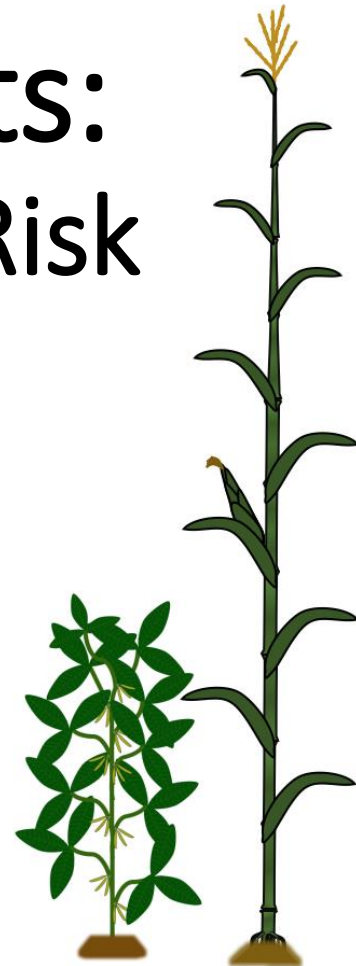
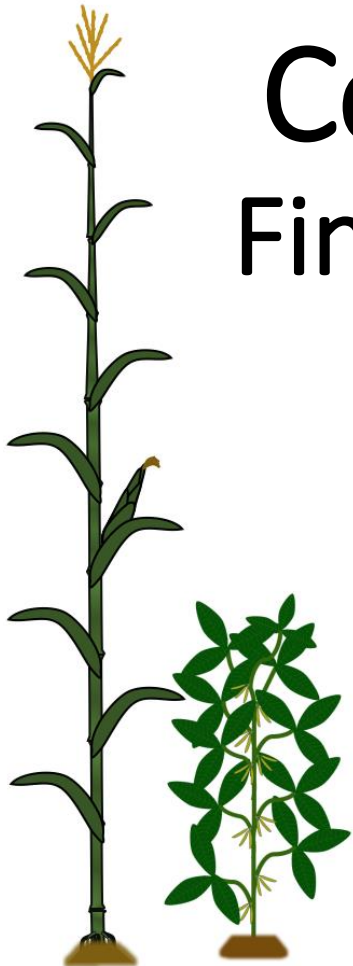


# Cover Crops and Insects: Finding a Balance Between Risk and Benefits

Justin McMechan, Assistant Professor  
Crop Protection and Cropping Systems Specialist

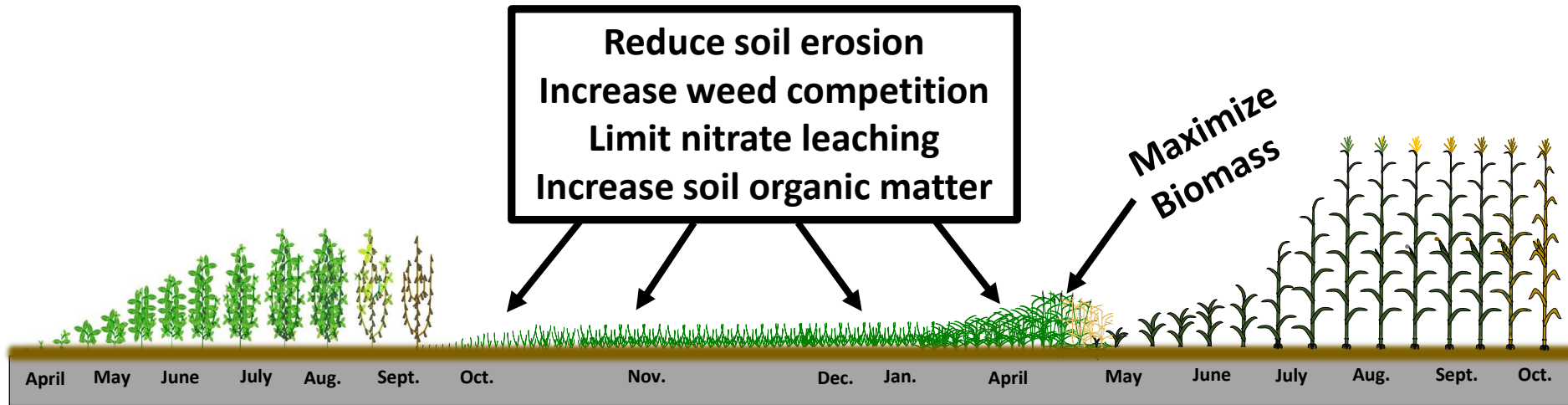


**EASTERN NEBRASKA  
RESEARCH AND EXTENSION CENTER**



# Cover Crop Systems

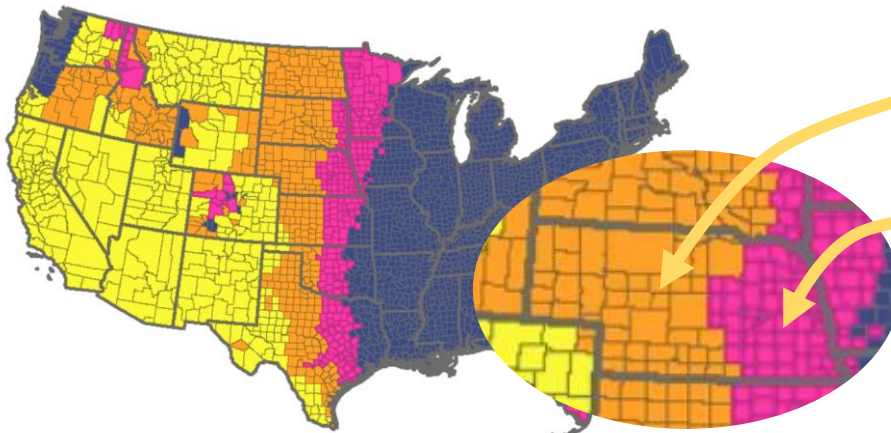
## Soybean – Corn Rotations



Soybeans

Cover Crop

Corn



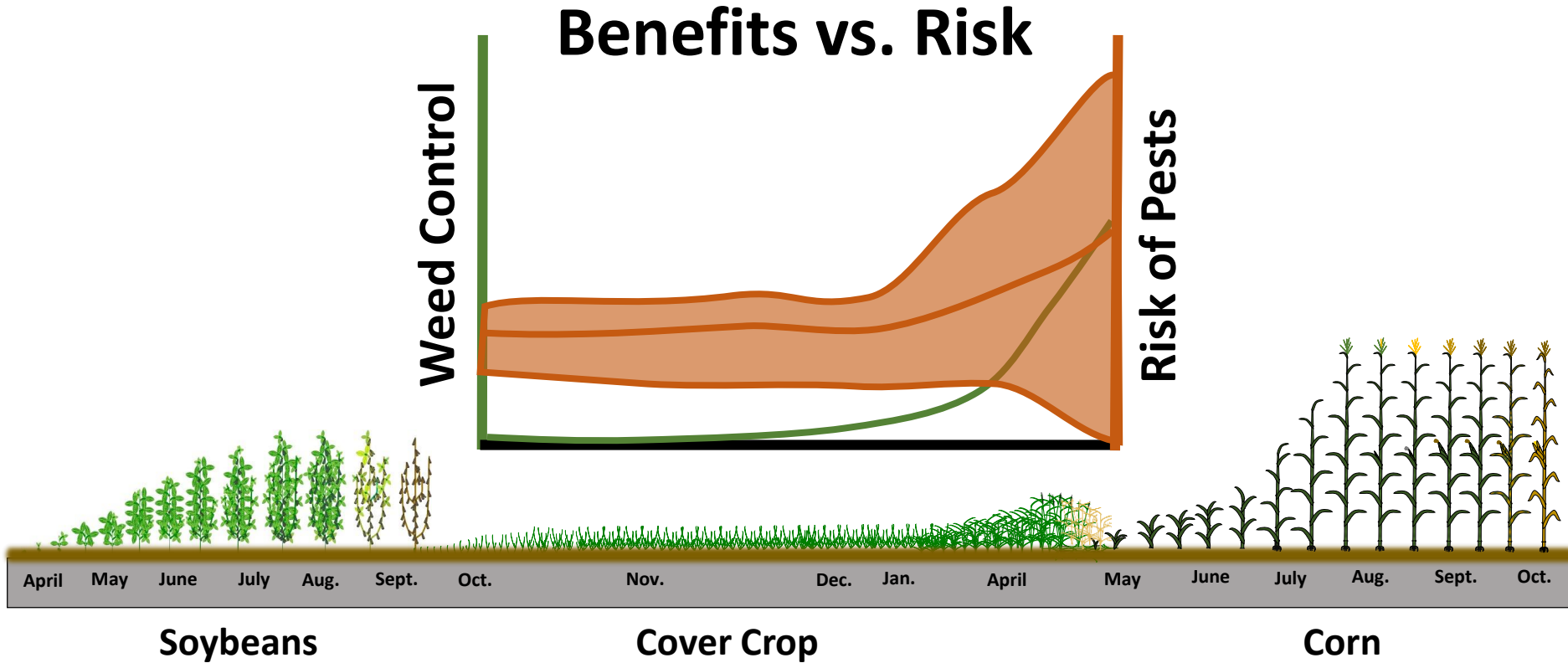
**Zone 2:** 15 days prior to plant

**Zone 3:** Terminate at or before planting

**NRCS EQUIP:** 6-8" of growth

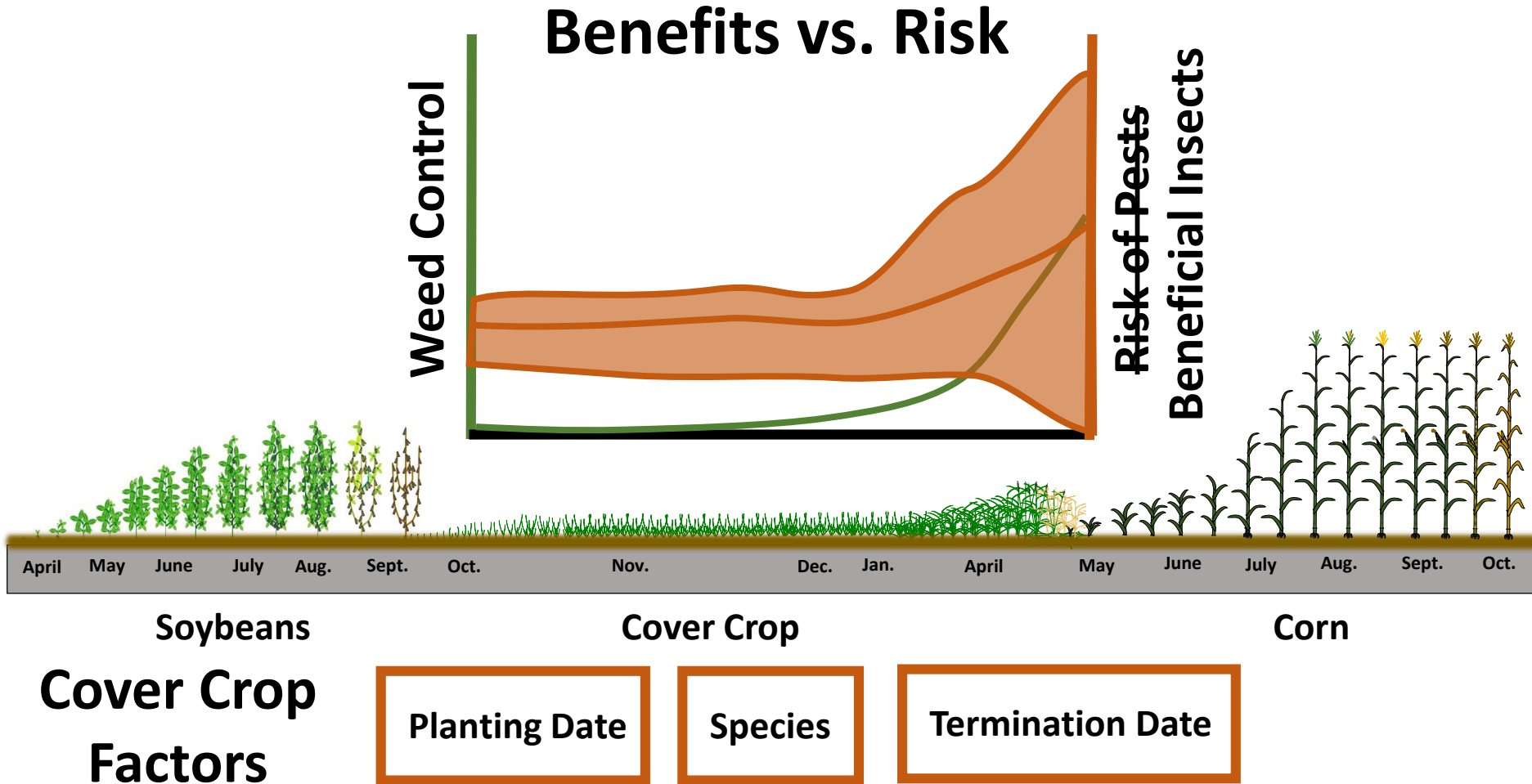
# Cover Crop Systems

## Soybean – Corn Rotations



# Cover Crop Systems

## Soybean – Corn Rotations



## Insects in Cover Crops



# Cover Crops and Insects

- **Studies evaluating the influence of cover crops on insects**

## Beneficials

### Predators

House and Del Rosario 1989  
Koch et al. 2015  
Lundgren and Fergen 2010  
Bottenberg et al. 2008  
Leslie et al. 2017

### Seed Feeders

Dunbar et al. 2017

## Pests

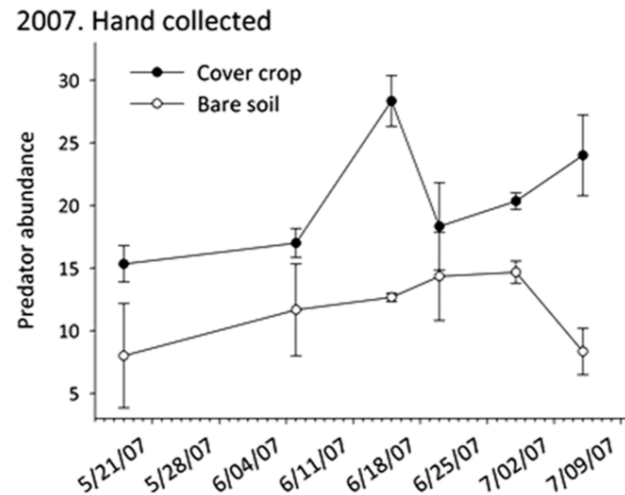
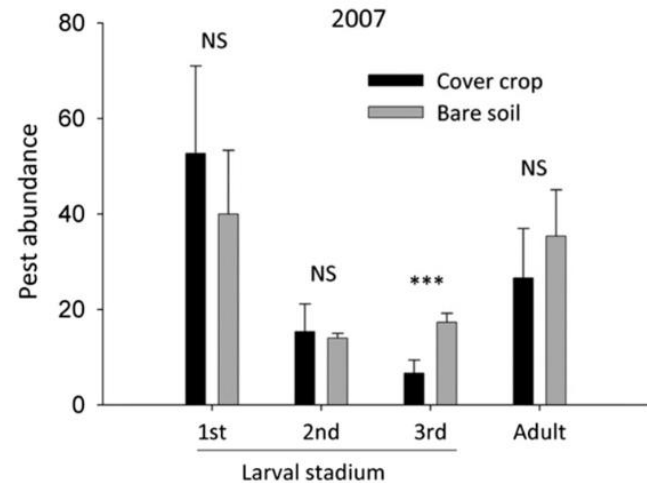
Dunbar et al. 2016  
Tillman et al. 2004  
Smith et al. 1988  
House and del Rosario 1989  
Koch et. al. 2017

**Increased risk of pests  
based on their ecology**

# Beneficial Insects in Cover Crops

## Western Corn Rootworm Control

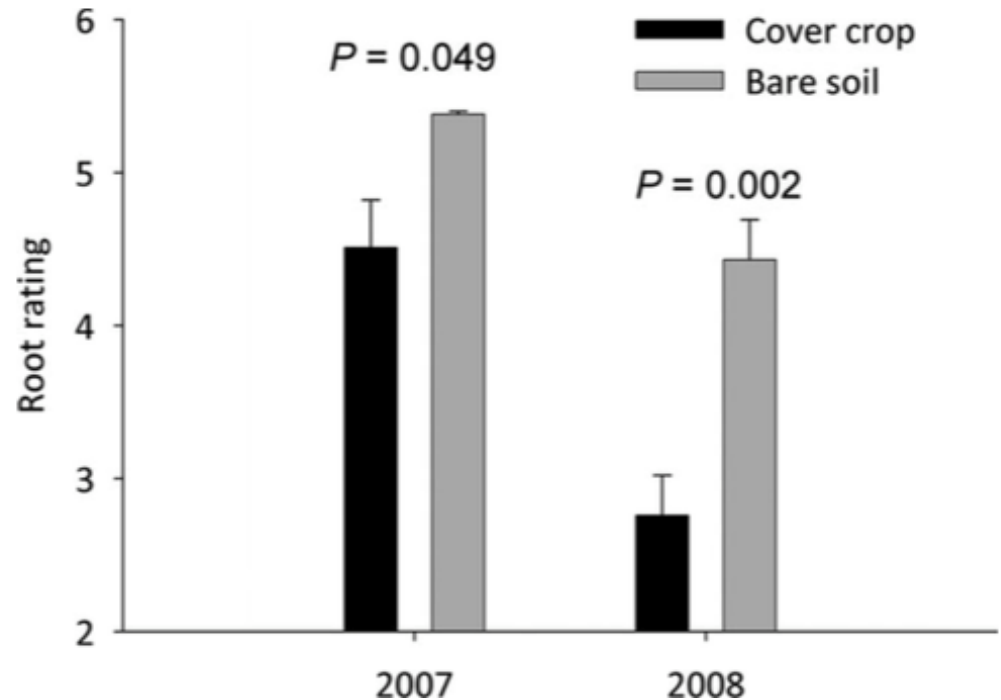
- **Fall-planted slender wheatgrass**
  - Planted: Early-September
  - Terminated at corn planting
- **Reduced abundance of western corn rootworm 3<sup>rd</sup> instar larvae during both years**
- **Increased predator abundance**
- **Strong relationship between predator abundance and reduction in 3<sup>rd</sup> instar WCR**



# Beneficial Insects in Cover Crops

## Western Corn Rootworm Control

- **Reduced root damage ratings in corn**
- **No yields were taken to determine economic value of predators**



# Beneficial Insects in Cover Crops

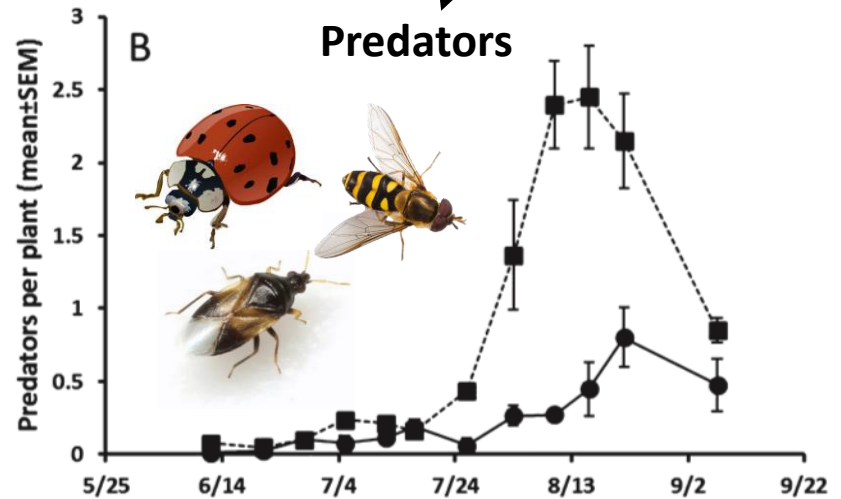
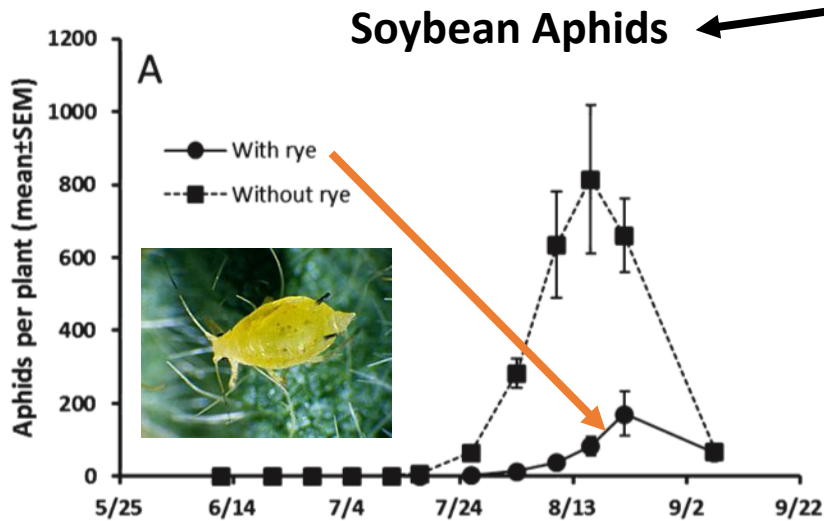
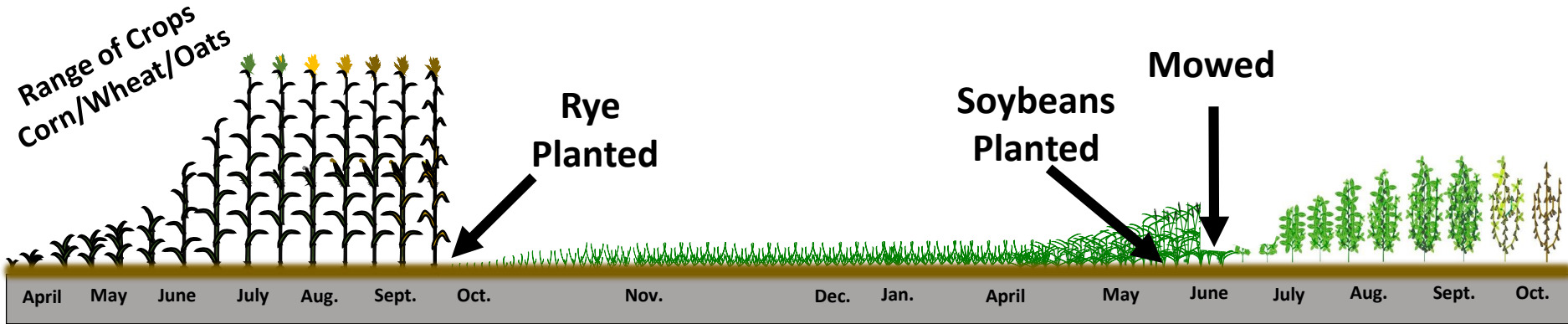
## Ground Beetles

- **Rye cover crop to soybeans and corn**
  - Impact only observed in cover crop planted to soybeans
- **Greater abundance of ground beetles**
  - Most frequently captured in June and July
- **Ground beetles are a diverse group of seed feeders and predators**

**Cover Crop  
Termination:  
Approx. 2 weeks  
prior to planting  
cash crop**

# Beneficial Insects in Cover Crops

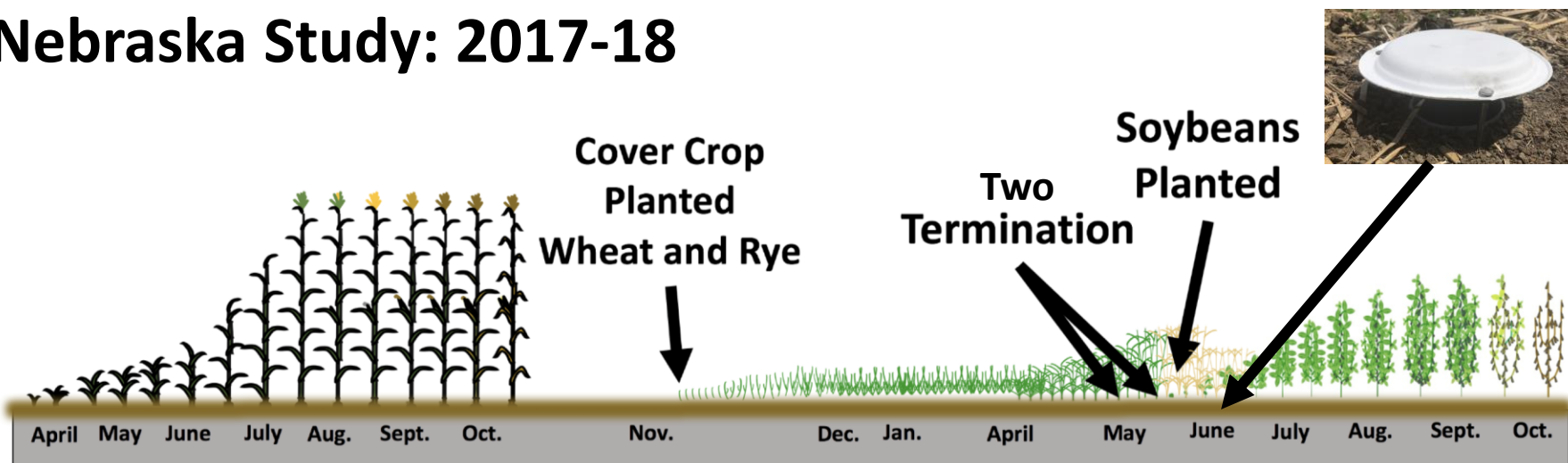
## Soybean Aphid Control



# Pest and Beneficial Insects

## Cover Crop Species and Termination Date

### Nebraska Study: 2017-18



### Cover Crop

**Biomass at termination**  
- lbs/acre

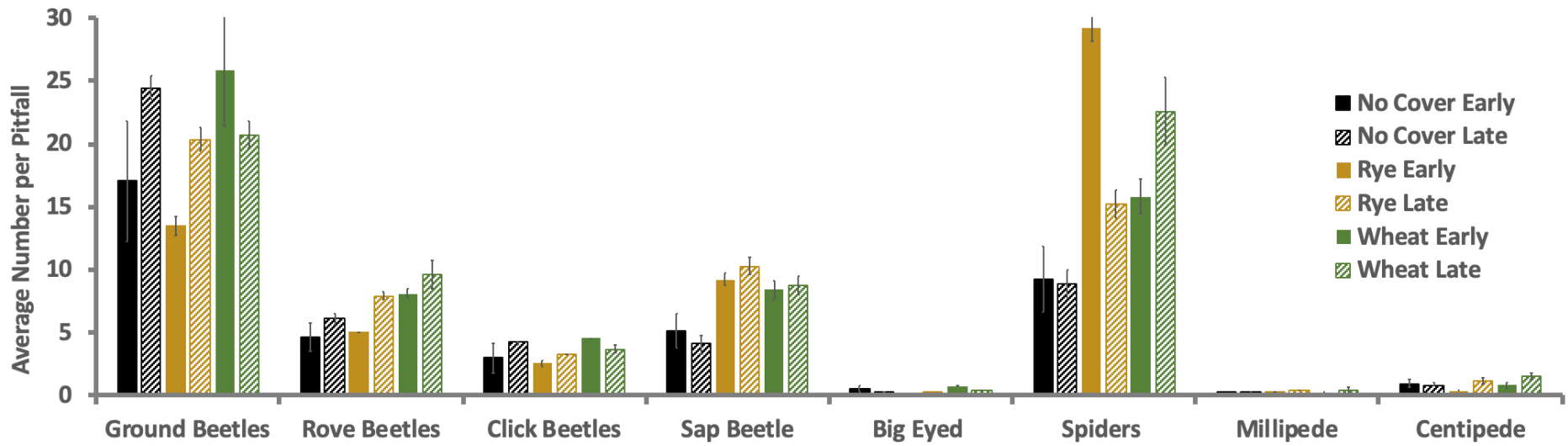
**Extended leaf height**

### Insects

**Damage Assessment**  
- Incidence (number of plants)  
- Severity (damage on plant)

**Pitfall Samples**  
- Insect activity on the ground  
- Capture beneficial insects

# Arthropods in Pitfall Traps



## Average of 4 Sites:

- Kenesaw
- Cedar Bluffs
- Albion
- Hartington



# Cover Crop and Insects

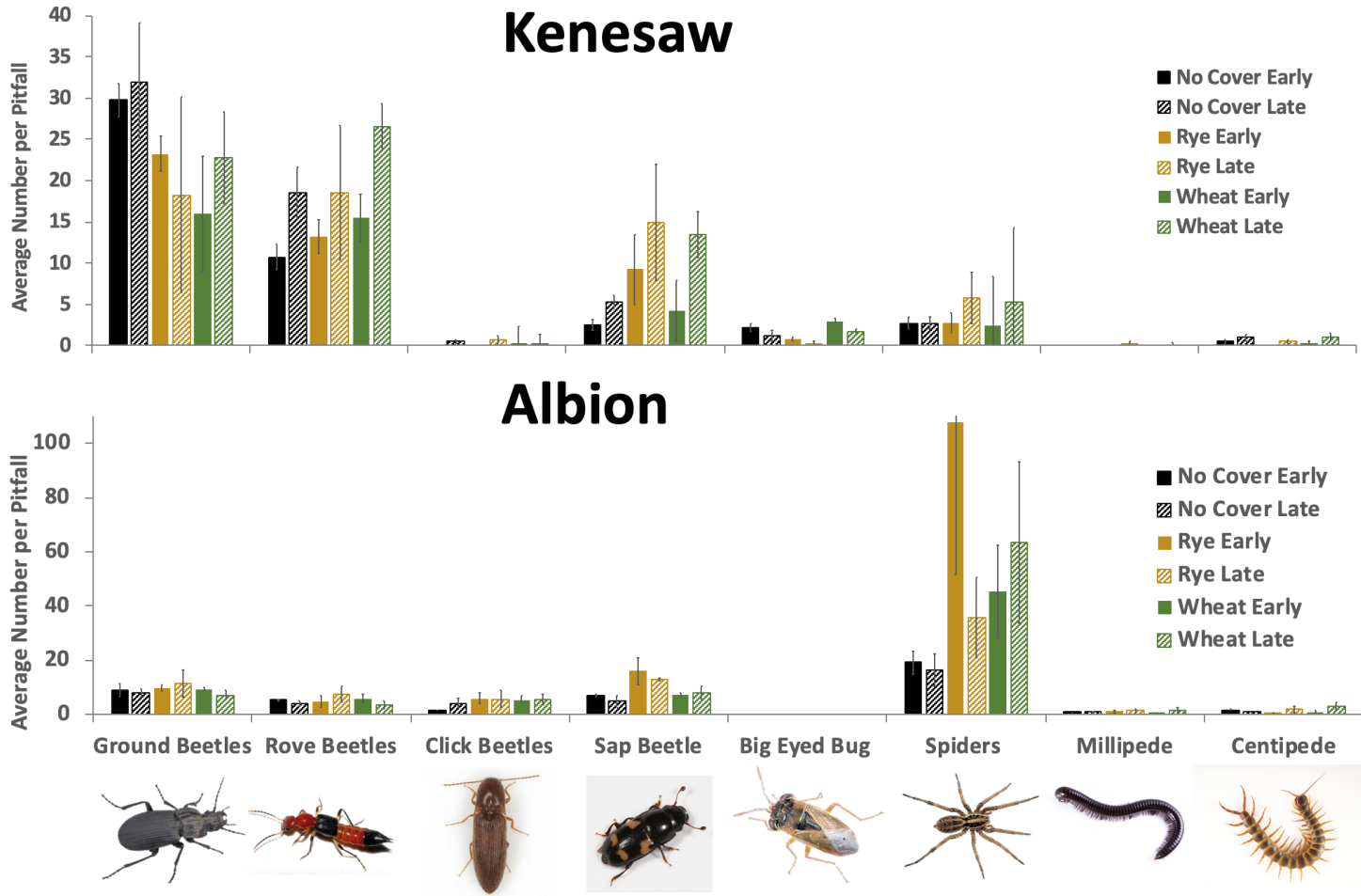
## Site-to-Site Variability

Large differences between sites

Strong relationship with cover crop biomass

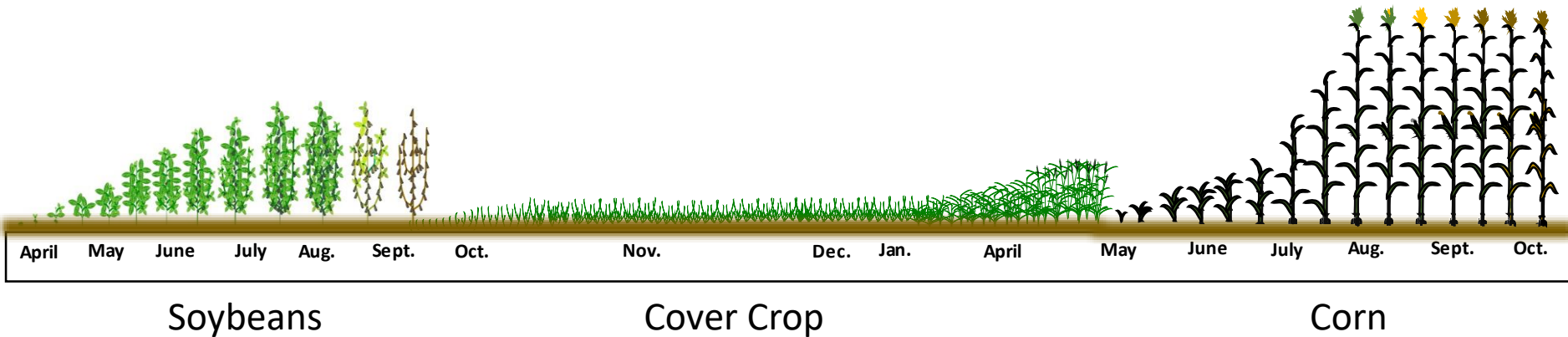
Other factors:  
Landscape  
History

\*Little to no pest pressure



# Cover Crop and Insects

## Insect Pest Risk

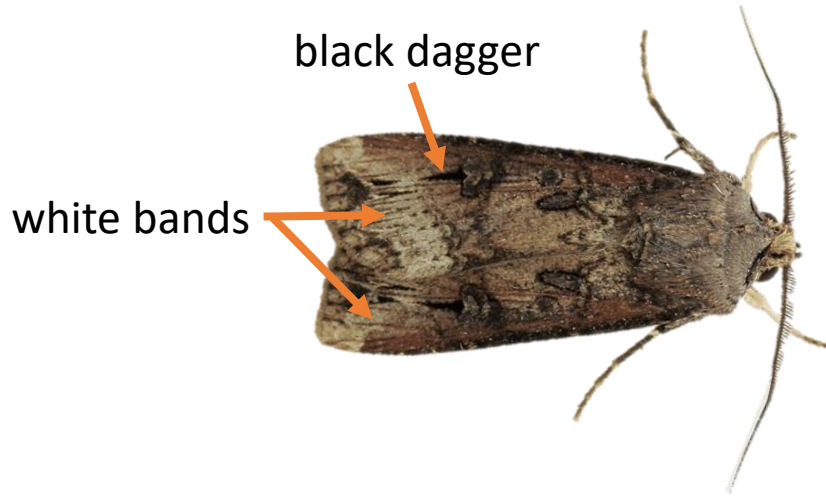
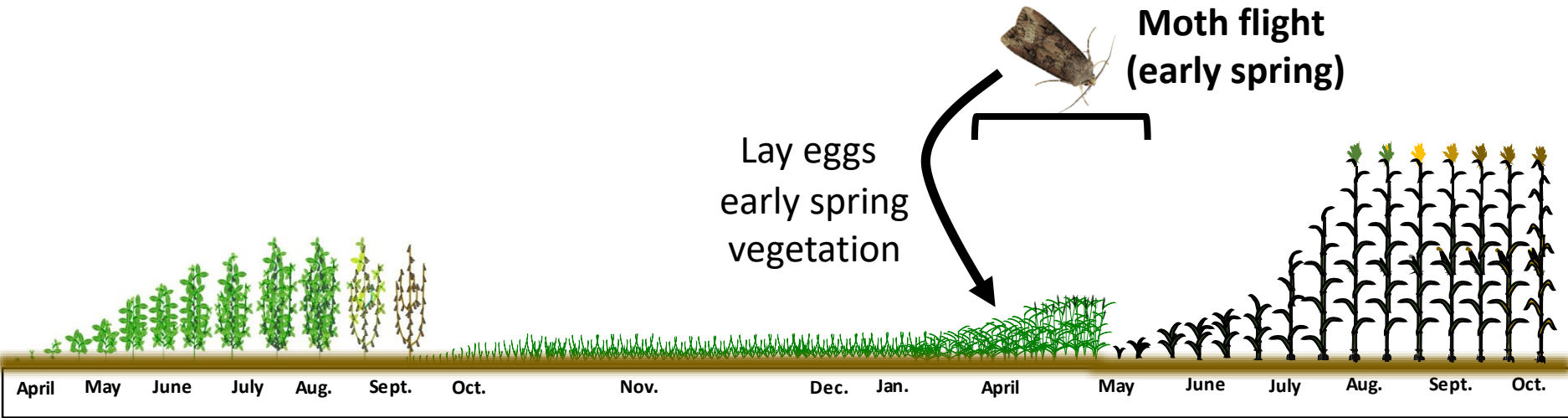


## Source of Risk for Pests

- Host range spans cover crop and cash crop
- Suitable overwintering site
- Termination of cover crop drives insect into cash crop

# Cover Crop and Insects

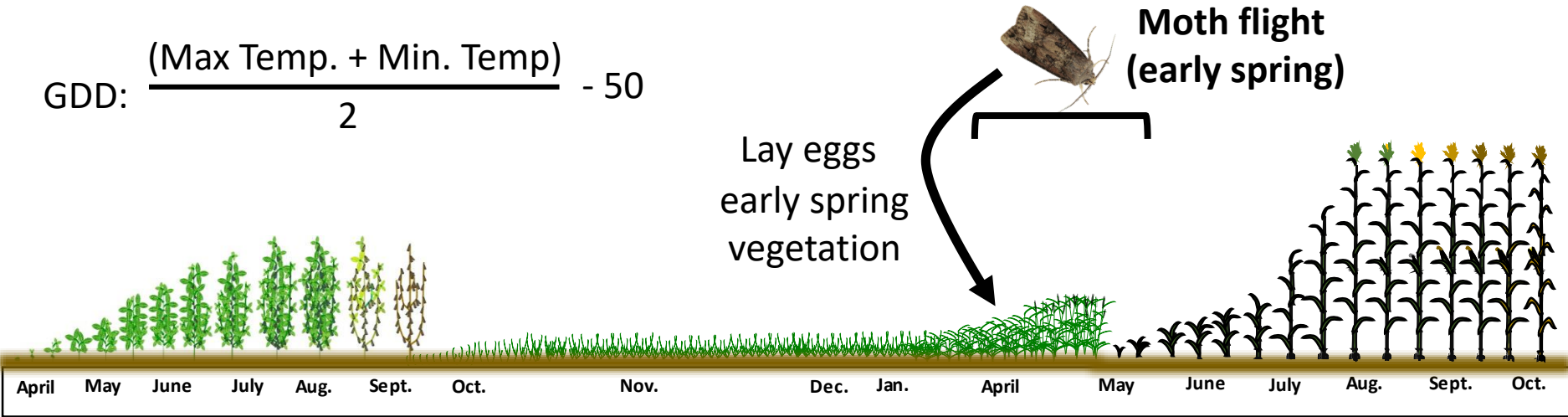
## Black Cutworm



# Cover Crop and Insects

## Black Cutworm

$$\text{GDD: } \frac{(\text{Max Temp.} + \text{Min. Temp.})}{2} - 50$$



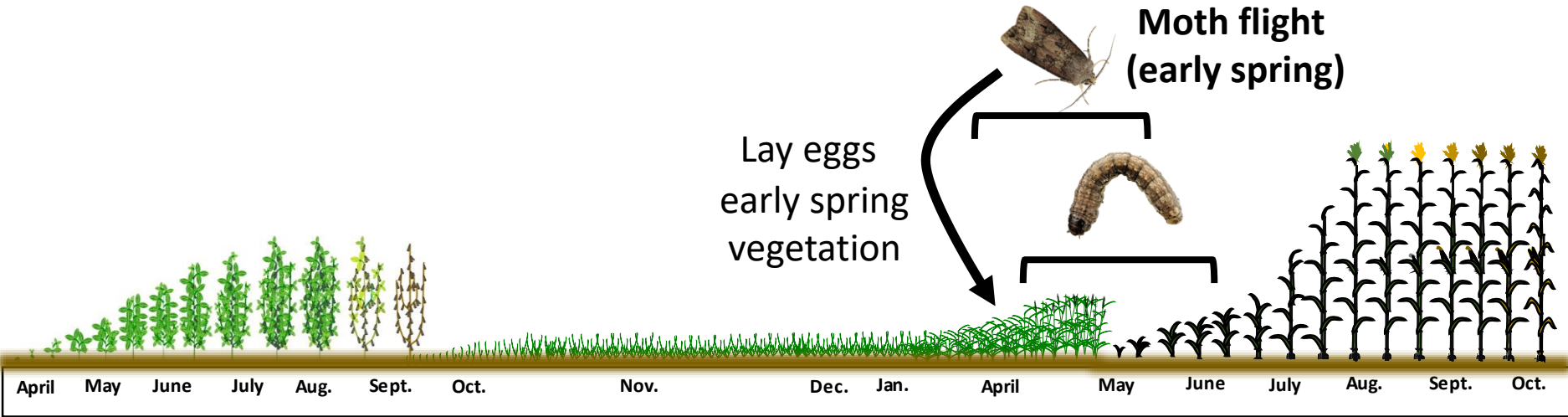
County	Town	Average Moth Count Per Night					
		May 3-9		April 26-May 2		April 19-25	
		Variegated	Black	Variegated	Black	Variegated	Black
Adams	Juniata	—	—	0.3	0	3.6	0
Burt	Craig	0.1	0.0	0.1	0	0.3	0
Butler	Garrison	1.3	0.9	0.3	0.1	0.4	0.1
Dixon	Dixon	0.7	0.6	0.3	0.3	2.2	0
Johnson	Johnson	—	0.1	1.0	0	0.7	0
Hamilton Site 1	Aurora	0.1	0.1	3.1	0	2.6	0
Hamilton Site 2	Aurora	0.1	0.6	3.1	0.4	2.4	0

### UNL Cutworm Network Updated on UNL CropWatch

Cumulative Degree Days	Black Cutworm Stage	Black Cutworm Activity
0 (Biofix)	Significant Moth Capture	Egg laying
90	Egg hatch	
91-311	1st-3rd instar	Leaf feeding
312-364	4th instar	Cutting begins
365-430	5th instar	Cutting begins
431-640	6th instar	Cutting slows
641-989	Pupa	No feeding

# Cover Crop and Insects

## Black Cutworm



### Scouting Corn:

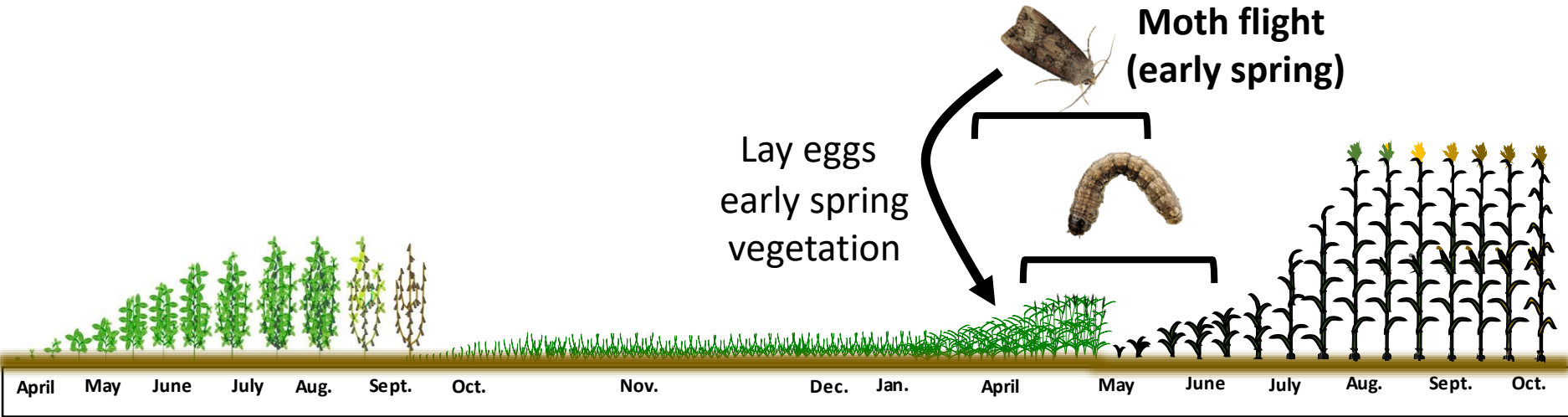
- Leaf damage
  - Wilted plants
  - Cut stalks
- 3-5% damaged



Cumulative Degree Days	Black Cutworm Stage	Black Cutworm Activity
0 (Biofix)	Significant Moth Capture	Egg laying
90	Egg hatch	
91-311	1st-3rd instar	Leaf feeding
312-364	4th instar	Cutting begins
365-430	5th instar	Cutting begins
431-640	6th instar	Cutting slows
641-989	Pupa	No feeding

# Cover Crop and Insects

## Black Cutworm



Larval Instar	Days	Potential Cut Plants
4	25	
5	21	
6	14	
7	5	

Number of Cuts Based on 72F

What if.....

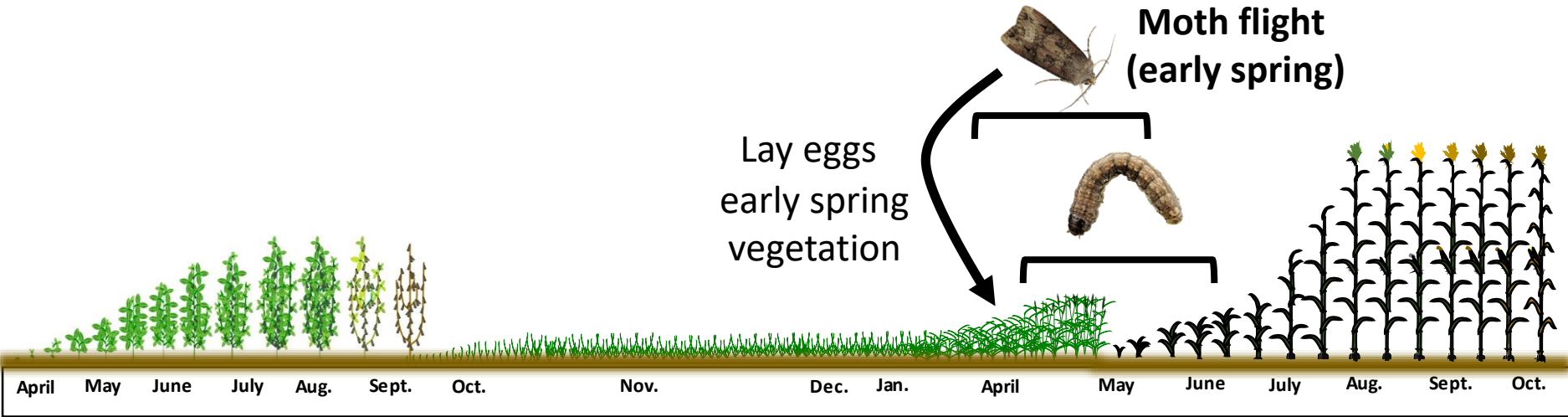
Which one has more potential cut plants?

60F                      80F



# Cover Crop and Insects

## Black Cutworm



Larval Instar	Days	Potential Cut Plants
4	25	
5	21	
6	14	
7	5	

Number of Cuts  
Based on 72F

What if.....

Which one has more potential cut plants?

**60F**

up to 12 plants

**80F**

up to 2.3 plants



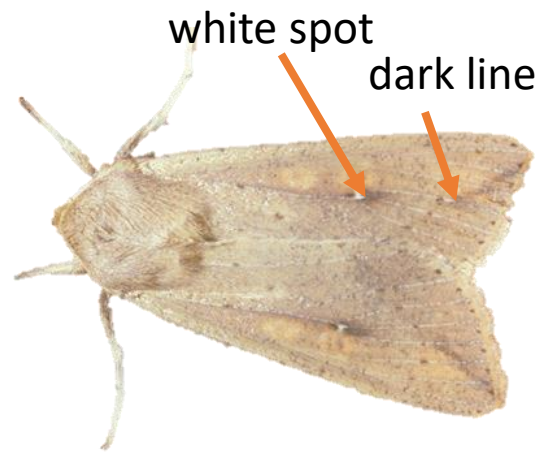
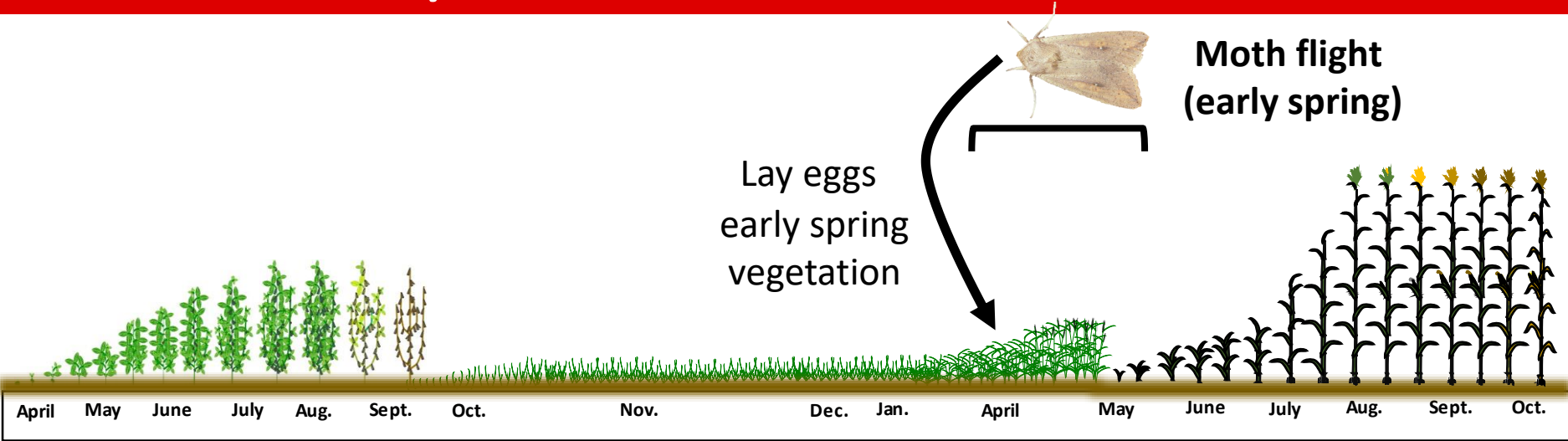
# Black Cutworm - Dense vegetation



Photos: Nathan Mueller

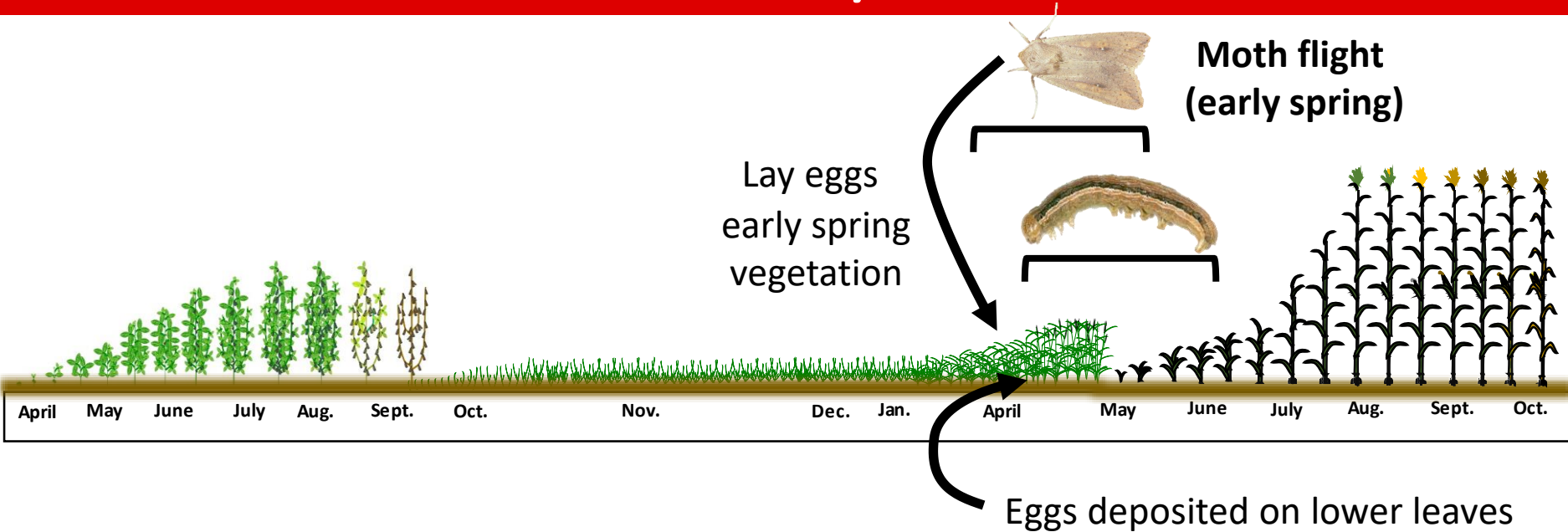
# Cover Crop and Insects

## True Armyworm



# Cover Crop and Insects

## True Armyworm



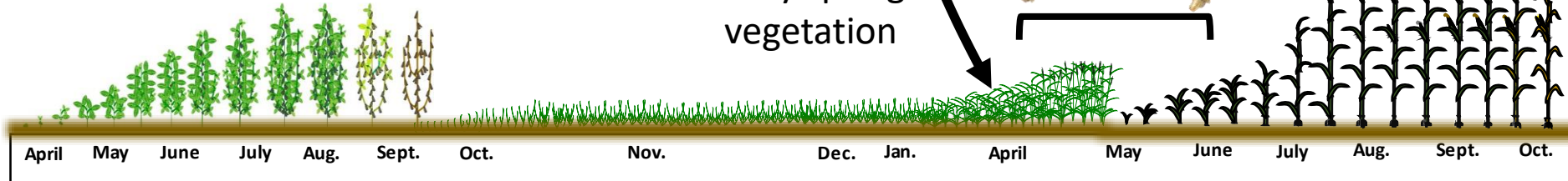


# Cover Crop and Insects

## True Armyworm

### Scouting

Examine 20 plants at 5 locations  
Determine larval size



- Larvae feed at night
- Feed for 3 weeks
  - 80% of consumption occurs in 6<sup>th</sup> instar
- Control
  - 25% or more of plants are damaged
  - Difficult if larvae are >1 inch
- A number of predators, parasitoids, fungi and viruses
  - Cool/Wet weather favors armyworm

# Cover Crop and Insects

## Common Stalk Borer



**"Dead heart"  
damage in corn**



# Cover Crop and Insects

## Common Stalk Borer



**"Dead heart"  
damage in corn**



(Base Temp. 41F)

### Degree Days

- 575 – Egg hatch begins
- 750 – Egg hatch complete
- 1400 – 10% move out of grasses
- 1700 – 50% move out of grasses

Scout at 1300-1400 degree days

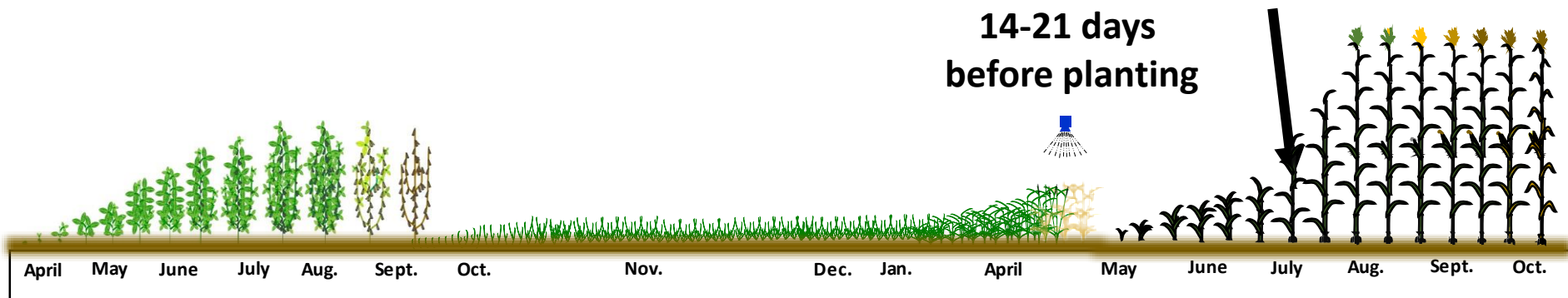
<b>Thresholds</b> 200 bu at \$3/bu	Stage	% Infested
	V1	4.3
	V2	5.3
	V3	7.0
	V4	7.4
	V5	8.5
	V6	14.9

# Cover Crop and Insects

Dunbar 2016

14-21 days  
before planting

Sampled weekly  
until V8



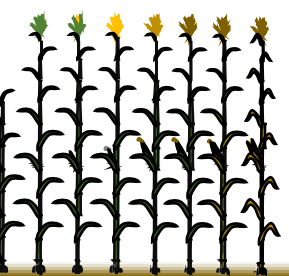


# Cover Crop and Insects

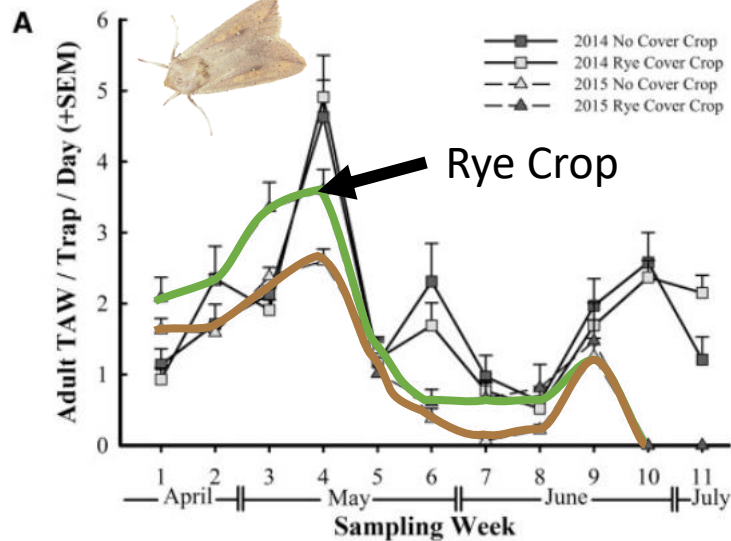
## True armyworm and Black Cutworm

Dunbar 2016

14-21 days  
before planting



### Adult Dheromone Trap

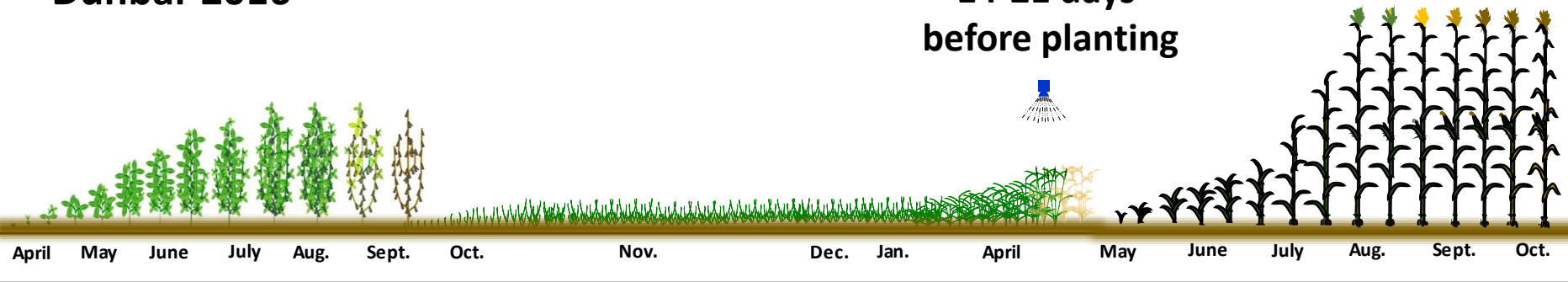


# Cover Crop and Insects

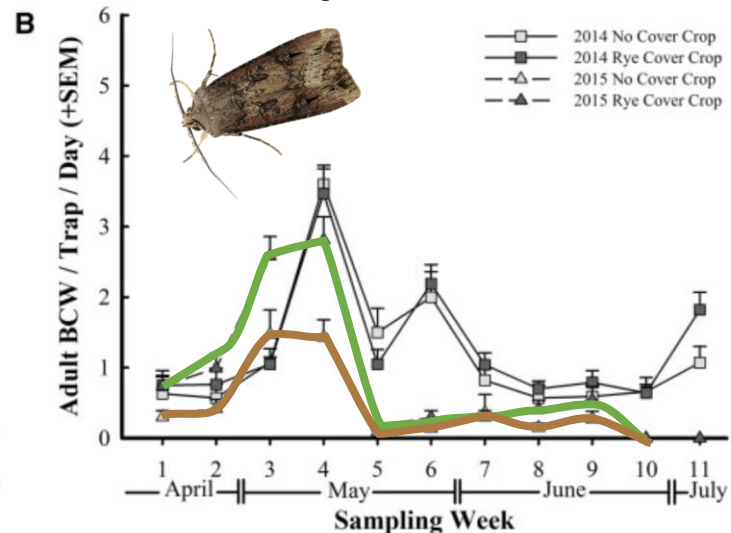
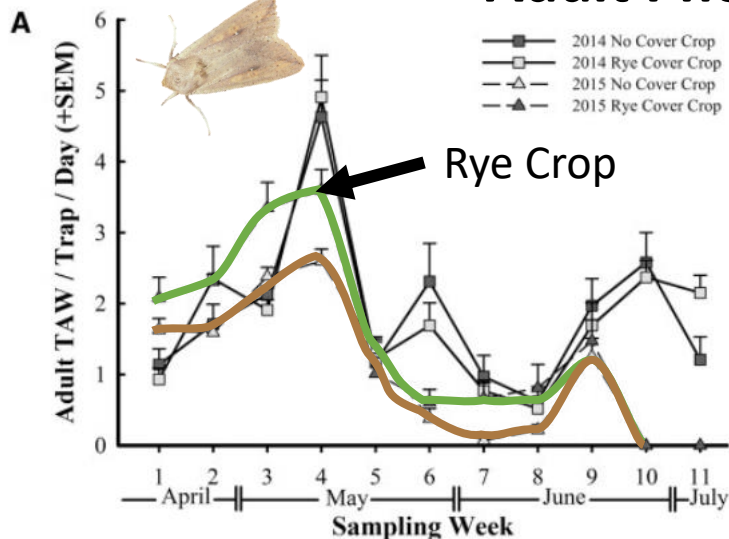
## True armyworm and Black Cutworm

Dunbar 2016

14-21 days  
before planting



### Adult Pheromone Trap

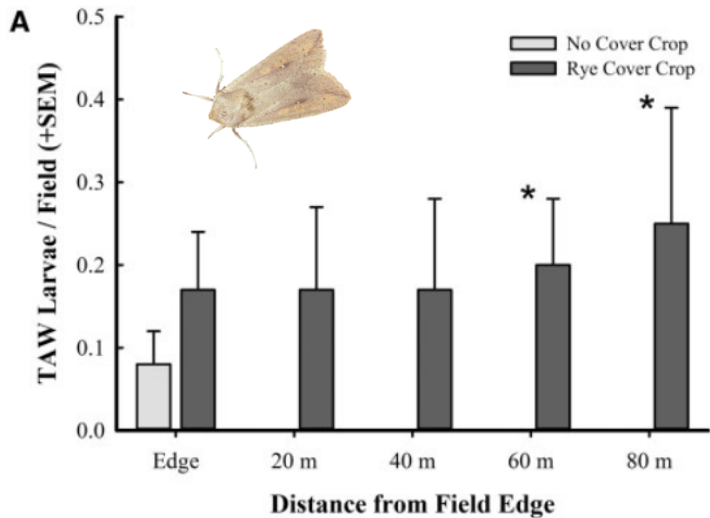
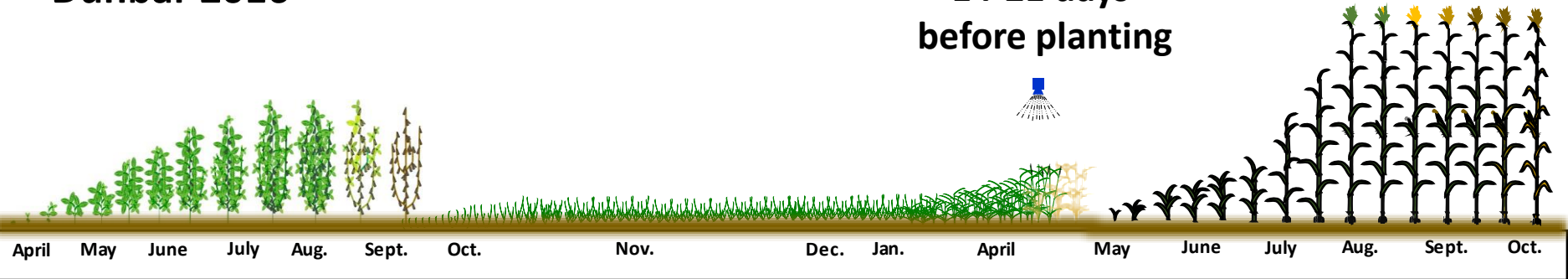


# Cover Crop and Insects

## True armyworm and Black Cutworm

Dunbar 2016

14-21 days  
before planting



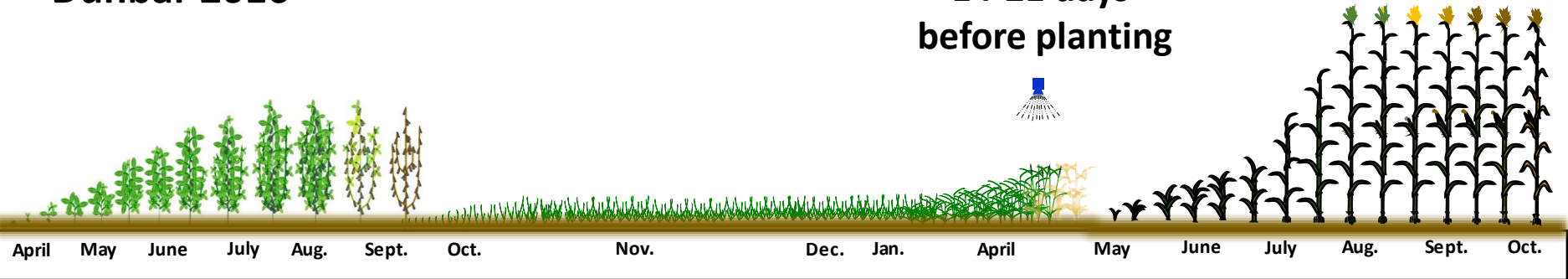
		Insects Captured	
		Cover Crop	No Cover
2014	TAW	19	1
	BCW	1	0
	CSB	14	6
2015	TAW	77	5
	BCW	0	1
	CSB	6	13

# Cover Crop and Insects

## True armyworm and Black Cutworm

Dunbar 2016

14-21 days  
before planting



Adam Varenhorst

### Insects Captured

		Cover Crop	No Cover
2014	TAW	19	1
	BCW	1	0
	CSB	14	6
2015	TAW	77	5
	BCW	0	1
	CSB	6	13

# Cover Crop and Insects

## Stinkbugs

**Abundance and spread  
has been increasing**

Hunt et al. 2011,2014

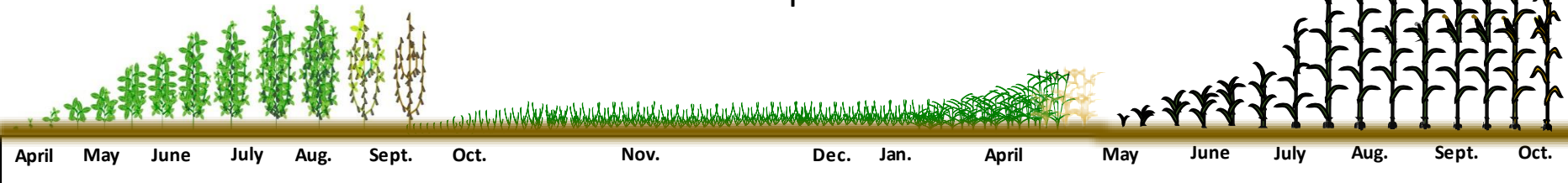
Michel et al. 2013



**Overwinter**



Wooded  
Grass Borders  
Cover Crops



**Fields with Increased Risk**

No-till

Cover crop prior to planting

Corn following wheat

Edwards et al. 1985

Townsend and Sedlacek 1986

Sadlacek and Townsend 1988

**Significantly higher stinkbugs in cover crop.**

**Did not impact cotton yields.**

Tillman et al. 2004



# Cover Crop and Insects

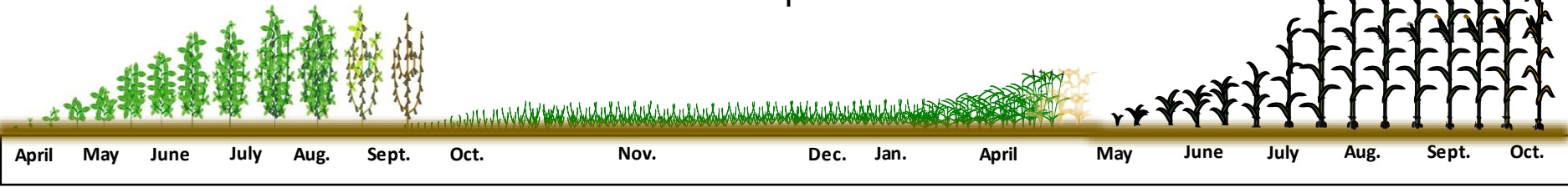
## Stinkbugs



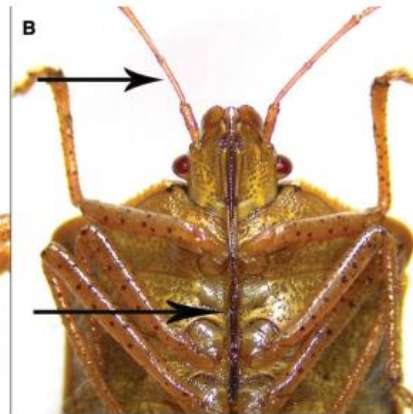
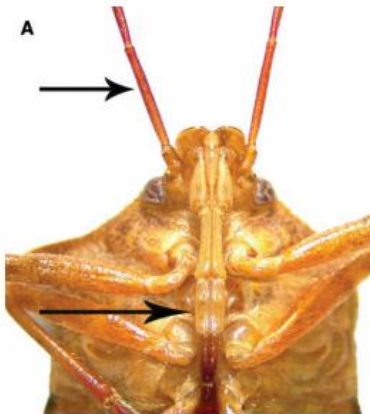
**Overwinter**



Wooded  
Grass Borders  
Cover Crops



**Beneficial**  
Spined Solder Stinkbug



**Pest**  
Brown Stinkbug



Fig. 5. Mouthparts (i.e., rostra) of predatory (A) and herbivorous (B) stink bugs. Rostrum of predator is thick (about twice the thickness of the antenna), and rostrum of herbivore is thin (similar to thickness of antenna) (arrows indicate rostra and antennae; photo credit: D. Pezzini).

Koch et al. 2017

# Spined Soldier Stinkbug



Jim McGill





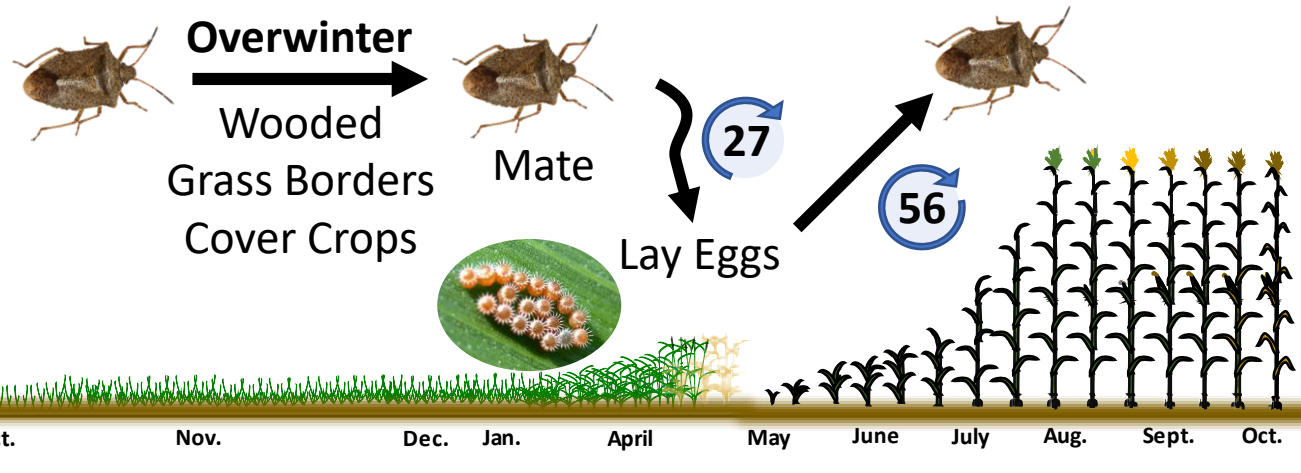
# Cover Crop and Insects

## Stinkbugs

**Abundance and spread  
has been increasing**

Hunt et al. 2011,2014

Michel et al. 2013



**Fields with Increased Risk**

No-till

Cover crop prior to planting

Corn following wheat

Edwards et al. 1985

Townsend and Sedlacek 1986

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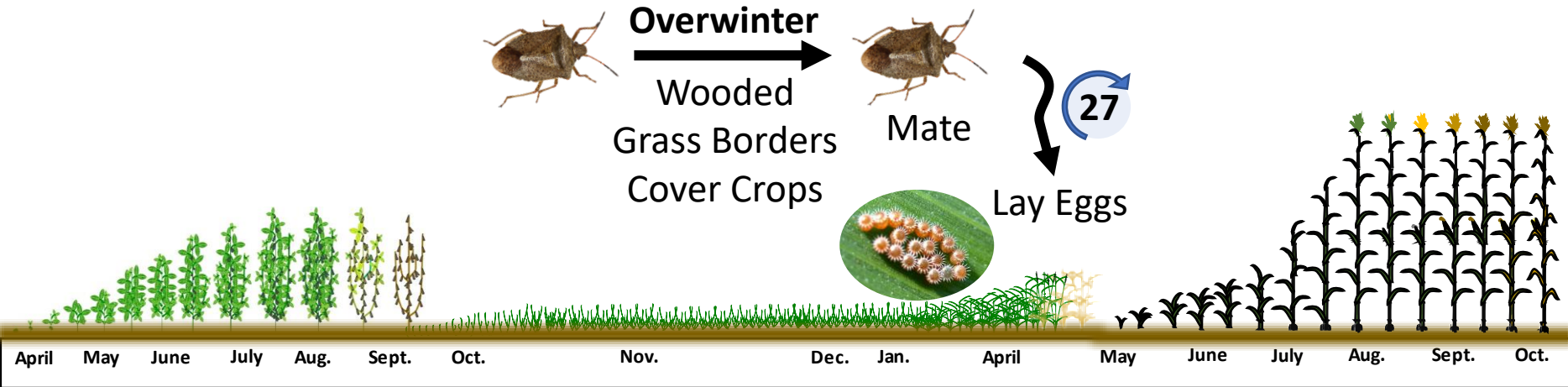
**Significantly higher stinkbugs in cover crop.**

**Did not impact cotton yields.**

Tillman et al. 2004

# Cover Crop and Insects

## Stinkbugs



### • Early season

- Kill small plants
- Tillering
- Repeating pattern of holes

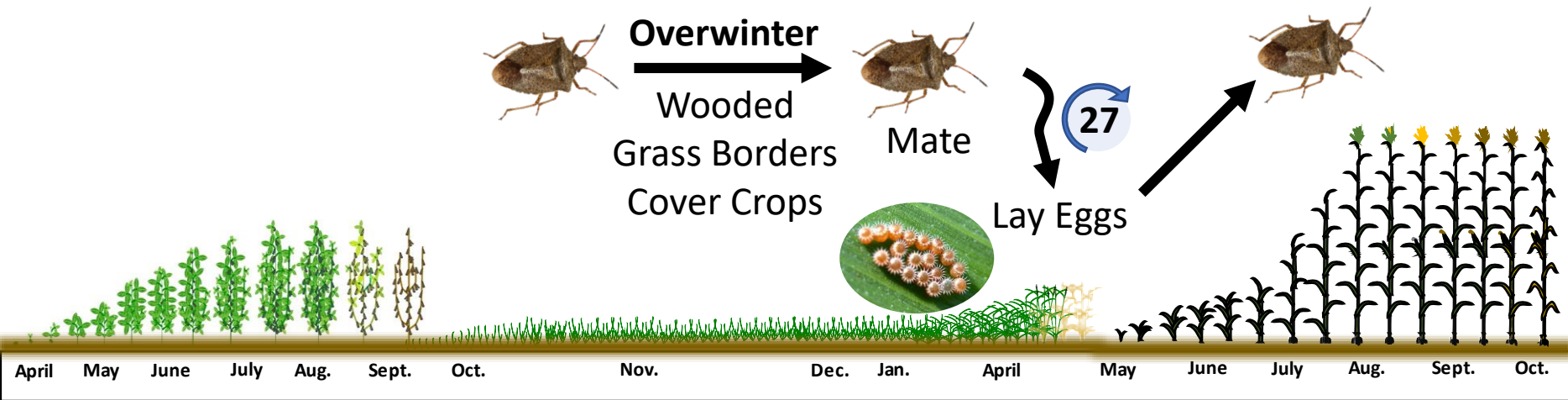


### Thresholds

- 5% damaged BSB present
- >10% infested Corn less than 2ft tall

# Cover Crop and Insects

## Stinkbugs



- **Late season**
  - Aborted kernels
  - Banana ears



P. Thomison



P. Thomison

### Thresholds

**1 stinkbug**  
**2 plants**

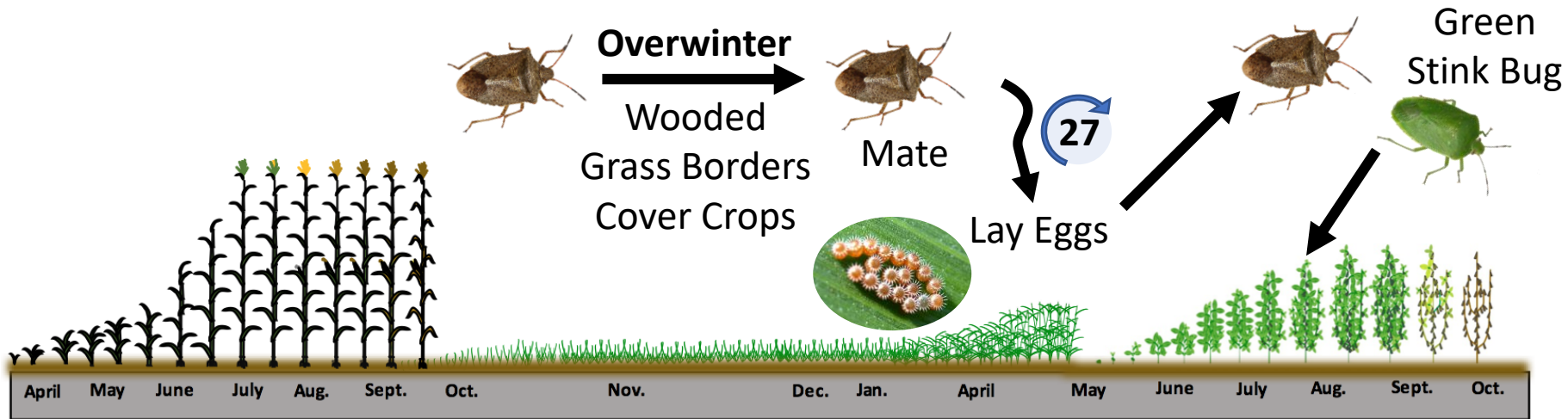
Ear forming  
to  
Pollen shed

**1 stinkbug**  
**4 plants**

Pollen shed  
to  
Blister

# Cover Crop and Insects

## Stinkbugs



### • Reproductive stage

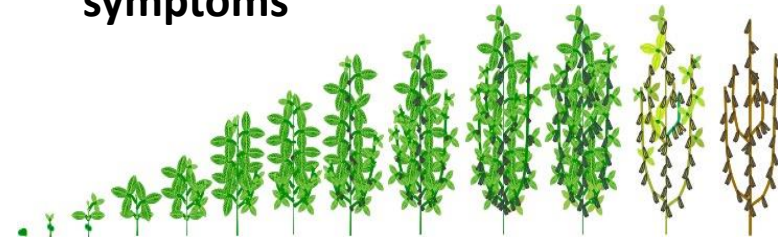
- Seed and pod damage
- Delayed maturity
- "Stay-Green" syndrome



### Thresholds

5% of plant exhibiting symptoms

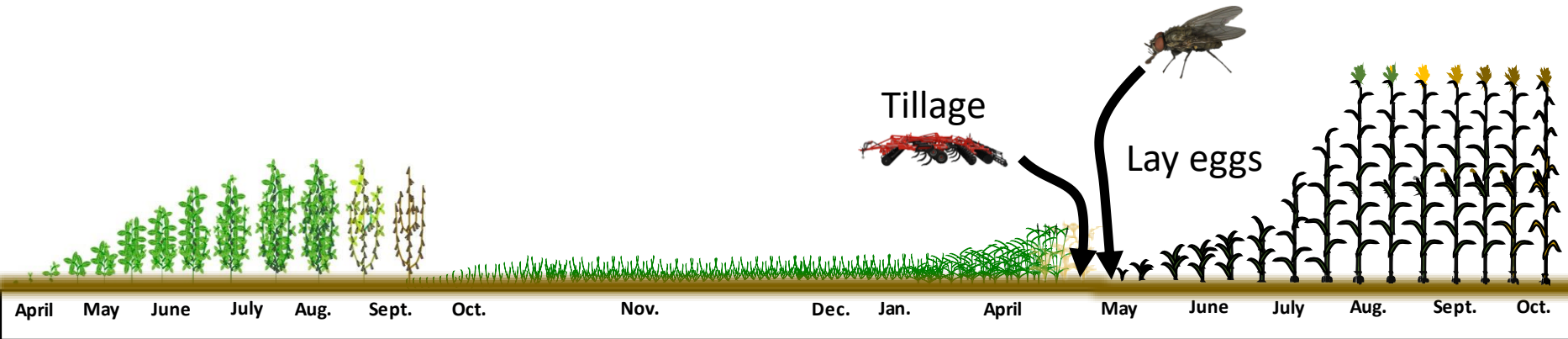
10 stinkbug  
25 sweeps



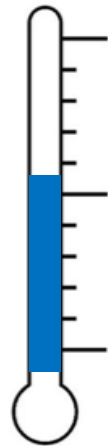


# Cover Crop and Insects

## Seed Corn Maggot



- **Increased risk**
  - Proximity to feedlot
  - Cold temperatures
- **Damage**
  - Unemerged plants
  - Weak seedlings



**Adult Emergence**

**360 DD**

86F Max

39F Min

$[(\text{Max}-\text{Min})/2]-39$

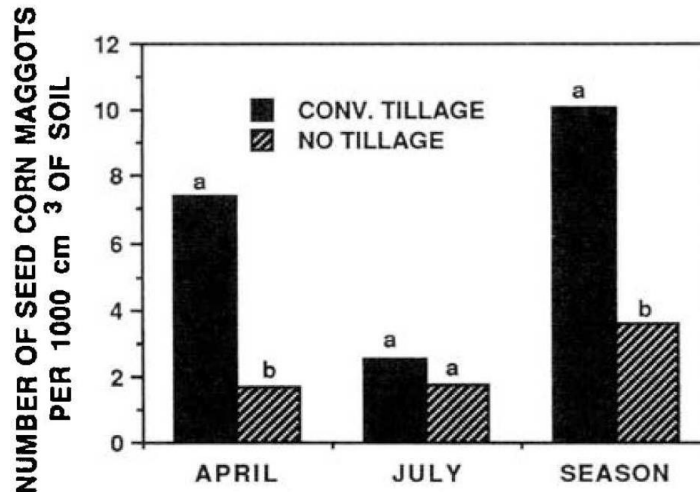
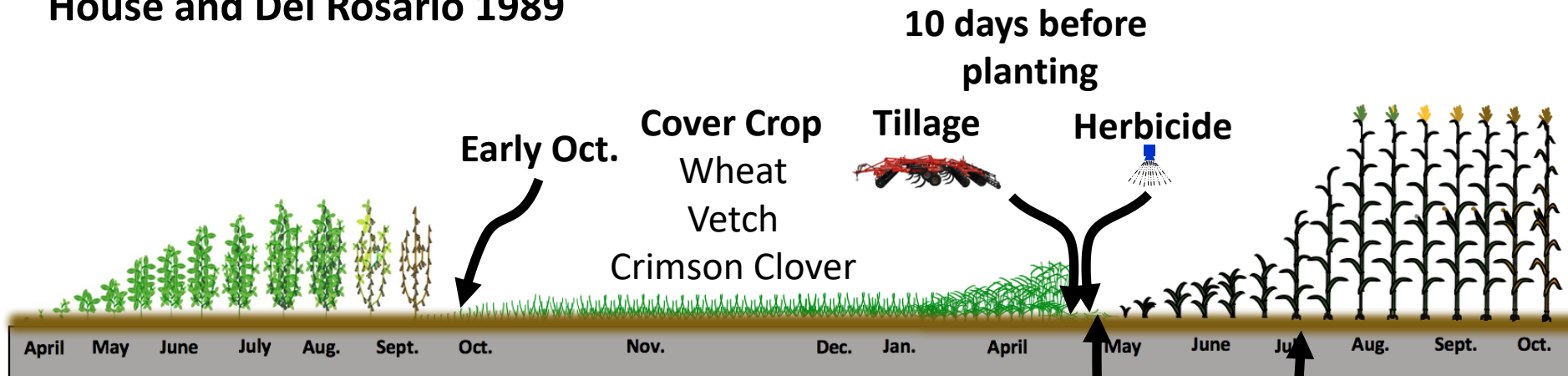
Since Jan 1



# Cover Crop and Insects

## Seed Corn Maggot

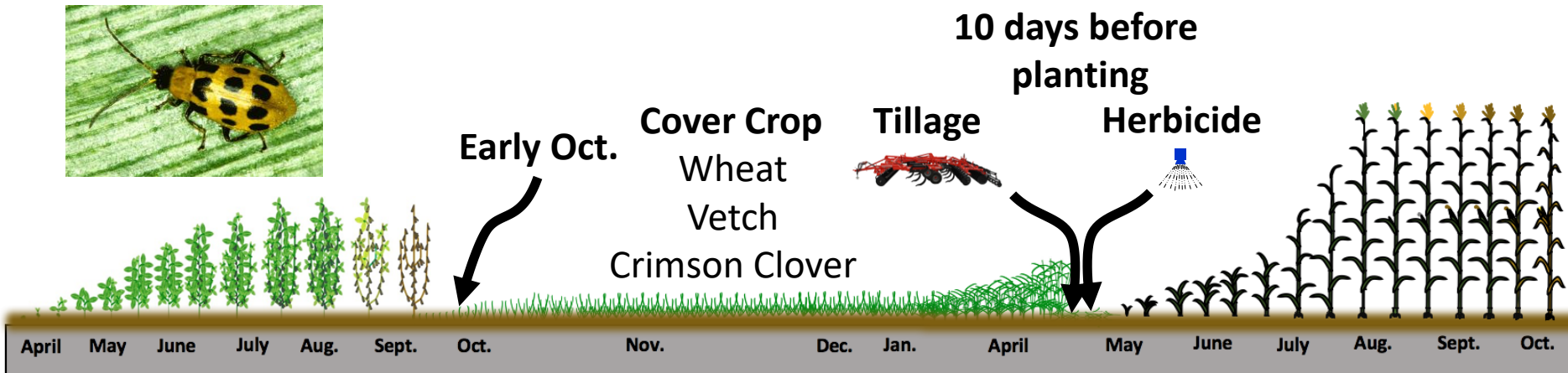
House and Del Rosario 1989



# Cover Crop and Insects

## Seed Corn Maggot

- House and Del Rosario 1989



**Table 1. Shoot, root, and whole-corn plant biomass in g/0.25 m of row, and percentage of damage to corn plants by the southern corn rootworm, Clayton, N.C., 1987; means and one standard deviation are shown**

Plant <sup>a</sup>	Tillage <sup>b</sup>	Shoot wt	Root wt	Whole plant	% Damage <sup>c</sup>
Crimson clover	NT	0.11* ± 0.01	0.29* ± 0.08	0.41* ± 0.09	25*
	CT	0.44 ± 0.15	0.66 ± 0.21	1.11 ± 0.28	11
Hairy vetch	NT	0.07* ± 0.04	0.34 ± 0.24	0.41 ± 0.19	30*
	CT	0.26 ± 0.09	0.57 ± 0.23	0.84 ± 0.47	14
Wheat	NT	0.06** ± 0.03	0.28* ± 0.13	0.35* ± 0.17	12
	CT	0.44 ± 0.12	0.75 ± 0.28	1.18 ± 0.36	8

# Cover Crops

## Other Potential Pests

- Bean leaf beetle
  - Overwintering (leaf litter/residue)
- Wireworm
  - Deposit eggs in weedy areas of fields or cereal crops
  - Live for a number of years in the soil (4-7yrs)
  - Damage depends on soil temperature in the spring
  - Bait traps or sift soil samples
    - 1 or more per bait or 1m<sup>3</sup>



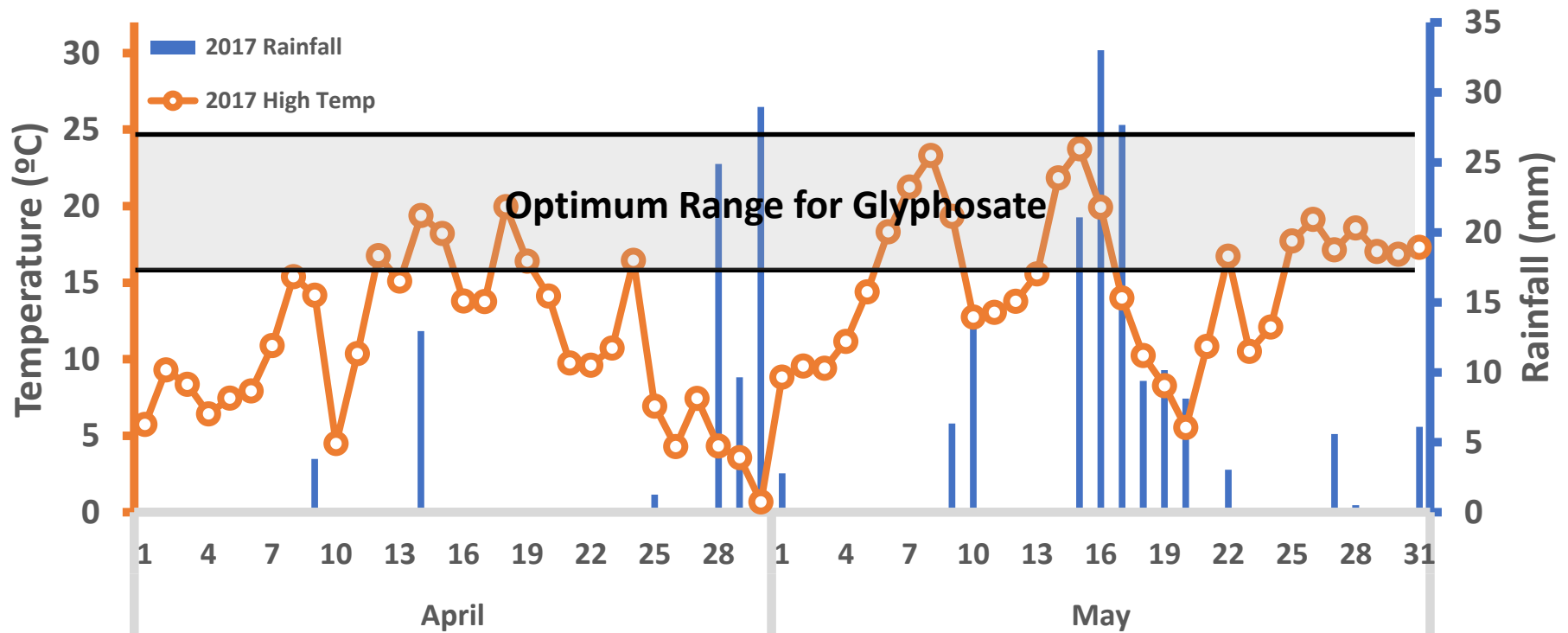
John Obermeyer



# New Pests of Cover Crops

# Spring 2017: Situation

- Cold, wet spring



# Wheat Stem Maggot Field Reports

## Field Reports: May 23<sup>rd</sup>, 2017

- Corn plants exhibiting
  - Dead heart symptoms

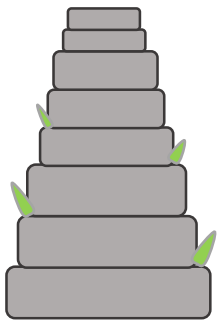


# Wheat Stem Maggot Field Reports

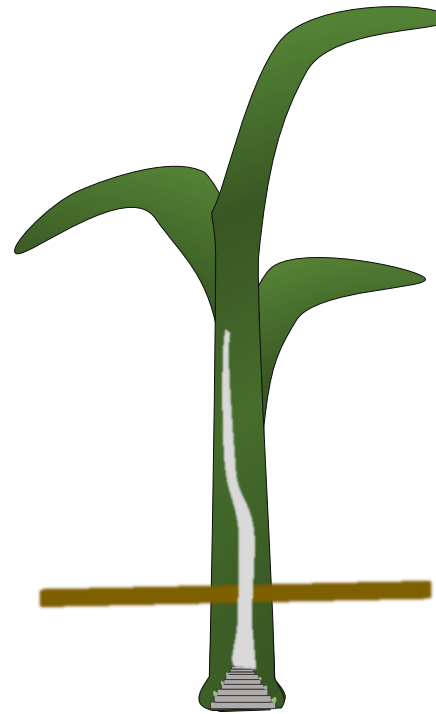
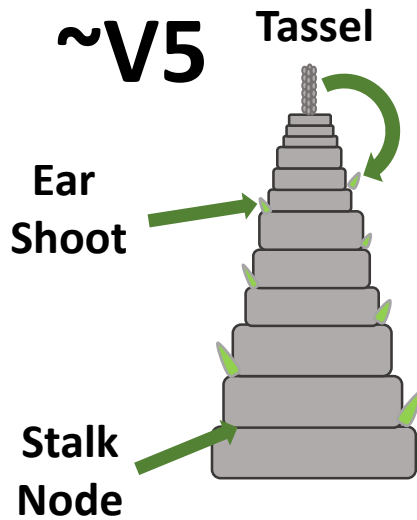
## Field Reports: May 23<sup>rd</sup>, 2017

- Corn plants exhibiting
  - Dead heart symptoms
  - Tillering

V3



~V5



# Cover Crops and Insects

## Wheat Stem Maggot

### Field Issue Reports: May 23<sup>rd</sup>, 2017

- Corn plants exhibiting
  - Dead heart symptoms
  - Tillering
- Dissected plants
  - Maggots typically found within 2 inches of growing point
  - Feeding channel increased in width from top to bottom of plant





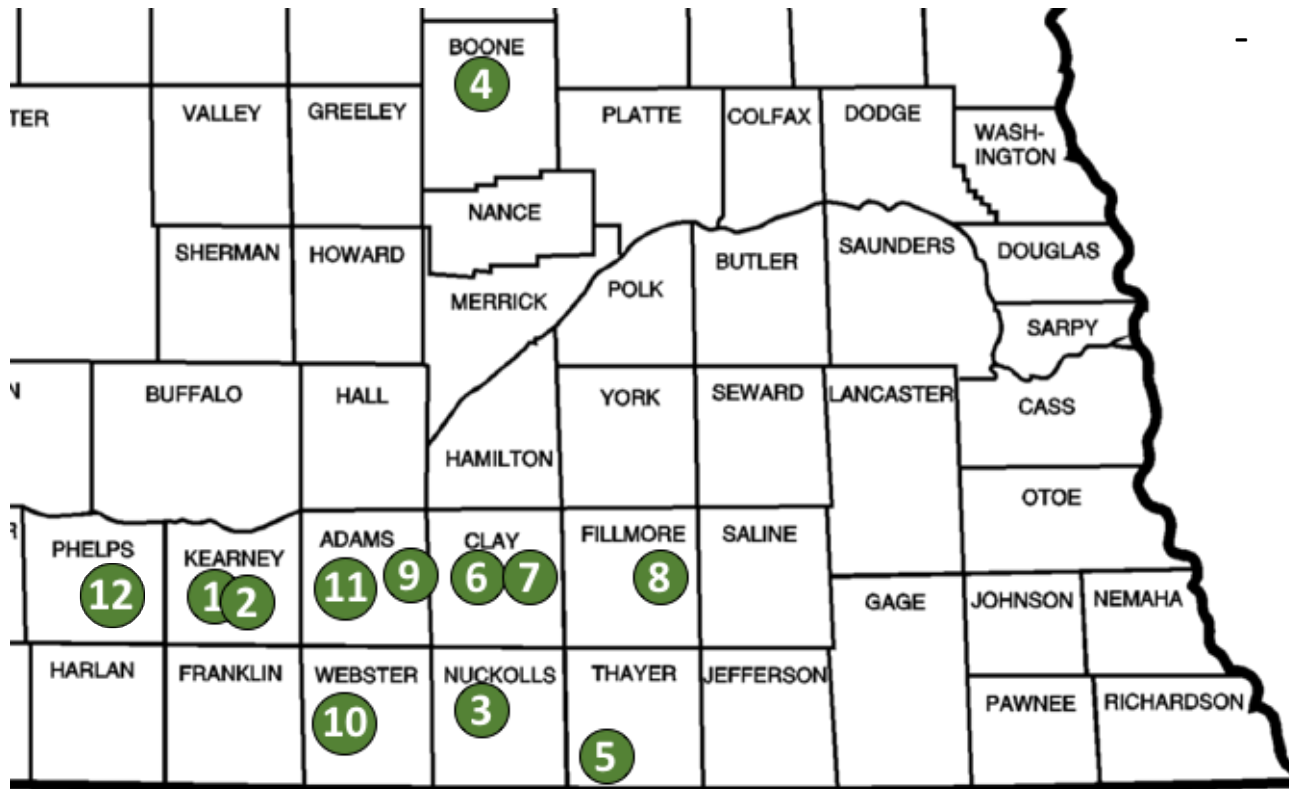
# Cover Crops and Insects

## Wheat Stem Maggot

### 2017 Field Reports

#### Isolated Fields

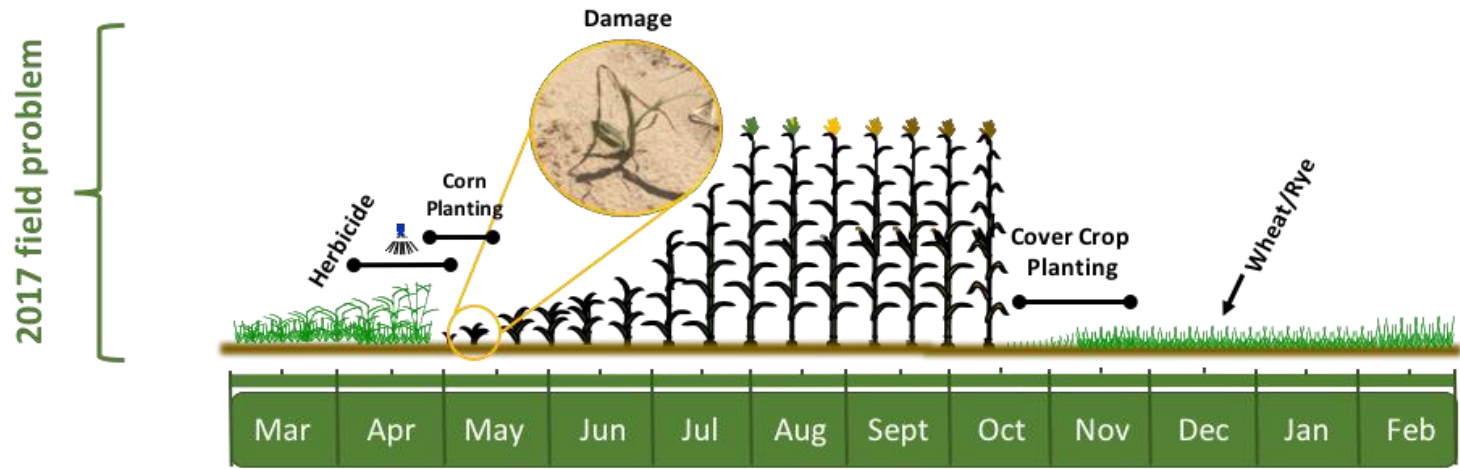
- Northeast Nebraska
- 2005 and 2015



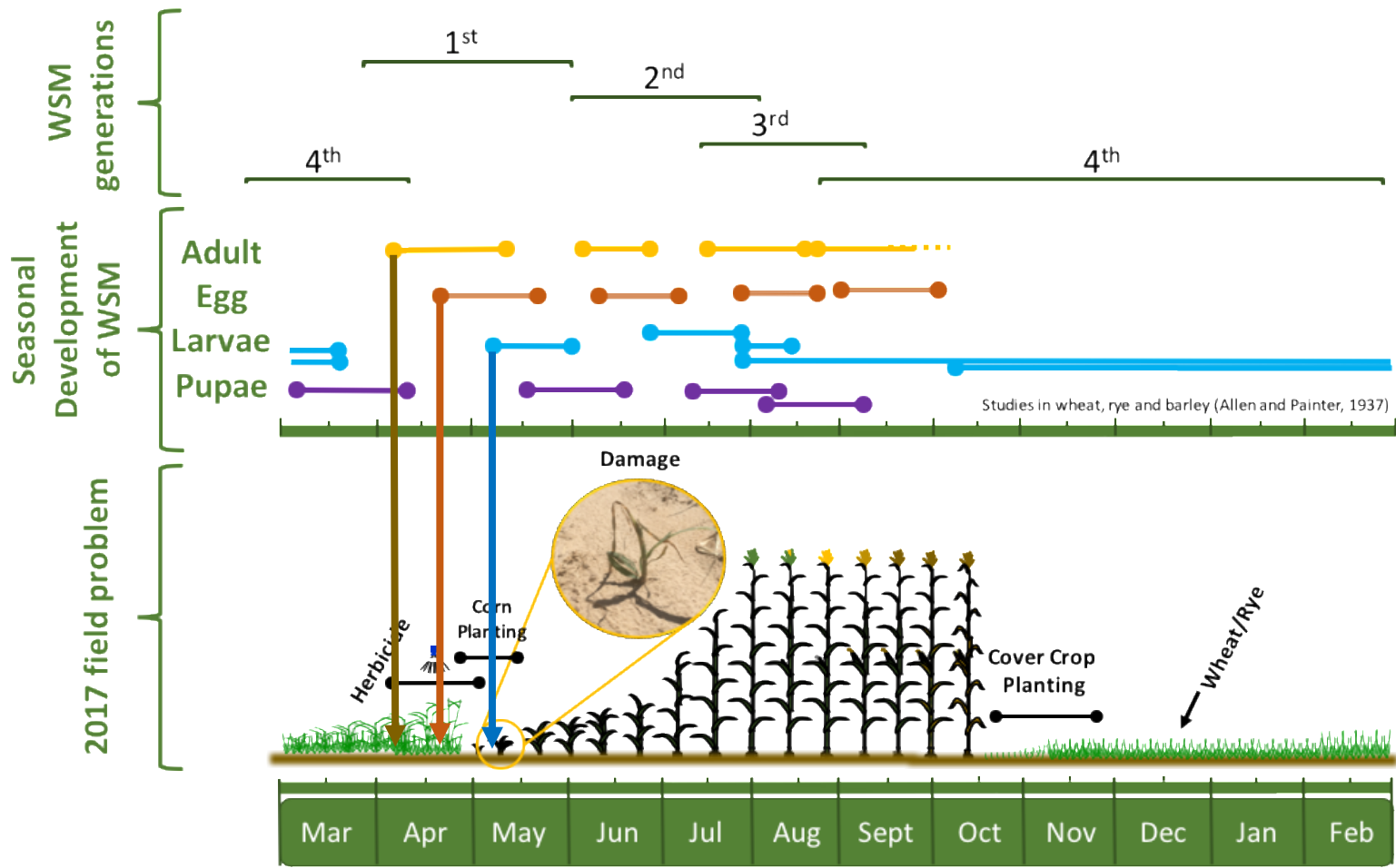
# Field Issue: Characteristics

Field	Cover Crop			Corn Planting	Cover Crop to Corn *	Symp. Plants	WSM Recovered**	Larval Size (mm)
	Species	Planting	Termination					
1	Rye	Mid-Oct	May 2 <sup>nd</sup>	Apr. 22 <sup>nd</sup>	+10d	4 to 23%	9/30	2-6mm
2	Rye	Mid-Oct	May 2 <sup>nd</sup>	Apr. 24 <sup>th</sup>	+12d	0 to 8%	8/21	3-6mm
3	Wheat	Fall	Apr. 19 <sup>th</sup>	Apr. 14 <sup>th</sup>	+4d	50 to 60%	4/25	4-7mm
4	Rye	Oct. 22 <sup>nd</sup>	May 4 <sup>th</sup> /5 <sup>th</sup>	Apr. 23 <sup>rd</sup> /24 <sup>th</sup>	+14d	1 to 3%	12/15	5-6mm
5	-	-	-	-	-	30 to 40%	7/25	4-6mm
6	Wheat	Nov. 5 <sup>th</sup> -11 <sup>th</sup>	Apr. 18 <sup>th</sup>	Apr. 17 <sup>th</sup>	+1d	7 to 29%	4/20	2-4mm
7	Wheat	Oct. 20 <sup>th</sup>	Apr. 18 <sup>th</sup>	Apr. 17 <sup>th</sup>	+1d	1 to 5%	4/21	3-5mm
8	Rye	Nov.	Apr. 24 <sup>th</sup>	Apr. 22 <sup>nd</sup>	+2d	8 to 33%	5/20	5-6mm
9	-	-	-	-	-	2 to 11%	10/20	4-6mm
10	Wheat	Fall	Apr. 8 <sup>th</sup> and May 10 <sup>th</sup>	Apr. 27 <sup>th</sup>	+13d	4 to 27%	2/15	7mm
11	Wheat	Fall	Apr. 24 <sup>th</sup>	Apr. 18 <sup>th</sup>	+6d	28 to 40%	7/21	5-6mm
12	Wheat	Fall	Apr. 28 <sup>th</sup> and June 7 <sup>th</sup>	Apr. 28 <sup>th</sup>	+9d	0 to 4%	0/17	-

# Field Issues and WSM Ecology



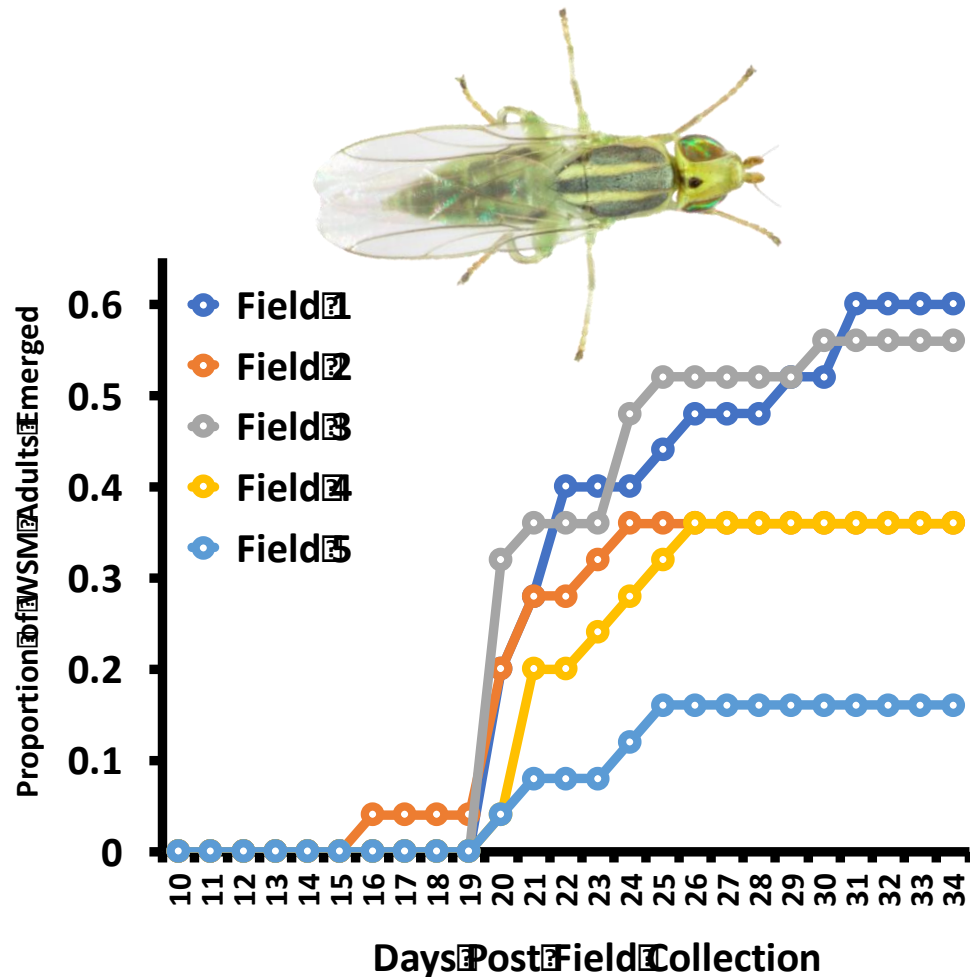
# Field Issues and WSM Ecology



# Cover Crops and Insects

## Wheat Stem Maggot

- Potted and collected symptomatic plants to rear out adults
  - Recovered larvae from 13 – 80% of symptomatic plants
- Adult emergence (+19d)
  - 16% - 64% (54/125)
  - 2 adults from 3 cages





# Cover Crops and Insects

## Current Hypothesis

- Wheat stem maggot eggs laid in fall or early spring on wheat or rye cover crop
  - In larval development stage at time of cover crop termination
  - Larvae moved to corn to complete development



# Cover Crops and Insects

## Wheat Stem Maggot

- **Yield impacts**
  - Not clearly defined
  - Tillering will reduce yields
  - Competition between plants
- **Fields with cover crop planted in patches**
  - ~30 bu yield loss (50% of plants infested)



# WSM Management in 2018

- **Seed treatments**
  - Trial naturally infested in 2015
  - No signs of control against WSM with highest rate of clothianidin
- **Tank mixing insecticide at termination**
  - Time of death and movement of WSM between cover crop and corn is not known
  - Unlikely to have enough residual insecticide
  - Kills beneficial insects
- **Grazing**
  - Little to no effect as maggots feed at the base of plant
- **Terminate cover crop 14 days prior to planting**



# Summary

- **Impacts of insects from cover crops**
  - **Cover crop species**
  - **Management practices (termination timing and method)**
  - **Environmental factors**
- **Scout fields to avoid significant losses**
- **Spraying cover crops with insecticide will likely eliminate beneficial insects**

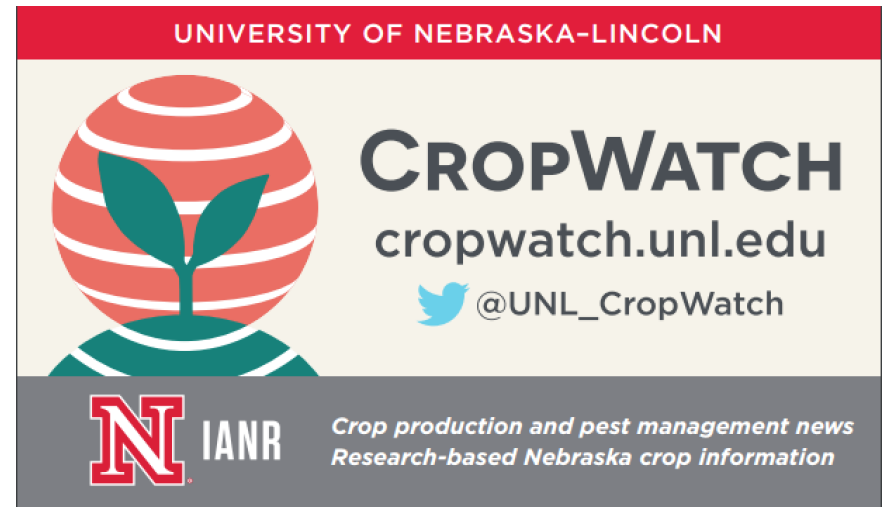
# On-Going Cover Crop Studies

- Planting date and termination study
  - Oat-Rye Cover Crop
  - Four fall planting dates and two termination dates
- Cover crop species and termination date study
  - Wheat, Rye and Triticale
  - Four termination dates
- Cover crop and insecticide use study
  - Tank-mixed vs. delayed insecticide application
  - Impact on pest and beneficial insects



# Thank You

What questions  
do you have?



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