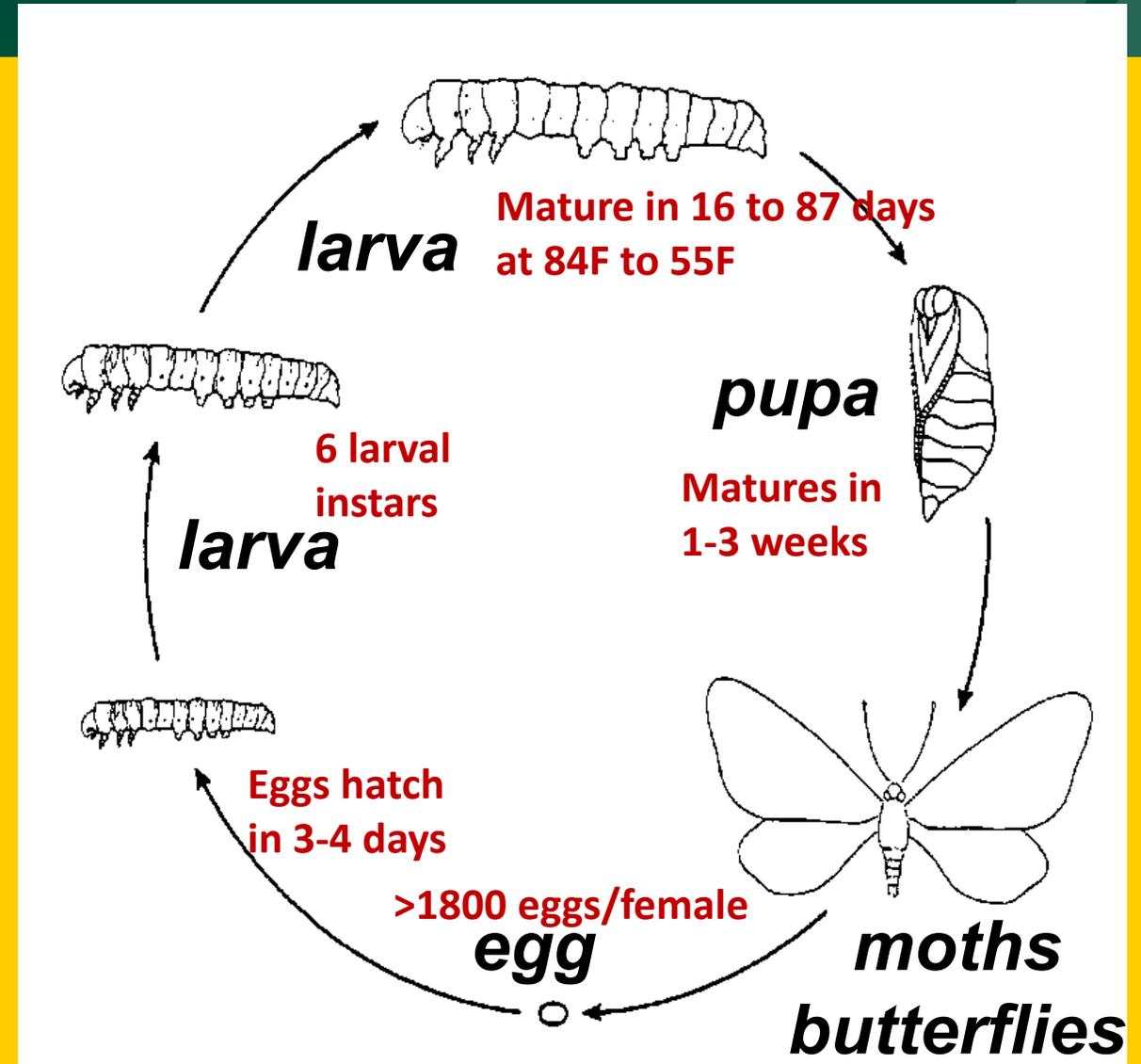


True Armyworm on wheat head
(Patrick Beauzay, NDSU)

Life Cycle of Foliage-feeding Caterpillars

Complete Metamorphosis

- Egg to larval stages to pupa to adult
- Larva
 - Chewing mouthparts
- Pupal stage
- Adult moth emerges from the puparium
- Complete one generation (egg to moth) in 35-60+ days
 - 575 DD (base 50F)



True Armyworm - Biology

- **Not survive our cold winters!**
- **Migratory (and reverse migration in fall)**
 - June to early July in ND & MN
- **2 generations per year in ND & MN**
- **Eggs**
 - Laid at night in moist, shady areas in small grain fields
 - Lodging or hail damage
- **Larvae can move in 'armies' when food runs out**



True Armyworm larvae
(Bruce Potter, University of MN)

Average armyworm larval measurements and damage to the crop

| Instar | Body length (mm) | Head capsule width (mm) | Avg days / life stage ² | Corn foliage consumption (mg) ³ | Percent of total foliage consumption ³ |
|--------|------------------|-------------------------|------------------------------------|--|---|
| 1 | 1.8 | 0.35 | 4.8 | 1 | 0.1 |
| 2 | 1.8 | 0.57 | 3.3 | 1.5 | 0.2 |
| 3 | 7 | 0.94 | 3.3 | 6 | 1.2 |
| 4 | 11 | 1.5 | 3.8 | 21 | 4.2 |
| 5 | 18-20 | 2.3 | 4.4 | 75 | 14.9 |
| 6 | 30-35 | 3.0-3.5 | 10.3 | 400 | 79.3 |

¹After Breeland, 1958.

²After Guppy, J.C. 1951. Three-year average in an Ontario, Canada environment (1957-1959).

³Adapted from Mukerji, M.K. and J.C. Guppy (1970). Estimated individual instar values determined from measurement of the manuscript's graphic data.

True Armyworm – Host Crops

- Hosts
 - Grasses, small grain crops and corn
 - Non-preferred hosts - Alfalfa, beans, clover, flax, millet, and sugarbeets



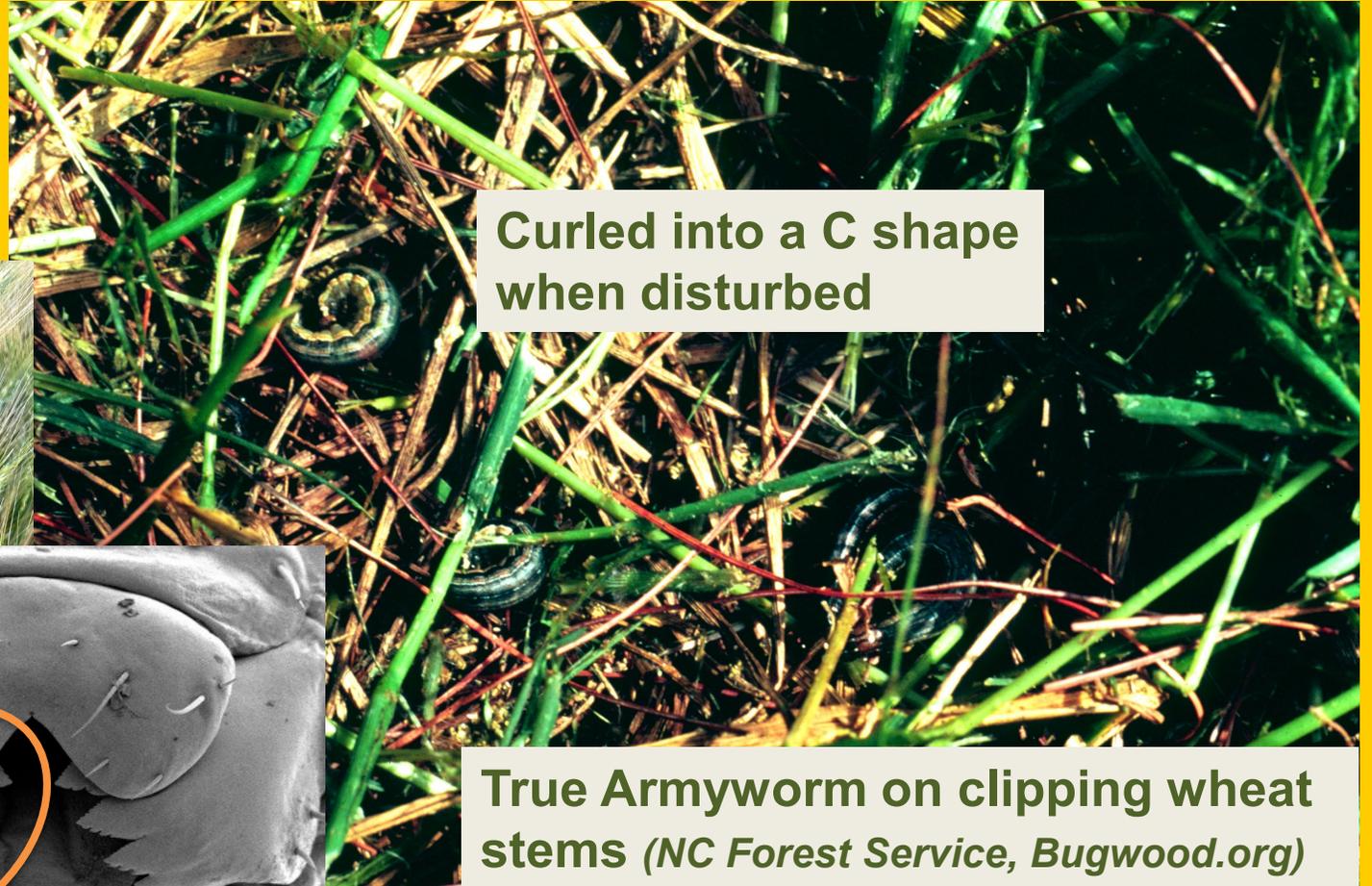
True Armyworm on grasses
(Gerald Fauske, NDSU)



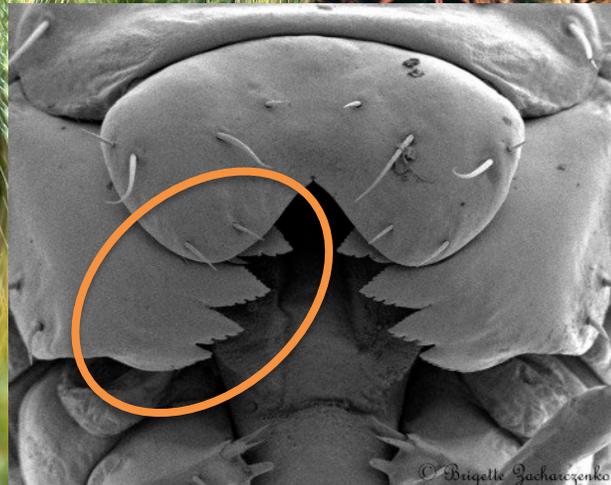
True Armyworm on corn leaves
(Bruce Potter, UMN)

True Armyworm – Crop Damage by Larvae

- Defoliation
- Clipping stems/heads



Curled into a C shape when disturbed



True Armyworm on clipping wheat stems (NC Forest Service, Bugwood.org)

Wheat Defoliators: True Armyworm

Armyworm E.T. in Small Grains (wheat, barley, oats)

- Preheading – 4 or more larvae per square foot
- Heading (head clipping): 2 or more larvae per square foot



True Armyworm on wheat head (*Patrick Beauzay, NDSU*)



True Armyworm killing seedling wheat (*Ian MacRae, UMN*)



True Armyworm on clipping wheat stems (*NC Forest Service, Bugwood.org*)

Corn Defoliators: True Armyworm

True Armyworm E.T. in Corn

- **Seedling corn: 10% of plants damaged and larvae $< \frac{3}{4}$ "**
- **Whorl stage: 25% of plants damaged with 2 larvae per plant or 75% with 1 larva per plant**
- **Tassel stage: Defoliation at or above the ear leaf**

Corn defoliated by true armyworms after a rye cover was terminated
(Bruce Potter, UMN)



True Armyworm Trapping

Above 60 moths per night =
armyworm problem



Blacklight trap



True Armyworm moth
(Gerald Fauske, NDSU)

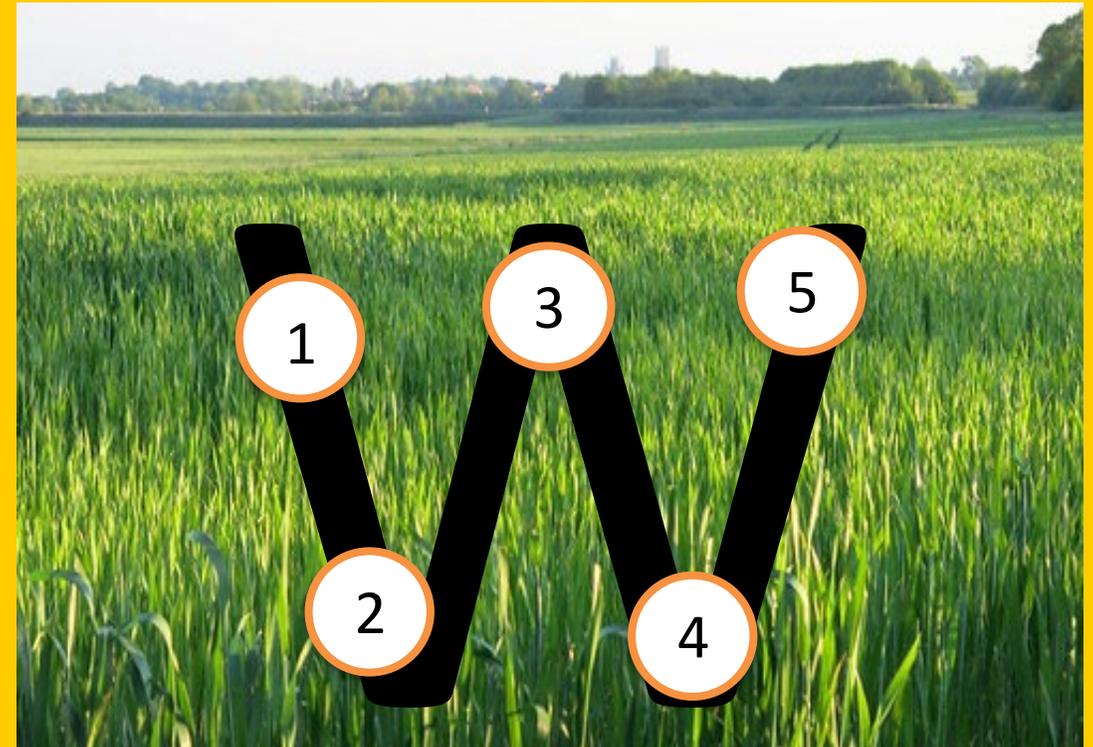
No correlations with moth
catch to crop damage



Green bucket trap
(Janet Knodel, NDSU)

True Armyworm – Scouting

- **Initial field scouting** - field margins, low areas with thick grass and lodged wheat
- **Where to look for larvae**
 - Beneath plant debris around the base of plants
 - Heads of wheat and barley



True Armyworm – Scouting

- Symptoms of armyworm feeding:
 - Leaf defoliation
 - Worm frass (droppings) on ground or leaves
- Finding mature larvae or pupae indicates that feeding is ending

True Armyworm killing seedling wheat (*Ian MacRae, UMN*)



Noctuid pupa (*Whitney Cranshaw, CSU, Bugwood.org*)



High Risk Fields for True Armyworm Crop Damage

- Cool wet weather
- Multiple weather systems bringing moisture and insects
- Early-planted small grains
- Lodged/hailed wheat field or late-terminated grass cover crops like rye
- Grassy weeds or grass cover crops
- Larvae are not parasitized/diseased

Parasitic Tachnid fly eggs behind the head of True Armyworm on wheat head
(*R.J. Bauernfeind, KSU, Bugwood.org*)



True Armyworm – Insecticide Control

- Use Economic Threshold
- Apply at dawn or dusk* (night)
- Proper pesticide application
- High labeled rate for larvae $>3/4$ inch
- No pyrethroid-resistance documented
- Poor efficacy: coverage, environmental conditions, short insecticide residual, missing late or early hatching larvae, application too late (non-feeding prepupae larvae)



True Armyworm - Wheat Insecticide Seed Treatments

| Insecticide | Example Trade Names |
|----------------------------|---------------------|
| Diamides (Group 28) | |
| Chlorantraniliprole | Lumivia CPL |

*** Neonicotinoid (Cruiser, Gaucho, Poncho) seed treatments at high rate = partial control or suppression when true armyworms arrive early**

True Armyworm

Wheat Foliar Insecticides

| Insecticide | Example Trade Names |
|---|---|
| Organophosphates (1B) Chlorpyrifos Chlorpyrifos + Lambda-cyhalothrin (Groups 1B, 3A) Malathion | Govern, Pilot 4E, Warhawk Clearform Lambdafos Malathion 57EC |
| Pyrethroids (Group 3A) Alpha-cypermethrin Beta-cyfluthrin Cyfluthrin Lambda-cyhalothrin Lambda-cyhalothrin + Chlorantraniliprole (Groups 3A, 28) Zeta-cypermethrin | Fastac EC Baythroid XL (target early instars) Tombstone Helios (target early instars) Warrior II, Grizzly Too, Lambdastar Plus, Ravage II Besiege Mustang Maxx |
| Diamides (Group 28) Chlorantraniliprole | Coragen eVo, Vantacor |
| Spinosyns (Group 5) Spinetoram Spinosad | Radiant SC Blackhawk, Entrust SC |
| Microbial Midgut Disruptors (Group 11A) <i>Bacillus thuringiensis</i> (Bt) | Biobit HP, DiPel DF, XenTari DF (target early instars) |

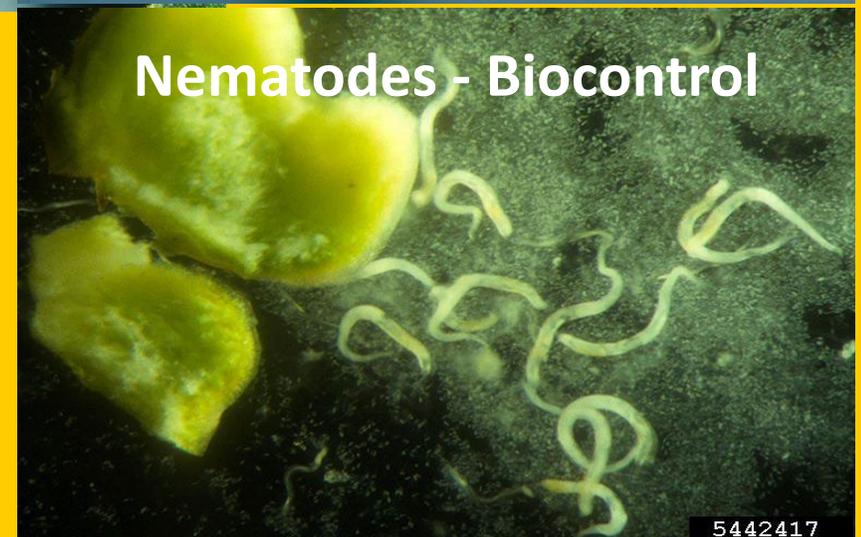
Natural Control

- Diseases

- Fungal (*Nomuraea rileyi*)
- Viral
 - Nuclear polyhedrosis virus
- Favored by high humidity and warm temperatures

- Parasitic wasps

- Predators



Natural Control

- **Predators**

- **Ground beetles, predaceous stink bugs, birds, frogs, rodents**



NDSU Wheat Insect Resources

E1479 (Revised)



Integrated Pest Management of Wheat Stem Sawfly in North Dakota

Wheat stem sawfly adult
(R.K.D. Peterson, Montana State University)

Janet Knodel
Department of Plant Pathology
NDSU, Fargo, N.D.

Thomas Shanower
U.S. Department of Agriculture –
Agricultural Research Service Center for
Grain and Animal Health Research
Manhattan, K.S.

Patrick Beauzay
Department of Plant Pathology
NDSU, Fargo, N.D.

Distribution and History

Wheat stem sawfly, *Cephus cinctus* Norton (Hymenoptera: Cephalidae), is widely distributed across North America, from California to the Mississippi River and from British Columbia to Manitoba. It has been reported from as far south as Kansas and New Mexico.

Many authorities consider it a native North American insect that adapted to wheat as European settlers began large-scale cultivation of cereal crops. Alternatively, some researchers have suggested that the wheat stem sawfly may have been introduced into North America inadvertently from northeastern Asia. Whatever its origins, wheat stem sawfly is the most serious insect pest of spring wheat and durum wheat in North Dakota.

Wheat stem sawfly first was reported as a pest of wheat in Saskatchewan and Manitoba in the late 1890s. In 1906, larvae were found attacking wheat in south-central North Dakota. By 1909, losses of up to 25 percent were reported around Minot and in the Red River Valley near Fargo.

The North Dakota infestation reached epidemic levels in 1916 but receded rapidly, and by the early 1920s, wheat stem sawfly was a pest of minor importance. During the 1940s, wheat stem sawfly again became a problem, with as much as 50 percent crop loss reported in northwestern North Dakota.

Sawfly populations have fluctuated across years and locations, although infestation levels and damage are greatest in western North Dakota. Wheat stem sawfly has increased steadily in the past 10 years, with the heaviest economic loss occurring in southwestern North Dakota.

In 2009, a survey of wheat producers statewide revealed that crop loss due to wheat stem sawfly ranged from 10 to 25 percent. However, some fields in southwestern North Dakota had severe lodging, and 100 percent of the spring wheat fields were lost due to wheat stem sawfly in 2009. Based on current production totals and crop values, North Dakota wheat producers lost between \$25 million and \$70 million in 2009.

NDSU EXTENSION SERVICE
North Dakota State University
Fargo, North Dakota

Revised and reprinted Feb. 2016

E1230 (REVISED)

NORTH DAKOTA SMALL-GRAIN INSECTS

Cereal Leaf Beetle

Oulema melanopus (L.) (Coleoptera: Chrysomelidae)

Revised by
Janet J. Knodel, Extension Entomologist
Lesley Lubenow, Area Extension Specialist / Cropping Systems



Figure 1. Adult CLB.
(Photo by J. Knodel, NDSU)

The cereal leaf beetle (CLB) is an imported insect pest from Europe. It first was detected in Michigan in 1962. Cereal leaf beetle spread into all states east of the Great Plains and into Idaho, Montana, Utah, Wyoming and

DESCRIPTION

Adult — The adult beetle is ¼ inch long with a brightly colored orange-red thorax, yellow legs and metallic blue head and wing covers (Figure 1).

Eggs — Newly laid eggs are bright yellow, darkening to orange brown and finally to black before they hatch (Figure 2).

Larva — The larva has a light yellow body with brown head and legs (Figure 3). They have three pairs of legs close to the head end. The body is protected by a layer of

NDSU EXTENSION
E830 (Revised)

EXTENDING KNOWLEDGE » CHANGING LIVES

The Armyworm and the Army Cutworm

Armyworm and army cutworm feed on a wide variety of crops in North Dakota. Although the names are similar, these two insects are distinct, feeding at different times during the growing season. Identifying and finding these insects, and recognizing when they become an economic threat will aid in successful pest management.



Figure 1. Armyworm moth. (G. Fauske, NDSU)

Revised by: **Janet J. Knodel**, Professor and Extension Entomologist
Travis J. Prochaska, Area Extension Crop Protection Specialist

Armyworm

Mythimna unipuncta (Haworth)
Lepidoptera: Noctuidae

Description

The adult armyworm is a light brownish gray moth or "miller" (Figure 1) with a conspicuous white spot about the size of a pinhead on each front wing. When expanded, the wings are about 1½ inches across.

Armyworm larvae (Figure 2) have five pairs of prolegs. Their color varies from pale green to tan in the early growth stage to dark green to black in later stages. The head capsule is brown with netlike patterns.

Full-grown larvae are smooth, striped and almost hairless. They grow to a length of 1½ to 2 inches. A series of longitudinal stripes on the body are arranged as follows:

- Thin, white, broken line down the middle of the black
- Wide, dark, mottled stripe halfway down the side
- Pale orange stripe with white border
- Brownish mottled stripe
- Another brownish mottled stripe slightly above the legs

Life Cycle

The armyworm does not survive North Dakota winters. Armyworm infestations are due to moth migrations from the South. Heavy infestations in southern states produce large moth numbers that fly or are blown northward on southerly winds. Moth numbers in the northern states are significantly reduced during winter.

E1330 (Revised)



INTEGRATED PEST MANAGEMENT of the Wheat Midge in North Dakota

Revised by
Janet Knodel, Extension Entomologist and
Associate Professor

Introduction and Distribution

Wheat is the most widely cultivated plant in the world, providing more than 20 percent of the food calories consumed. The wheat midge (or orange wheat blossom midge), *Sitodiplosis mosellana* (Géhin) (Diptera: Cecidomyiidae), is one of the most destructive pests of wheat. The first reference to a wheat midge larva in wheat was in 1741 in England, although researchers are uncertain if it is the same midge causing trouble today. Wheat midge originated in Europe, and the first record of its occurrence in North America was from Quebec in 1828. Since then, it has been recorded in various locations throughout the Old World and New World, especially in North America, Europe and China. In recent years, wheat midge infestations have been reported in Minnesota, Montana, North Dakota, Alberta, Saskatchewan, Manitoba and British Columbia. In North Dakota, wheat midge occurs throughout the wheat-producing areas and has caused economic damage in the northern tier of the state.

Host Plants

Wheat midge is an oligophagous insect. Common wheat, *Triticum aestivum* L., is the primary host of the wheat midge throughout its modern distribution in Europe, Asia and North America. All 17 species in the genus *Triticum* are hosts for wheat midge. Other grass hosts include durum wheat (*Triticum durum* Desf.), occasionally rye (*Secale cereale* L.) and barley (*Hordeum vulgare* L.). Wheat midge also will deposit eggs on some grassy weeds, such as quackgrass (*Elymus repens* (L.) Gould), slender meadow foxtail, (*Alopecurus myosuroides* Huds.) and other grasses, but larval development on these grassy hosts is questionable.

Identification

Adults (Figure 1)

The adult wheat midge is an orange-colored, fragile, very small insect approximately half the size of a mosquito. It is about 0.08 to 0.12 inch (2 to 3 millimeters) long with three pairs of long legs. It has a pair of wings, which are oval, transparent and fringed with fine hairs. Two eyes are conspicuous and black.



Figure 1. Adult wheat midge.
(Extension Entomology, NDSU)

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North Dakota State University
Fargo, North Dakota
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NDSU Crop & Pest Report

- Free to subscribers with email, but **MUST SIGN-UP ON WEBSITE!!!** (Do not need to re-sign up if you are subscribed)

– <http://www.ag.ndsu.edu/cpr/>



A collage of several overlapping pages from the NDSU Crop & Pest Report. The top page is dated July 14, 2011, and features a table of contents with sections for soils, weeds, entomology, and plant pathology. The entomology section includes a photograph of a ladybug and text about soybean aphids. Other pages visible include sections on wheat streak mosaic virus, winter wheat hardiness, and a survey of wheat diseases. A table titled 'around the state' is also visible, showing data for various counties.

North Dakota State University
CROP & PEST REPORT
July 14, 2011

soils

RECIPE FOR HIGHER WHEAT PROTEIN
Research on enhanced protein for wheat from post-emergence sprays has been based on this early work, and more recent work from the NDSU Carrington REC by Bill following is "The Recipe" for post-anthesis UAN application:

1. Wait until the wheat is nearly done flowering (some secondary or tertiary tillers are the main stems and first tillers are completely done flowering). If the wheat is flowering, the timing is good. If the wheat berries start to turn milky, it is too late for this application.
2. 10 gal water + 10 gal UAN (28-0-0)
3. Apply during the cool of the day (early morning or late evening-late afternoon)
4. Broadcast spray with flat fan nozzles aimed directly over the plants. This application nearly always results in at least a 1% percent protein increase. Do not apply low rates of slow-release N products to try to achieve a similar N rate, the costs for using slow-release N products are prohibitive. Some leaf burn should be expected after using the recipe. This decreases in recent studies at NDSU.

weeds

SCOUTING FIELDS TO DETERMINE HERBICIDE EFFECTIVENESS
Scouting fields 3 to 14 days after a herbicide application and the need and timing of any herbicide application to determine if a complete herbicide application was made. When using contact herbicides scout closer to three days after application. Scouting again 10 to 14 days after the total effectiveness of the herbicide application, if you will require an additional post-emergence application. If herbicide resistance is present in the field, intermediate-responding plants. If a low level of resistance is occurring in the field, dead plants or nearly normal appearing plants with the majority of plants showing normal response. Low-level resistance is usually inhibiting herbicides (Group 1 - examples: Set, examples: Flexstar, Cobra, Cadet). A continuous

around the state

| County | Wheat | Barley | Oats |
|--------------|-------|--------|------|
| Adair | 100 | 100 | 100 |
| Barnes | 100 | 100 | 100 |
| Benson | 100 | 100 | 100 |
| Bismarck | 100 | 100 | 100 |
| Bozeman | 100 | 100 | 100 |
| Buffalo | 100 | 100 | 100 |
| Cass | 100 | 100 | 100 |
| Cavalier | 100 | 100 | 100 |
| Cheyenne | 100 | 100 | 100 |
| DeMotte | 100 | 100 | 100 |
| Dickey | 100 | 100 | 100 |
| Dunn | 100 | 100 | 100 |
| Emmons | 100 | 100 | 100 |
| Faith | 100 | 100 | 100 |
| Fergus | 100 | 100 | 100 |
| Grand Forks | 100 | 100 | 100 |
| Grant | 100 | 100 | 100 |
| Griggs | 100 | 100 | 100 |
| Hazen | 100 | 100 | 100 |
| Healy | 100 | 100 | 100 |
| Hyland | 100 | 100 | 100 |
| Jackson | 100 | 100 | 100 |
| Jackson Park | 100 | 100 | 100 |
| Kimberly | 100 | 100 | 100 |
| LaMoure | 100 | 100 | 100 |
| Lincoln | 100 | 100 | 100 |
| McLean | 100 | 100 | 100 |
| McIntosh | 100 | 100 | 100 |
| McKenzie | 100 | 100 | 100 |
| Minnehaha | 100 | 100 | 100 |
| Mohr | 100 | 100 | 100 |
| Oliver | 100 | 100 | 100 |
| Pennington | 100 | 100 | 100 |
| Rockwell | 100 | 100 | 100 |
| Sargent | 100 | 100 | 100 |
| Shannon | 100 | 100 | 100 |
| Sioux | 100 | 100 | 100 |
| Sioux Falls | 100 | 100 | 100 |
| Stanley | 100 | 100 | 100 |
| Steele | 100 | 100 | 100 |
| Stutsman | 100 | 100 | 100 |
| Tadoussac | 100 | 100 | 100 |
| Towner | 100 | 100 | 100 |
| Walworth | 100 | 100 | 100 |
| Ward | 100 | 100 | 100 |
| Wells | 100 | 100 | 100 |
| Wheat River | 100 | 100 | 100 |
| Williston | 100 | 100 | 100 |
| Wynne | 100 | 100 | 100 |
| Yankton | 100 | 100 | 100 |
| Younis | 100 | 100 | 100 |

North Dakota State University
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plant pathology

SMALL GRAIN DISEASE SURVEY: JULY 4 - JULY 8
During the 5th of July week, the average growth stage of spring wheat in North Dakota for that week was early head emergence. Similar spotting in late wheat with a more advanced growth stage of early flower and late grain in both ND and SD was observed. A map of fields scouted from June 27 to July 11 in both ND and SD shows the variations in wheat growth stage across the region (see figures). At the time of July 8, tan spot symptoms were observed in 84% of ND surveyed fields, with an average of 22% incidence. Cereal grain aphids were observed in 100% of ND surveyed fields, with an average of 23% of the plants showing one or more grain aphids in each field. Barley

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July 14, 2011

entomology

SOYBEAN APHIDS INCREASING!
Soybean fields need to be scouted for populations. This time of year soybean aphids are near or have already reached the economic threshold of 250 aphids per plant on undersides of leaf. (Photo courtesy of P. N. Peterson, NDSU)

entomology

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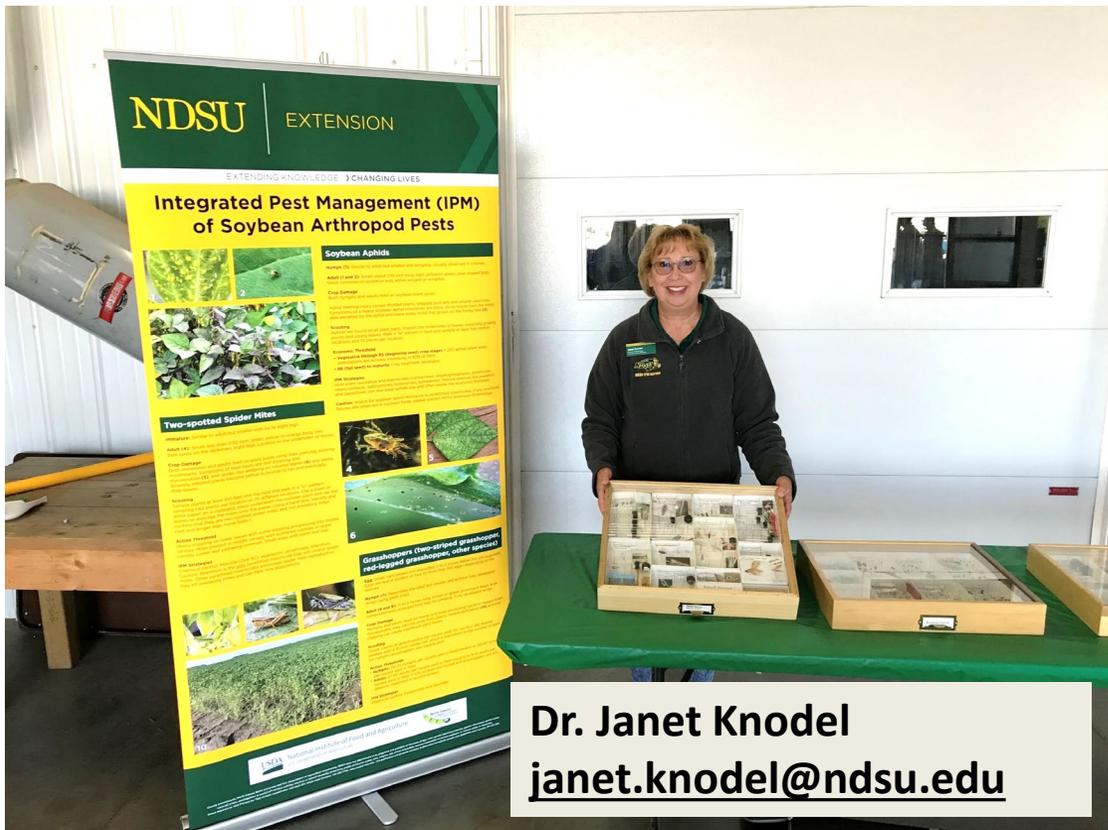
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Dr. Janet Knodel
janet.knodel@ndsu.edu



Patrick Beauzay
patrick.beauzay@ndsu.edu

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THANK YOU