PURDUE UNIVERSITY

PURDUE EXTENSION

Corn Earworm Management in Sweet Corn

Rick Foster

Department of Entomology

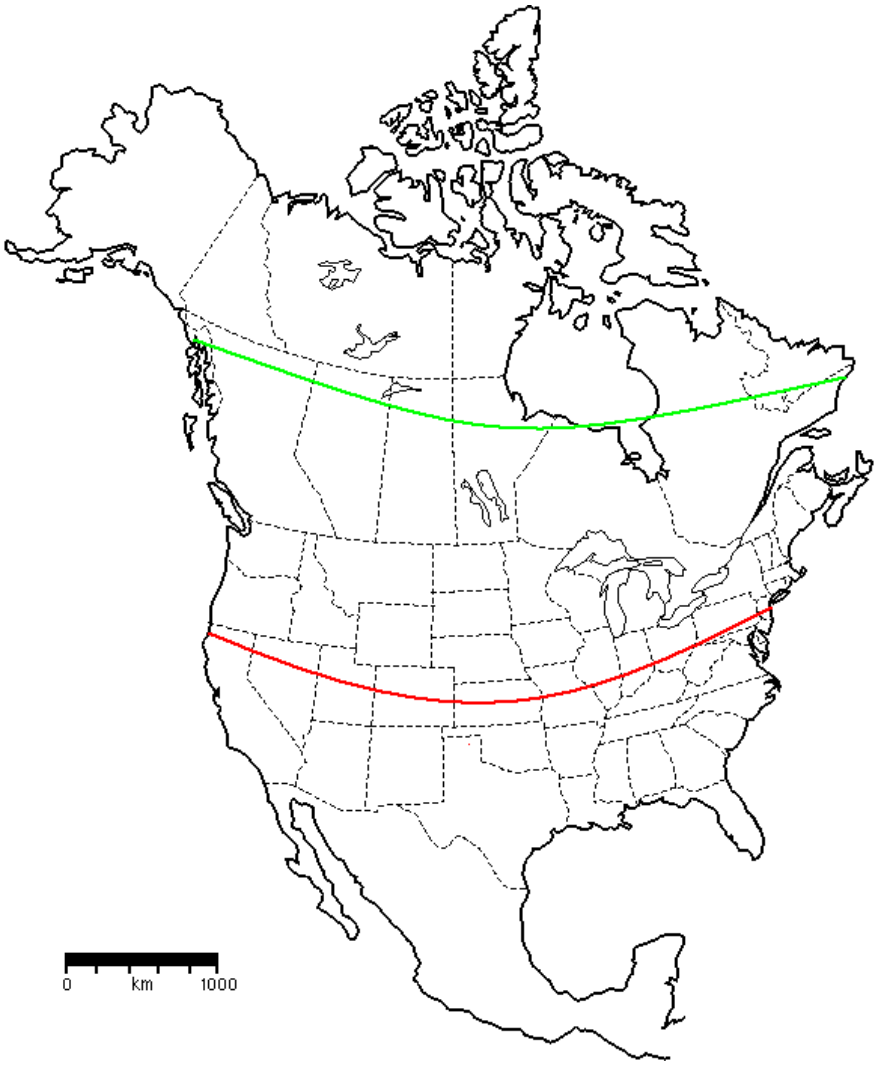
Purdue University

Corn Earworm

- Pest of sweet corn, seed corn and tomato
- Two generations per year where it overwinters– 2nd is usually most important
- Does not overwinter in large numbers in northern 2/3 of Indiana or Illinois

Corn Earworm Range

- Usually doesn't overwinter north of 40 N
- Migrate up to 59 N



Corn Earworm Biology

- Females prefer to lay eggs on green silks

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- Females prefer to lay eggs on green silks
- If silks are unavailable, will lay eggs on foliage
- Will also lay eggs on brown silks

Corn Earworm Biology

- When larvae hatch, they move directly into the ear tip
- Once inside the ear, the larvae are protected from insecticides
- Silks are constantly growing so unprotected silks are present every day

Corn Earworm Control

- Must have insecticide present on silk when larvae hatches from egg
- Pyrethroids have been primary control options, especially Capture, Mustang Max Hero, and Warrior
- Some concerns about resistance
- Coragen and Radiant appear to be good alternatives

Corn Earworm Management

- Treat when fresh, green silks are present (start at 70%)
- Treat if catching more than 10 moths per night

Corn Earworm Management

- Make treatments every 2-5 days from 70% silks until silks are brown; generally 3-4 treatments
- Shorten interval if temperatures are high
- Shorten interval if moth catches are high
- Include Penncap-M for adult control when moth catches exceed 100/night

Corn Earworm Management

- First generation populations may or may not reach economic levels
- During much of the season, few earworms present
- Once the second generation hits, populations will likely be high for the rest of the season
- Date of arrival of second generation is variable and dependent upon proper weather conditions

Weather & Insect Migration

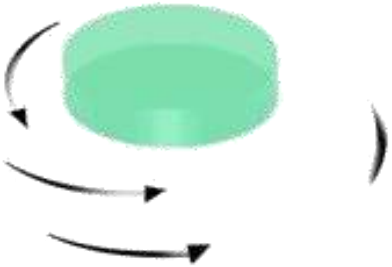
- Those insects that cannot overwinter must migrate from southern states to northern ones.

- Specific weather patterns must be in place for an insect migration to occur…

What Do You Need for Insects to Migrate?

A HIGH

A FRONT



A LOW

A Source Region

What is

A Source Region ?

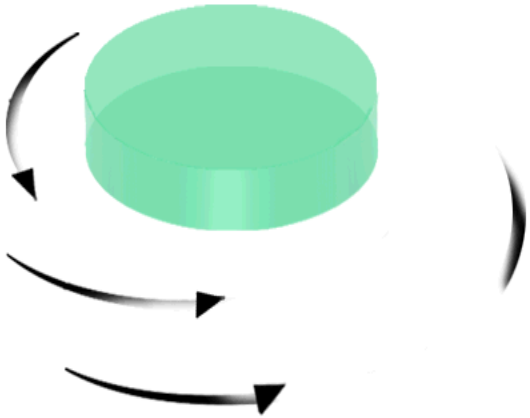
A Source Region is an area with a large population of adult (winged) insects.

Our Source Region for corn earworms is Texas and Louisiana

Corn earworms in South have continual generations

What is

A LOW ?



A Low Pressure Cell creates winds that move counter-clockwise
into its center.

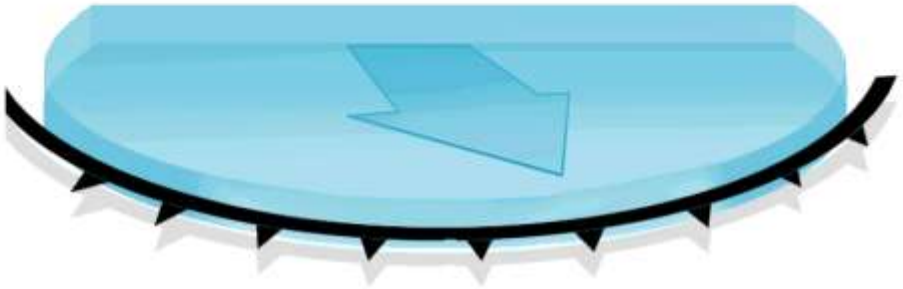
What is

A HIGH ?

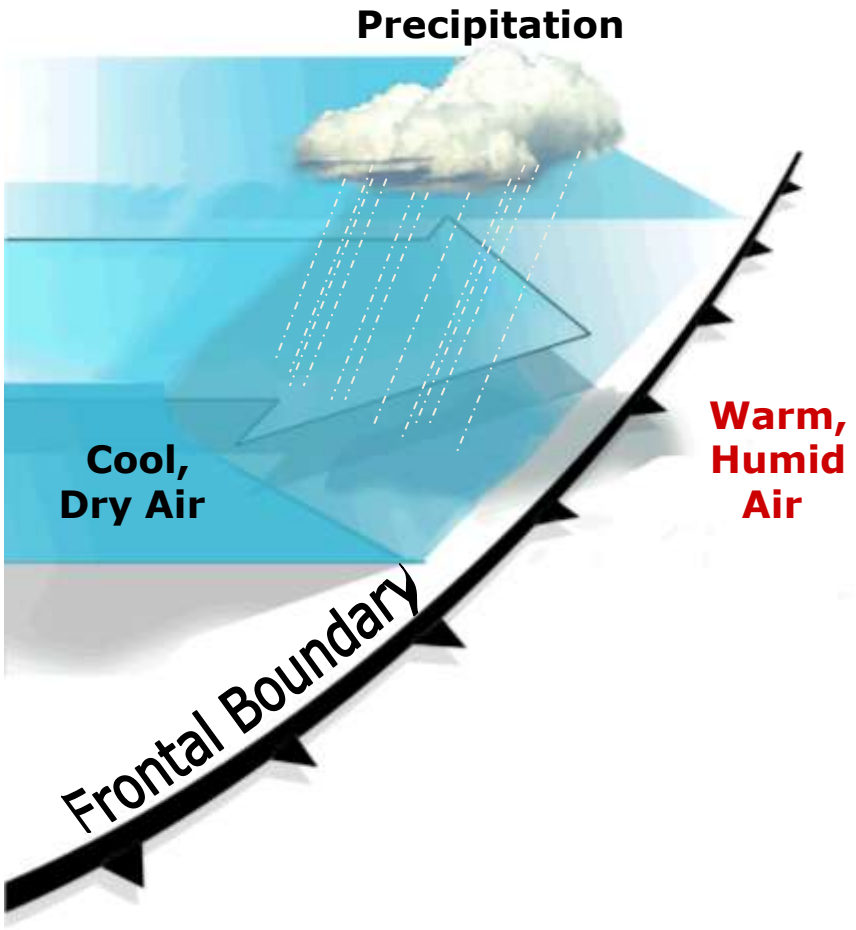
A High Pressure Cell creates winds that move clockwise *away* from its center.

What is
A FRONT ?

The Front brings in a mass of cool, dry air (blue).



A FRONT

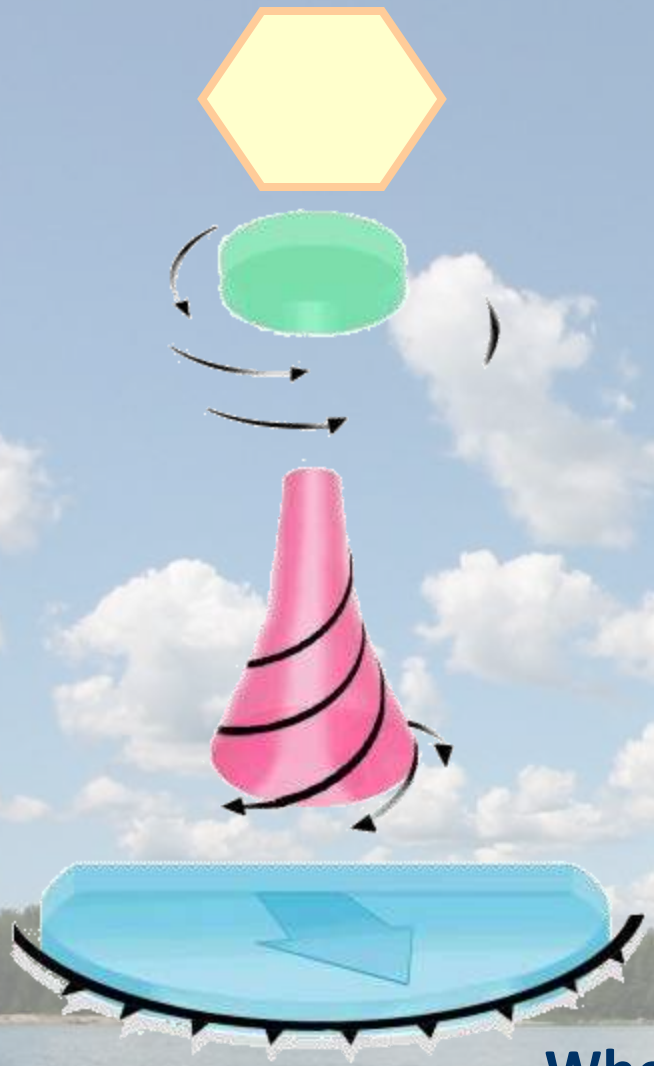


The cool air behind the Frontal Boundary (black line) moves like a wedge into warm, humid air.

A FRONT

The Frontal Boundary is characterized by fluffy clouds and precipitation.

The Pieces:



A Source Region

A LOW

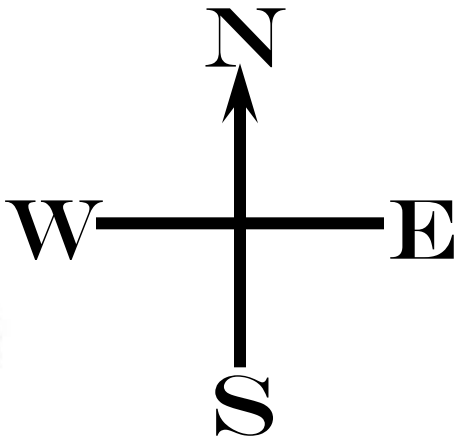
A HIGH

A FRONT

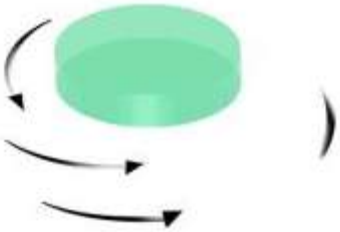
Where do the pieces need to be placed for corn earworms to migrate?

Where the Pieces Need to be Placed

The FRONT in the north



The LOW in the west



The HIGH in the east

The Source Region in the south

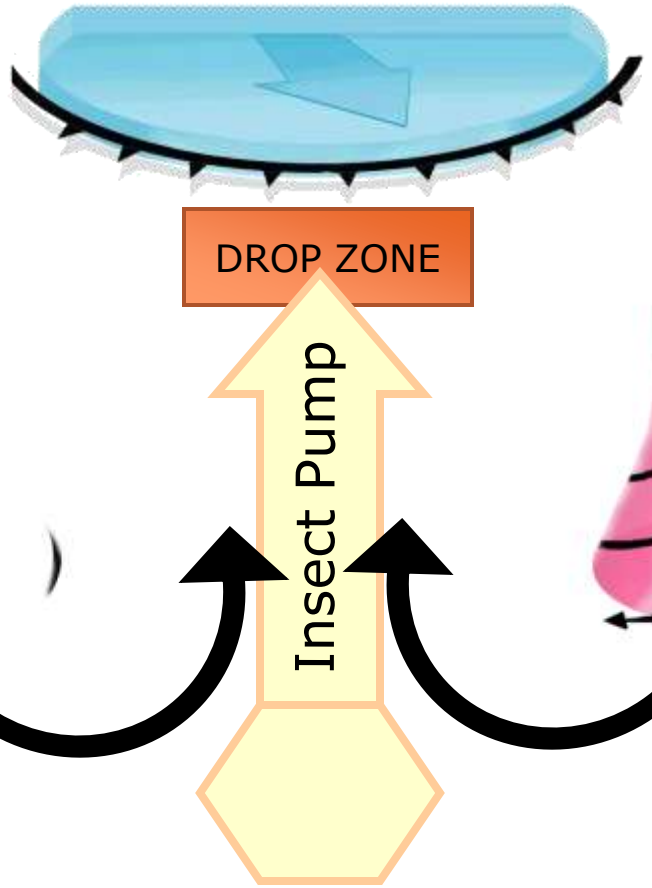
Where the Pieces need to be Placed

The FRONT in the north

When the traveling insects meet the Front, they fall to the ground.

We call this area

THE DROP ZONE.



The LOW in the west

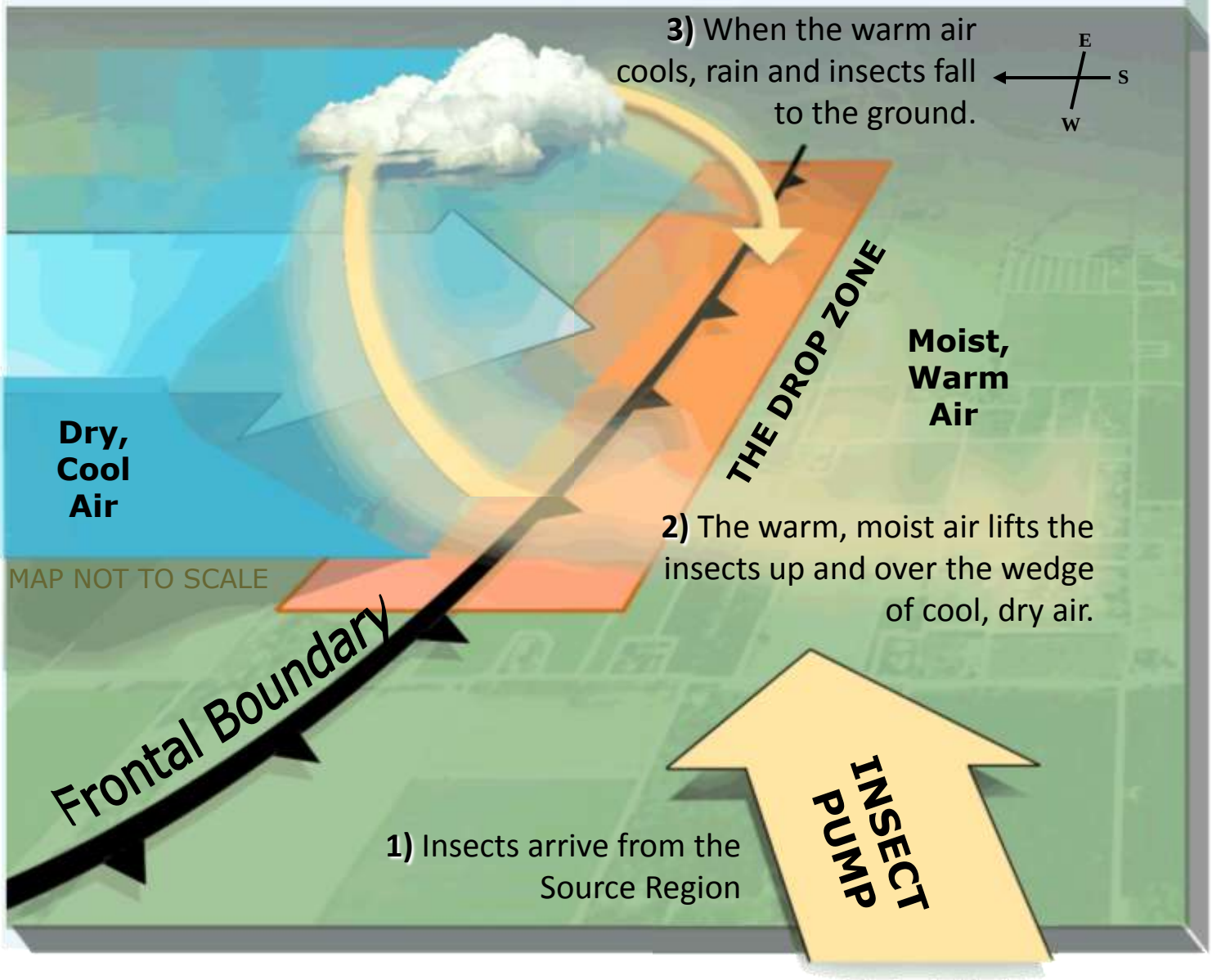
The HIGH in the east

Winds move counter-clockwise from the LOW

Winds move clockwise from the HIGH

The Source Region in the south

A Close-up of the DROP ZONE



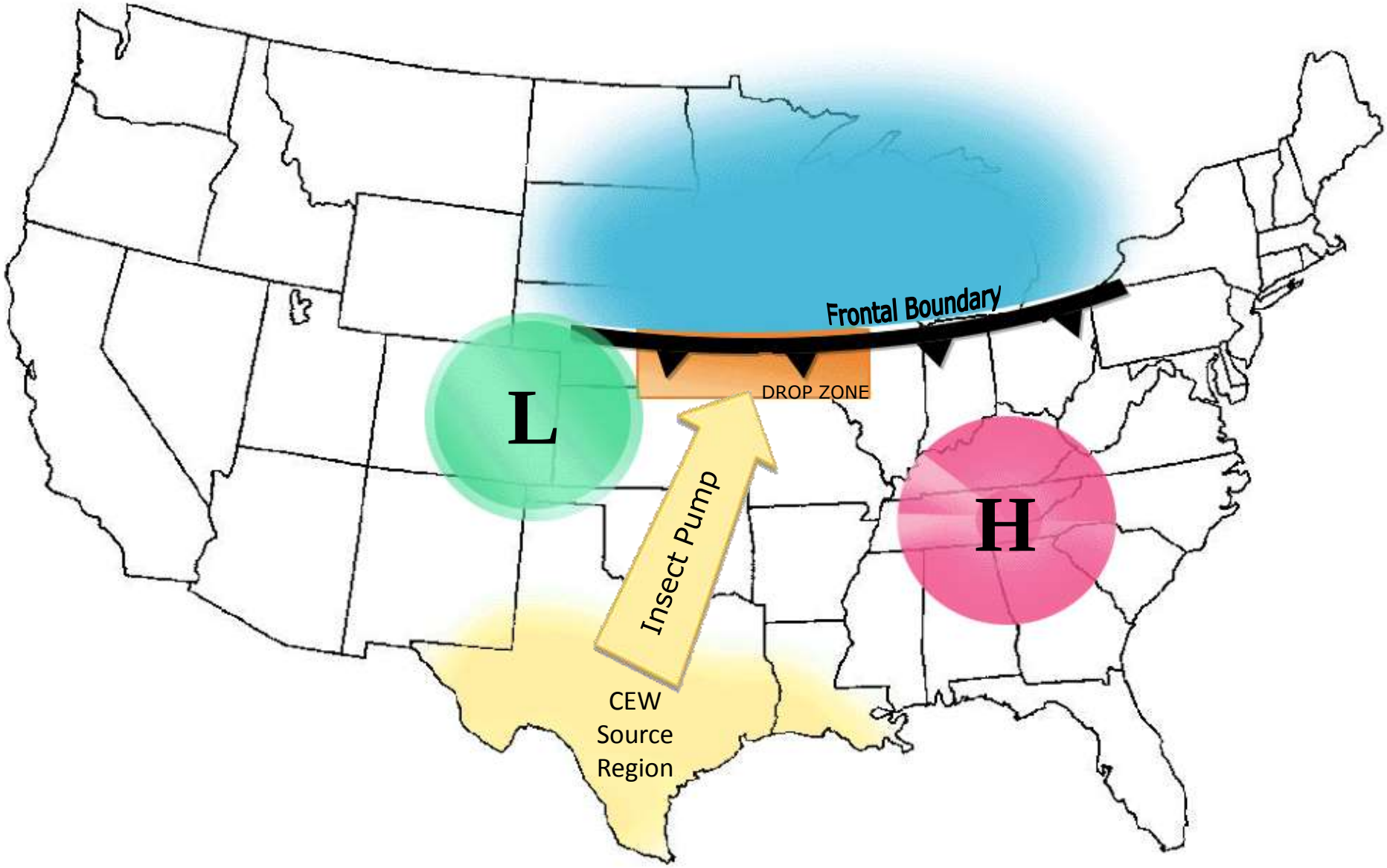
Corn Earworm Infestation in Iowa

August 4th–5th, 2002

Photo by B. Patterson

- Source Region: Texas and Oklahoma
- Drop Zone: Along Interstate 80
  Iowa, Nebraska, and Illinois
- The Result: Severely damaged cornfields

August 4th to 5th, 2002



August 4th to 5th, 2002

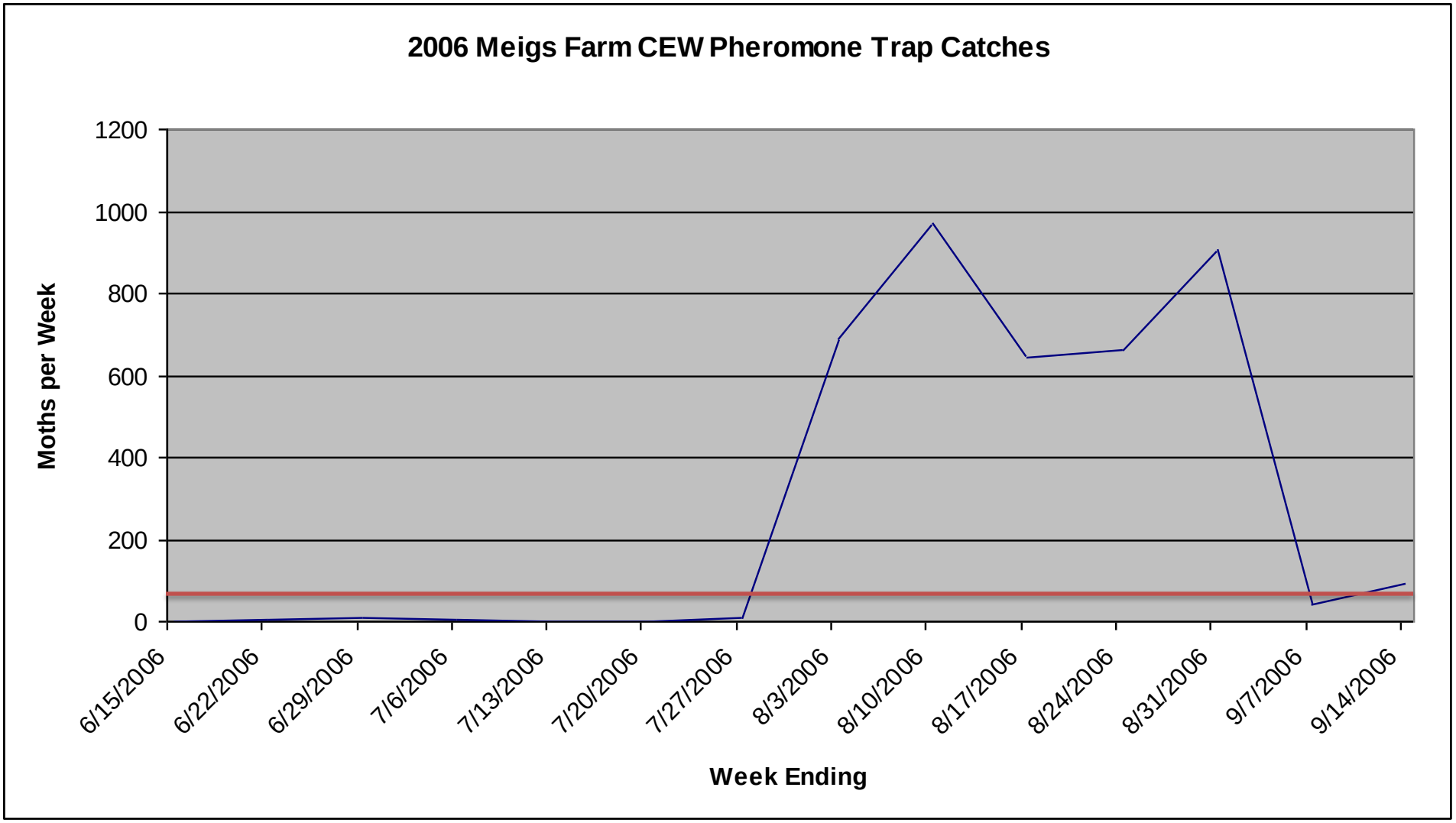
In 2002, corn earworm destroyed many crops in Iowa, Illinois, and Nebraska.

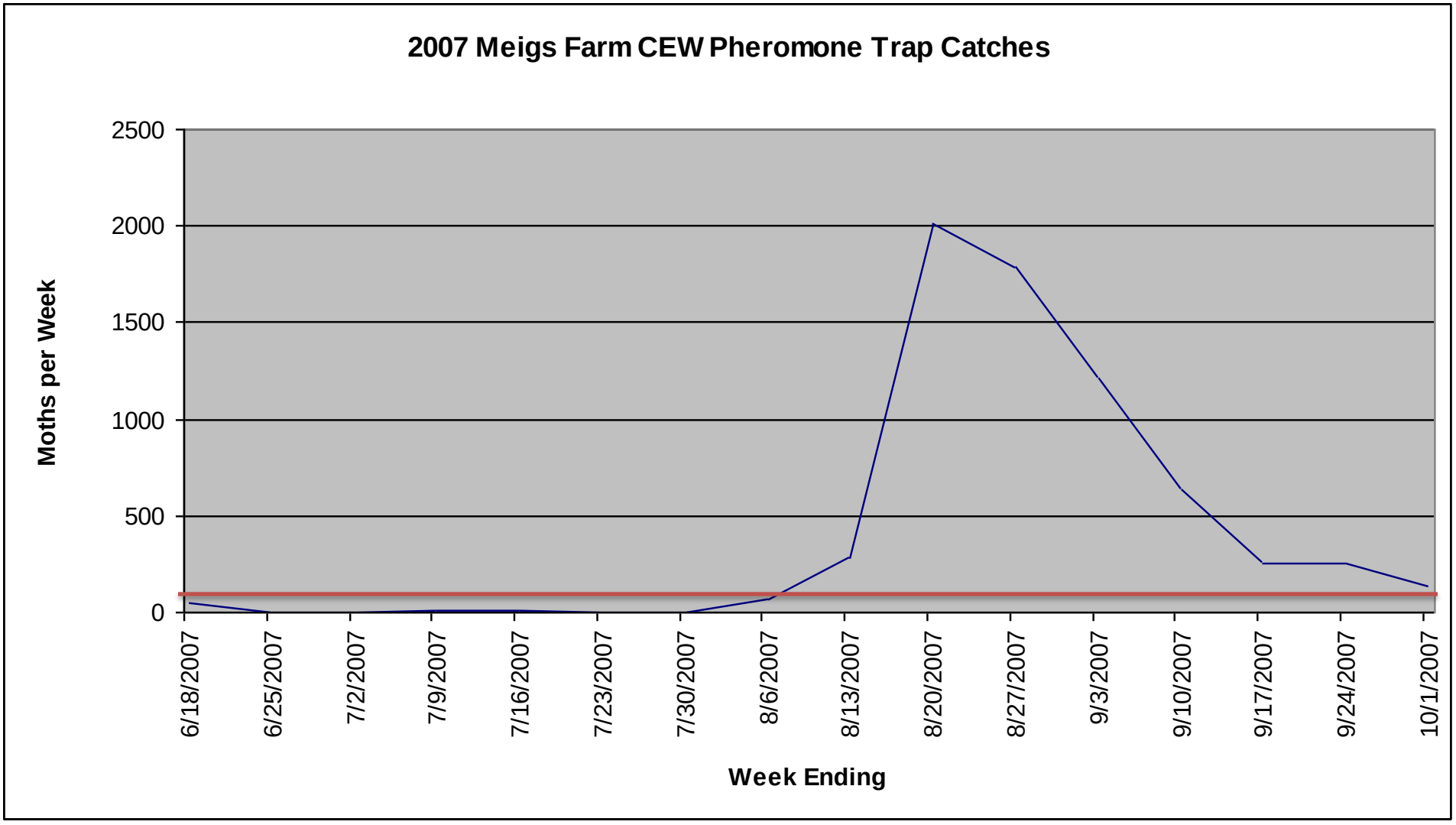
Corn Earworm Migration

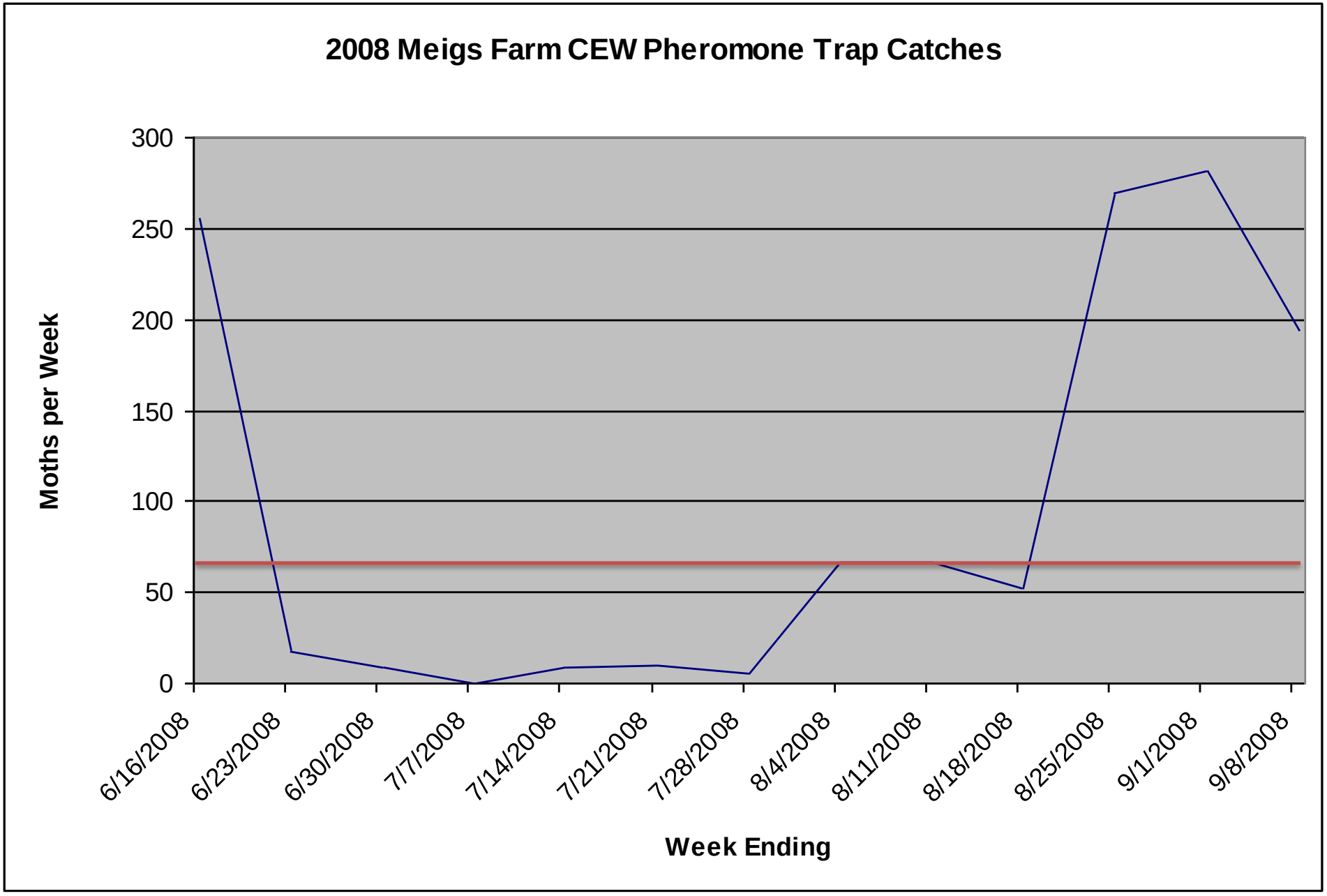
- Whenever weather conditions are suitable for migration, we are likely to see increased pheromone trap catches
- Can occur at any time during the season, but is most common in late July and August

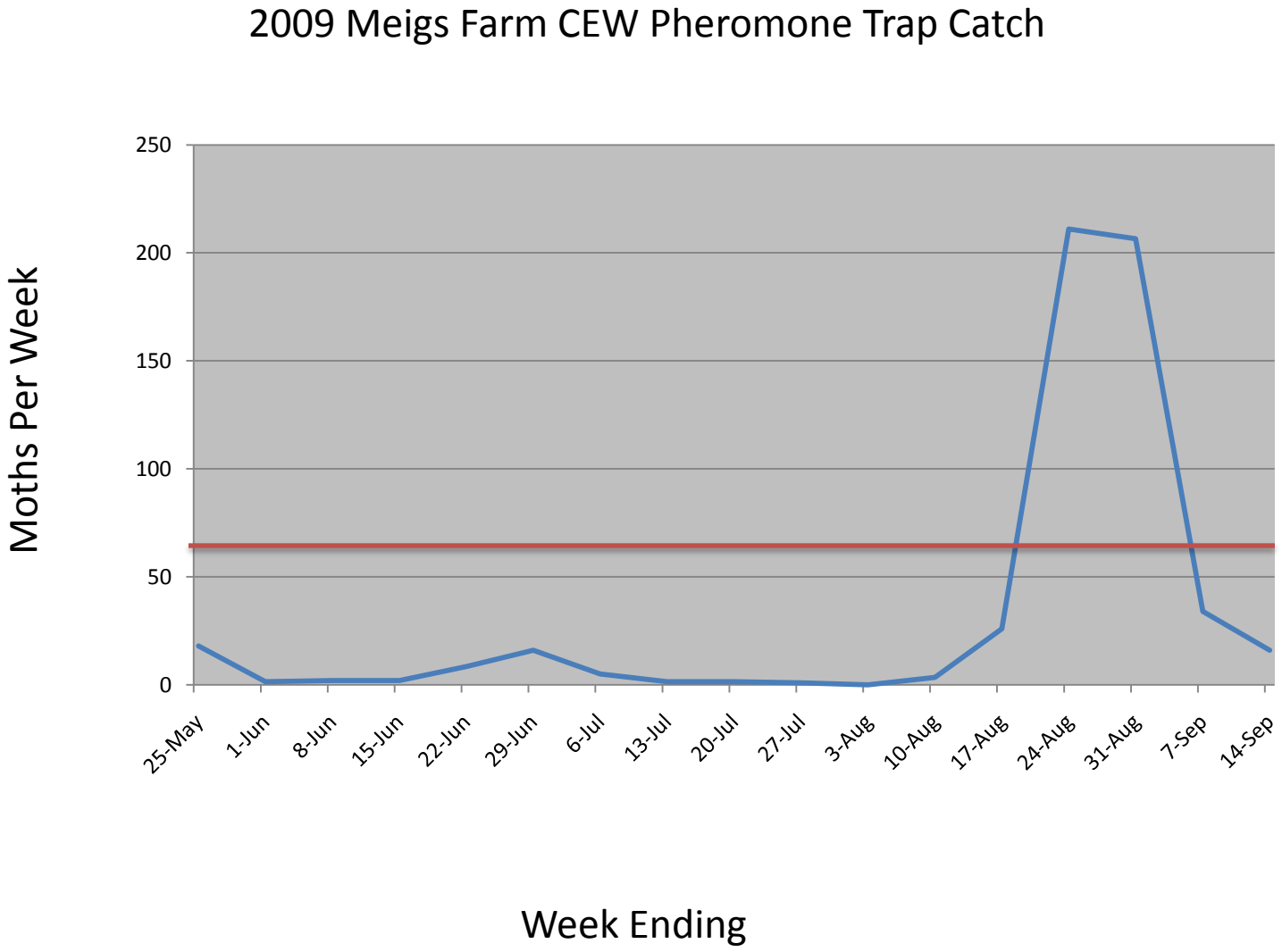
Corn Earworm Management

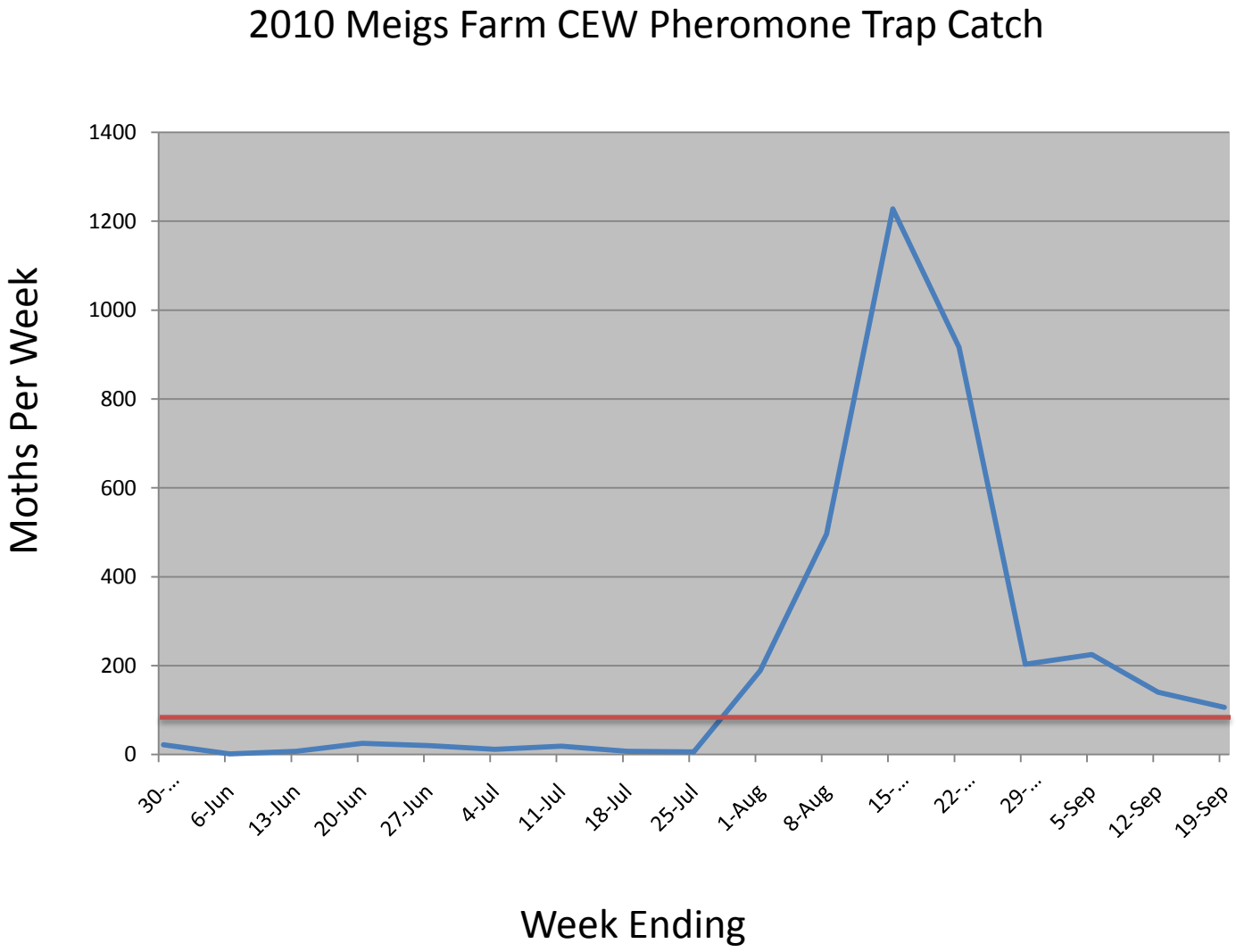
- First generation populations may or may not reach economic levels
- During much of the season, few earworms present
- Once the second generation hits, populations will likely be high for the rest of the season
- Date of arrival of second generation is variable and dependent upon proper weather conditions
- A pheromone trap is a critical management tool


2006 Meigs Farm CEW Pheromone Trap Catches
Moths per Week
1200
1000
800
600
400
200
0
6/15/2006
6/22/2006
6/29/2006
7/6/2006
7/13/2006
7/20/2006
7/27/2006
8/3/2006
8/10/2006
8/17/2006
8/24/2006
8/31/2006
9/7/2006
9/14/2006
Week Ending


2007 Meigs Farm CEW Pheromone Trap Catches
Moths per Week
2500
2000
1500
1000
500
0
6/18/2007
6/25/2007
7/2/2007
7/9/2007
7/16/2007
7/23/2007
7/30/2007
8/6/2007
8/13/2007
8/20/2007
8/27/2007
9/3/2007
9/10/2007
9/17/2007
9/24/2007
10/1/2007
Week Ending


2008 Meigs Farm CEW Pheromone Trap Catches
Moths per Week
300
250
200
150
100
50
0
6/16/2008
6/23/2008
6/30/2008
7/7/2008
7/14/2008
7/21/2008
7/28/2008
8/4/2008
8/11/2008
8/18/2008
8/25/2008
9/1/2008
9/8/2008
Week Ending


2009 Meigs Farm CEW Pheromone Trap Catch
Moths Per Week
250
200
150
100
50
0
25-May
1-Jun
8-Jun
15-Jun
22-Jun
29-Jun
6-Jul
13-Jul
20-Jul
27-Jul
3-Aug
10-Aug
17-Aug
24-Aug
31-Aug
7-Sep
14-Sep
Week Ending


2010 Meigs Farm CEW Pheromone Trap Catch
Moths Per Week
1400
1200
1000
800
600
400
200
0
30-…
6-Jun
13-Jun
20-Jun
27-Jun
4-Jul
11-Jul
18-Jul
25-Jul
1-Aug
8-Aug
15-…
22-…
29-…
5-Sep
12-Sep
19-Sep
Week Ending

CEW Management Tips

- The first application (70% silks) is the most critical, with each succeeding spray being less important
- Getting good coverage of the silks is imperative – consider drop nozzles. Test with water sensitive paper.
- High gallonage is preferred – 20 gallons per acre or more

Managing Corn Earworm in Bt Sweet Corn

- Bt toxin will kill or stunt the growth of earworms
- In late planted sweet corn, may have lots of very small larvae in ear tip
- May also need to treat to control rootworm beetles


Normal Sweet Corn
Bt Sweet Corn

2007 Sweet Corn Trial

Chemical	Small CEW/ear	Large CEW/ear	% Clean Ears	Damaged Kernels/Ear
Untreated	0.51 c	0.98 a	3.0 h	25.3 a
BC0805	0.79 ab	0.06 e	50.0 a	2.6 g
Warrior	0.06 e	0.19 b-e	24.6 def	12.2 c-f
Mustang Max	0.10 e	0.21 b-e	26.8 def	10.7 c-f
Capture	0.14 de	0.22 b-e	36.0 a-e	11.4 c-f

2008 Sweet Corn Trial

Chemical	Small CEW/ear	Large CEW/ear	% Clean Ears	Damaged Kernels/ear
Untreated	0.18 b	0.45 a	25.0 g	14.4 a
BC0805	0.38 a	0.01 de	64.5 f	2.3 b-e
BC0805 + Warrior	0.07 c	0.01 de	92.0 a	0.3 e
Warrior	0.02 c	0.04 cde	85.8 abc	1.3 de
Capture	0.04 c	0.03 cde	85.0 a-d	1.6 cde

New Research Project

- Funded by NC IPM Regional Grants Program – cooperative project with Rick Weinzierl
- Goal was to test and possibly refine threshold of 10 moths per night in pheromone trap
- Methodology was to cover ears with paper bags, expose them to earworm egg laying for one night, then count eggs on the silks
- We then wanted to relate pheromone trap catches with egg laying

Factors that Might Influence Relationship

- Weather
  - Temperature
  - Rainfall
  - Wind
  - Relative humidity
- Stage of development of surrounding corn
- Age of the silks

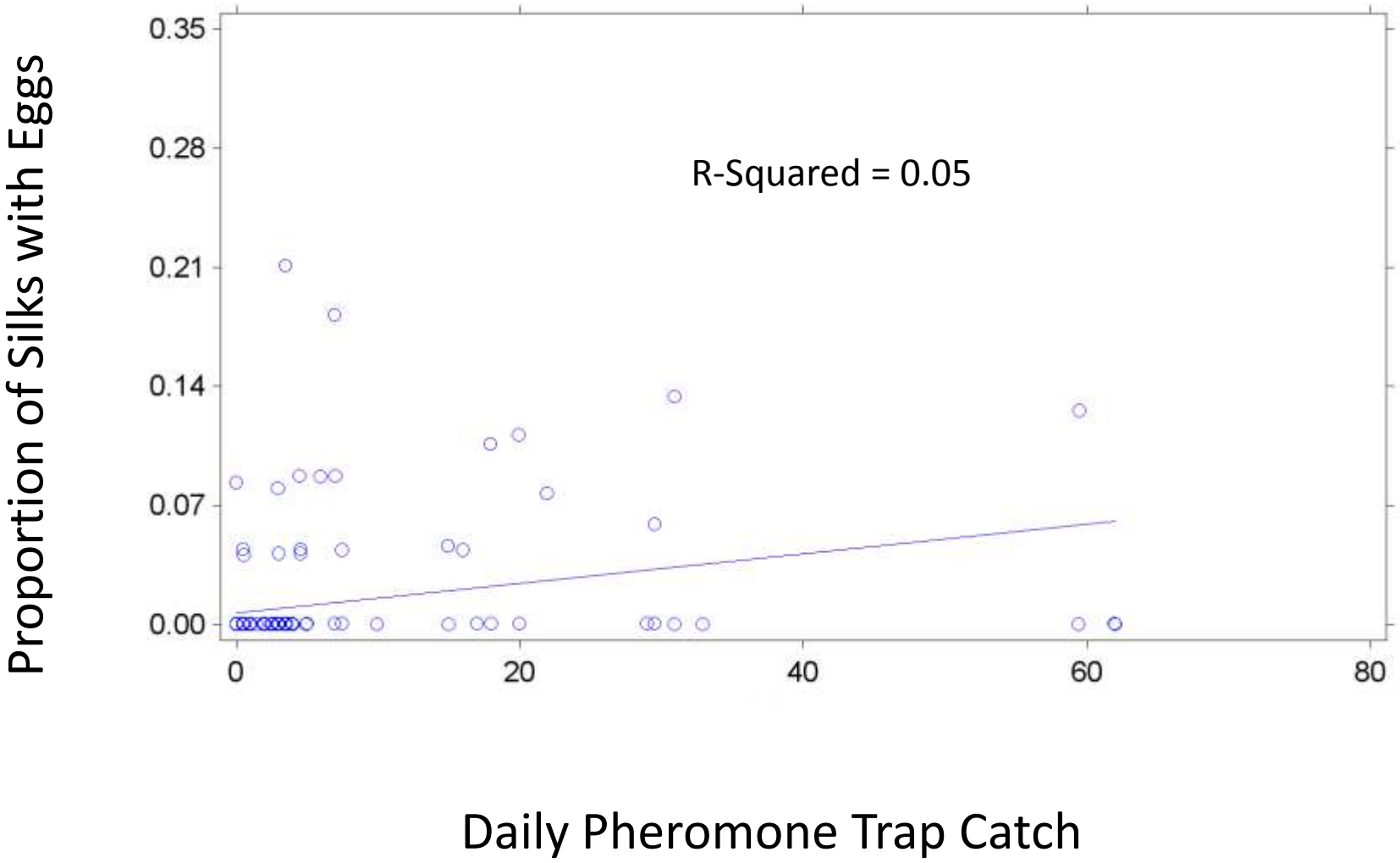
Experimental Design

- 10 planting dates in 2009; 9 planting dates in 2010 (ranged from mid-March through late July)
- 2 varieties with 7 days difference in maturity
- 4 locations; 2 in Indiana, 2 in Illinois
- 2 years
- 10 days of silking
- 25 silks per day
- Potentially 20,000 silks
- Also, equal number of ears exposed but saved for harvest evaluation; another 20,000 ears
- Each bag removed every morning and replaced every afternoon for 5-7 days to allow pollination

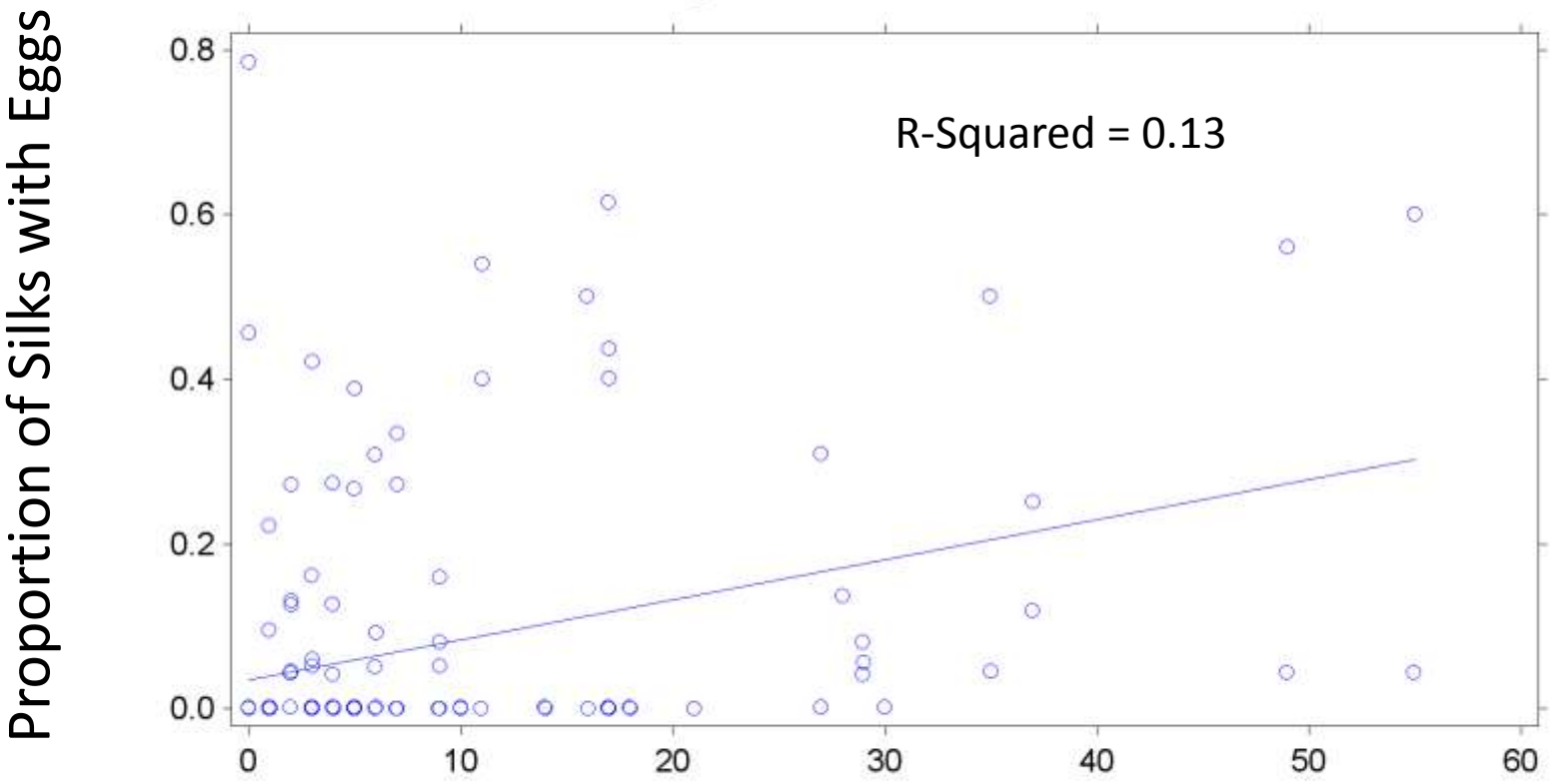
Results

- Lots of work still to do on data analysis
- If there was a perfect relationship between pheromone trap catch and egg laying, we would expect to see a straight line and an R squared of 1.00.
- Biological systems never work this way, so we expect to see some variation
  - Example

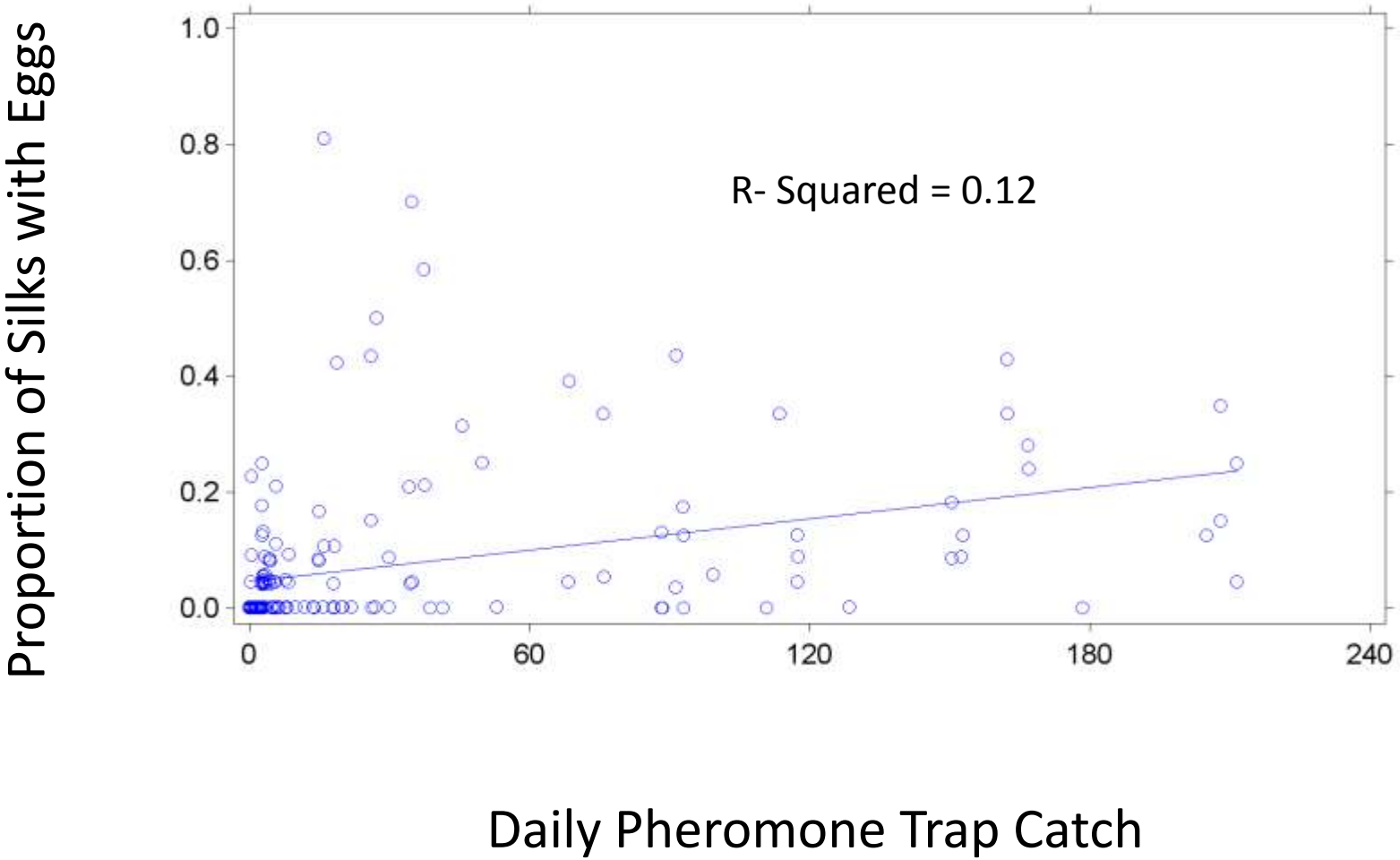
Lafayette, IN 2009



Vincennes, IN 2009



Lafayette, IN 2010



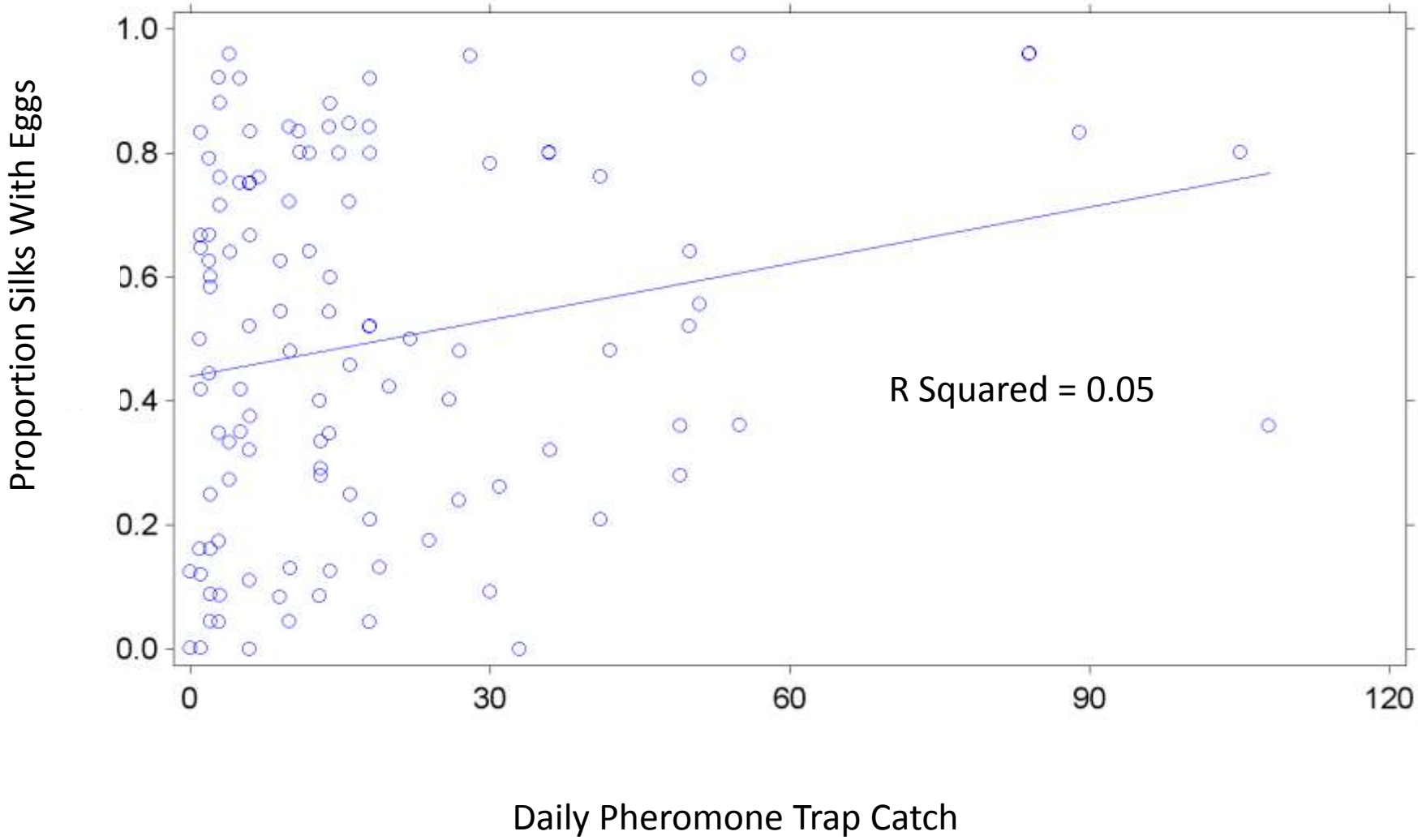
So?

- Obviously, there is not a simple relationship between pheromone trap catch and egg deposition
- Lots of data analysis (and 4 other site/years) need to be done
- One factor that has emerged (not statistically) as important is the stage of development of surrounding corn

Why Does the Stage of Development of the Surrounding Corn Matter?

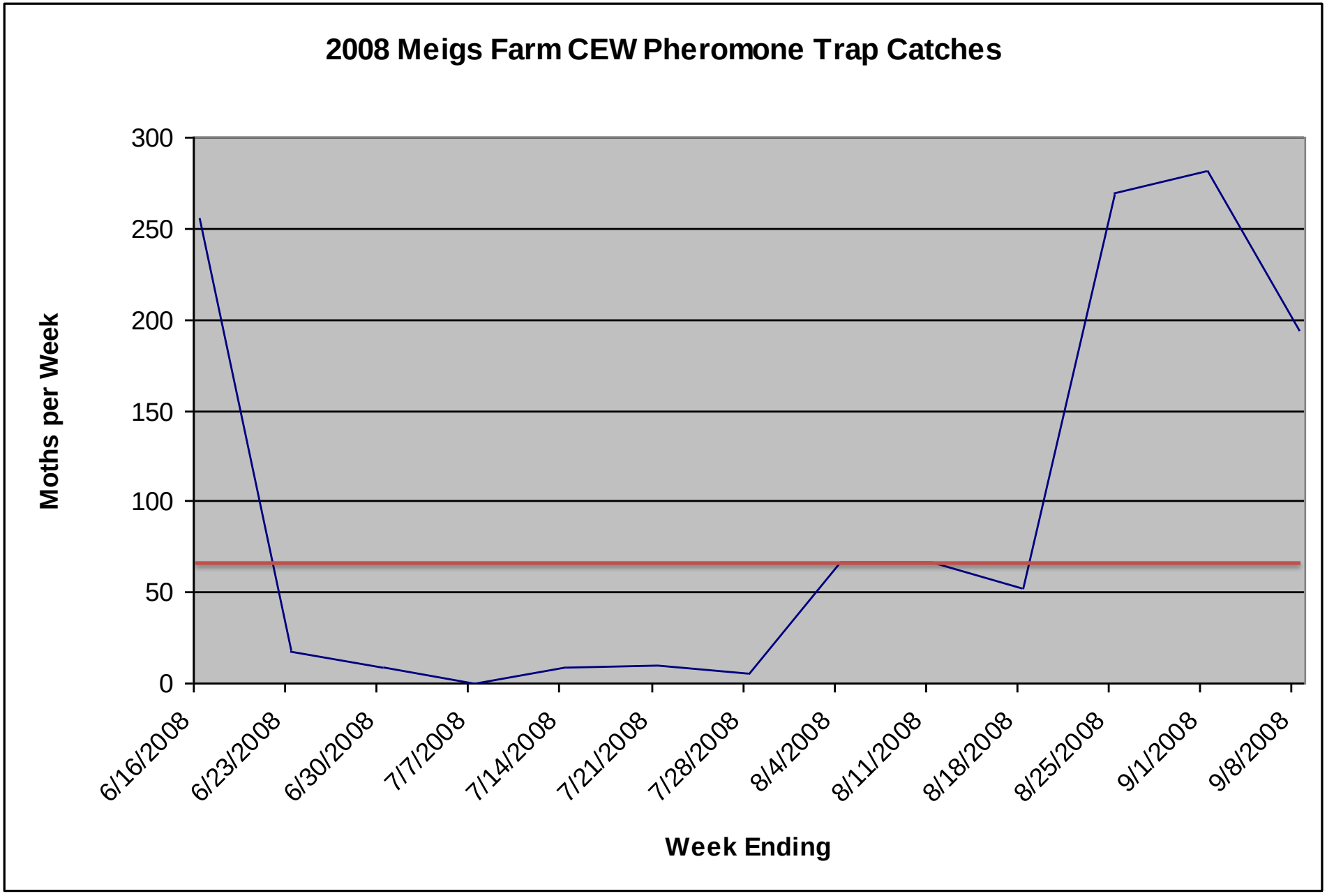
- In most Midwestern states, sweet corn is an island in an ocean of field corn
- Female earworm moths prefer to lay their eggs on green silks
- When most field corn is attractive to moths for oviposition, eggs are diluted throughout field and sweet corn
- When field corn is not attractive to moths for oviposition, eggs are concentrated in the relatively few acres of sweet corn that is in an attractive stage

Dixon Springs, IL 2010



So, what does that mean for sweet corn growers?

- During the middle of the season when field corn is attractive to moths for egg laying, the threshold of 10 moths per night is probably acceptable
- Early and late season sweet corn may require a lower threshold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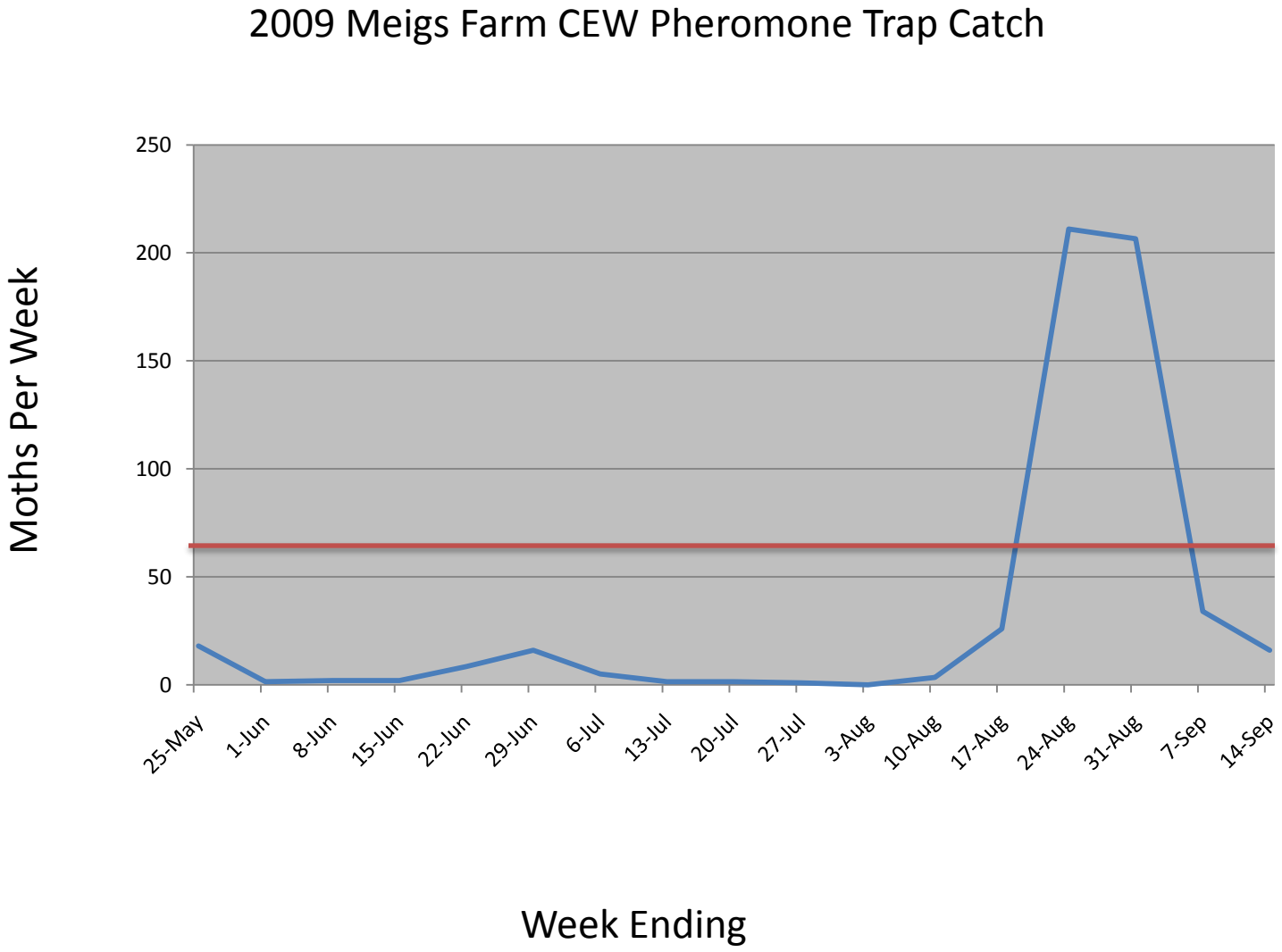
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31-Aug
7-Sep
14-Sep
Week Ending

Tentative Revised Thresholds

- For early sweet corn, treat if any moths are being caught in the trap and green silks are present.
- For main season sweet corn, 10 moths per night is still a viable threshold
- For late season sweet corn, use your biggest hammer
  - Best insecticide
  - Highest rate
  - 2 day interval between sprays
  - Start early and spray longer

Questions?