Thrips dispersal and Soybean Vein Necrosis Virus (SVNV) in Wisconsin soybean

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Overview

- Introduction
- Research objectives
  - Monitoring thrips
  - Disease impacts on yield
  - Cultivar Resistance
- Future Research
  - Thrips movements
  - Disease impact and cultivar resistance

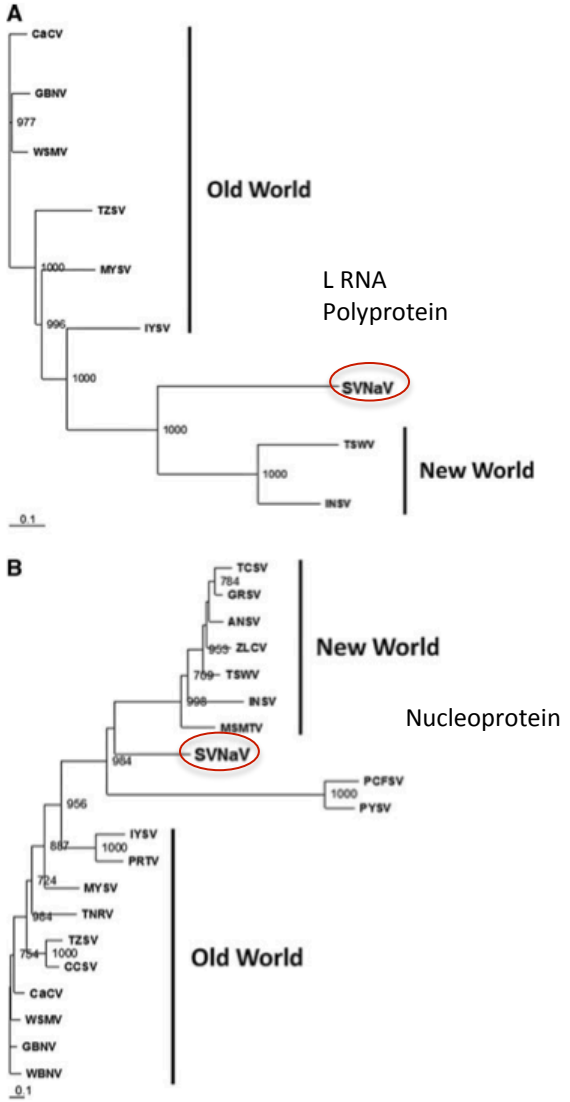
Soybean Vein Necrosis Disease (SVND)

- Caused by *Soybean vein necrosis virus* (SVNV)
- Symptoms
  - Leaf vein clearing
  - Leaf yellowing
  - Leaf vein necrosis
  - Leaf necrosis

- Discovered in Tennessee in 2008
  - First Detected in Wisconsin in 2012

Soybean Vein Necrosis Virus (SVNV)

- SVNV is a member of the family *Bunyaviridae* and the genus *Tospovirus*
- Same genus as other pathogens like *Tomato spotted wilt virus* (TSWV), *Impatiens necrotic spot virus* (INSV), and *Iris yellow spot virus* (IYSV)
- Only *Tospovirus* reported in Soybean
- SVNV is a somewhat unique species within the genus (40% or less amino acid similarity)
- Genetic analysis actually places the virus in a new cluster within the genus



Zhou et al., Virus Genes (2011) 43:289-295

Soybean Vein Necrosis Virus

- SVNV is transmitted by thrips
  - Soybean thrips (*Neohydatothrips variabilis*) are the only known vector
  - Virus is most likely acquired in either the 1st or 2nd instar similar to other *Tospoviruses* where it remains in the insect
  - Thrips are blown up from southern states each year
- Controlling the vector is a major way of controlling disease spread


Courtesy of J. Obermeyer


Courtesy of MJ Hatfield

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Research Objectives

1) Study thrips movement across Wisconsin and determine population composition
   -Use to develop a management plan
2) Measure the effects of SVNV on yield and seed quality
3) Identify resistant cultivars in common Wisconsin maturity group I and II soybeans

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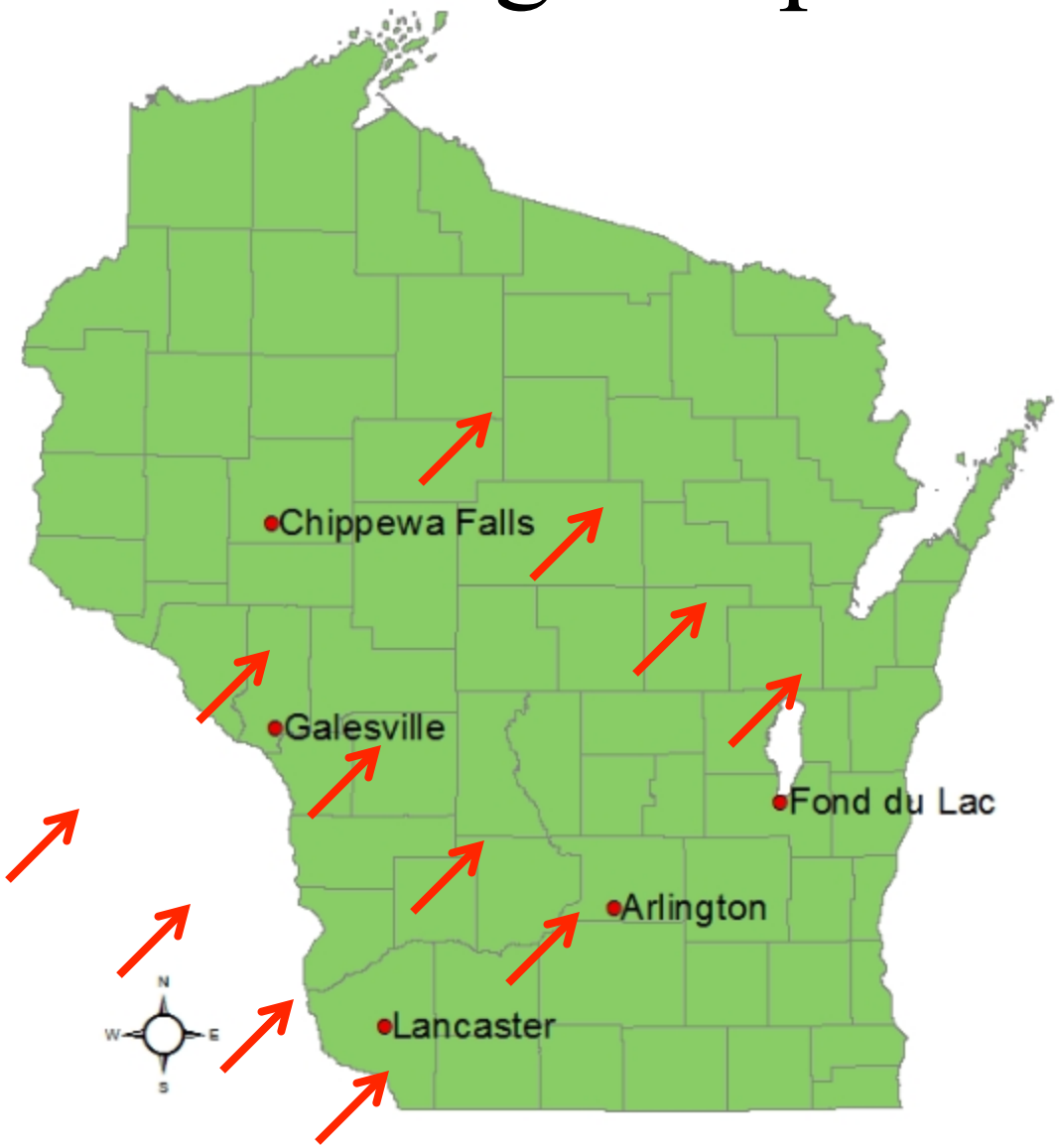
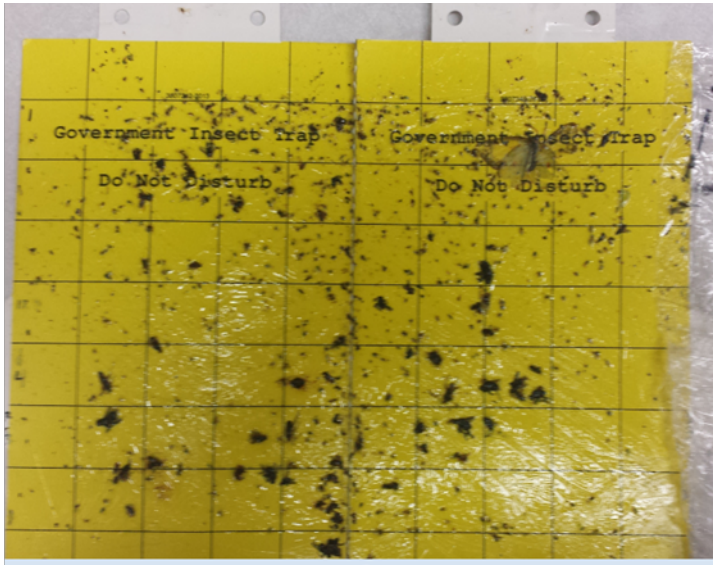
Monitoring Thrips



Monitoring Thrips

- Aerial fauna were sampled via yellow sticky card traps
  - Traps were changed weekly for 12 weeks (6/24 to 9/12)
  - 4 replications were set up per site per week
- Total thrips were counted in 20 of the 56 quadrats on each trap
  - Served to estimate total thrips catches
- Thrips were randomly selected per card for identification to determine population composition

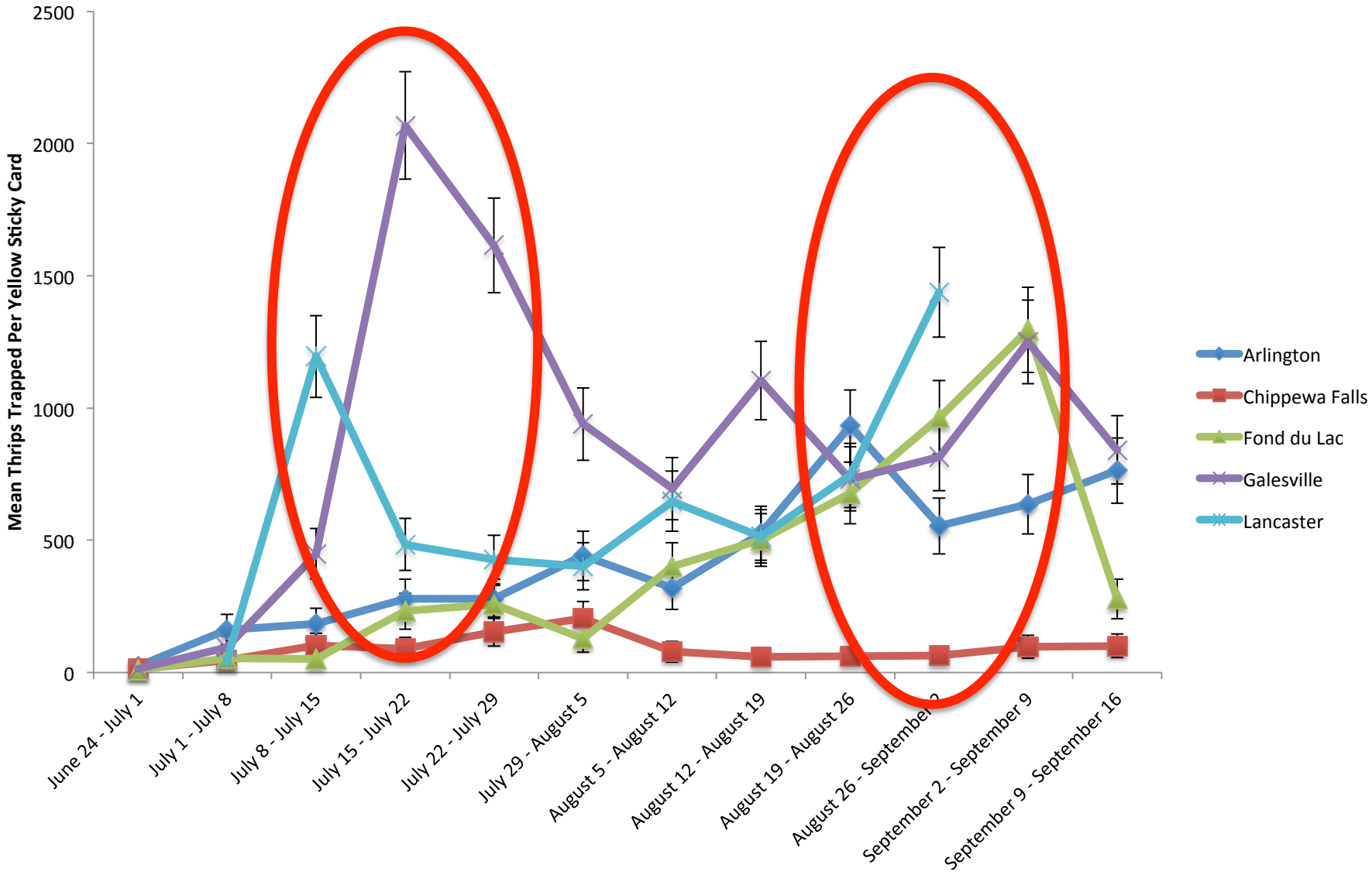

Government Insect Trap
Do Not Disturb


Government Insect Trap
Do Not Disturb
Government Insect Trap
Do Not Disturb

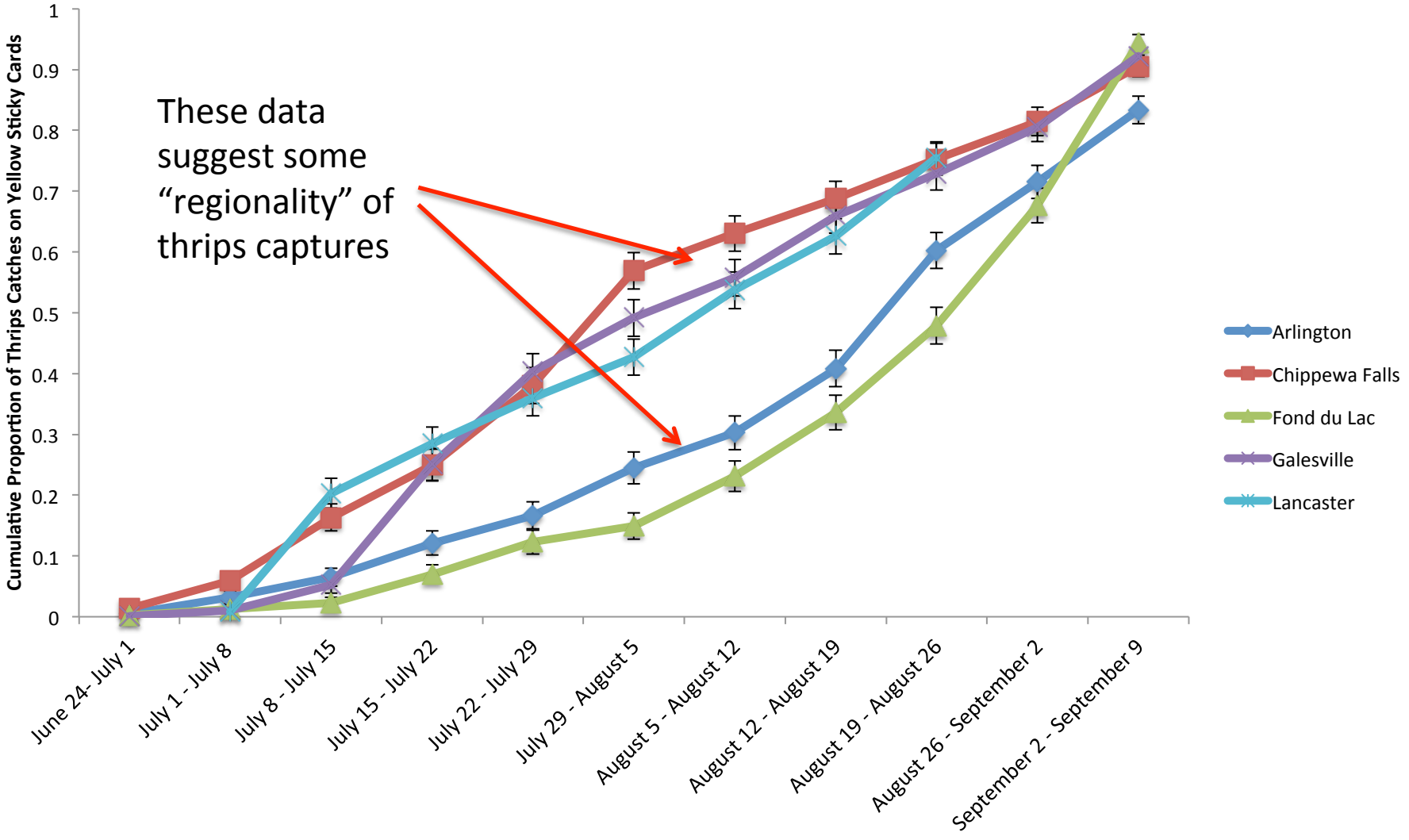
Monitoring Thrips

- In total there were 240 traps
  - 12wks x 4 reps x 5 sites
- 80,826 thrips counted
- A total of 50 thrips per card were removed for identification
  - Totaling ~12,000 thrips
  - Currently working on identifications

Total Weekly Thrips Catches



Cumulative Proportion of Thrips Catches at each location



Peak thrips catches in eastern Wisconsin lagged two weeks behind peak thrips catches in western Wisconsin

Thrips Monitoring: Summary

- Thrips captures peak earlier in western Wisconsin and in greater numbers
  - First peak in thrips captures occurs in early to mid July
  - Upon completing speciation, we can identify when soybean thrips arrive to aid in control
- In order to control the spread of SVNV, need to control thrips
  - Means we need to understand thrips flights

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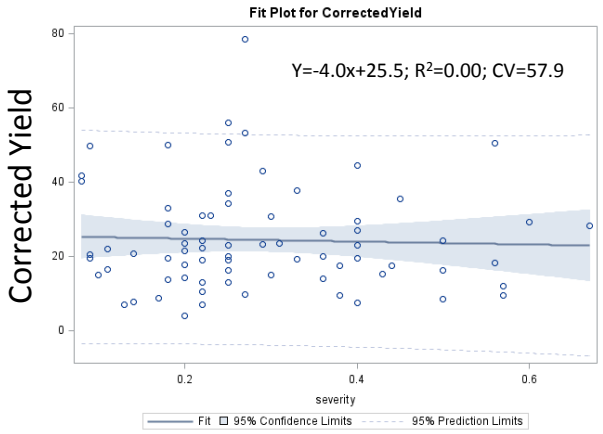
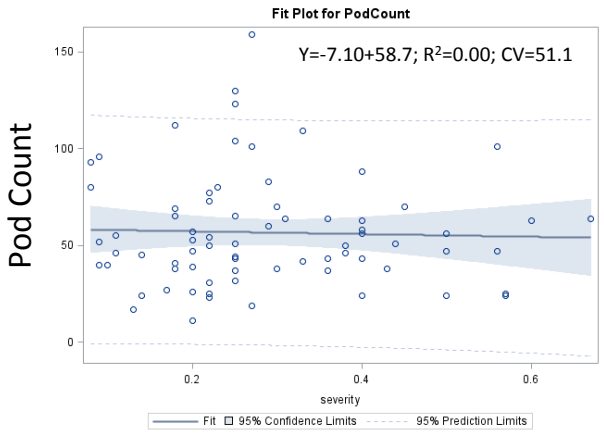
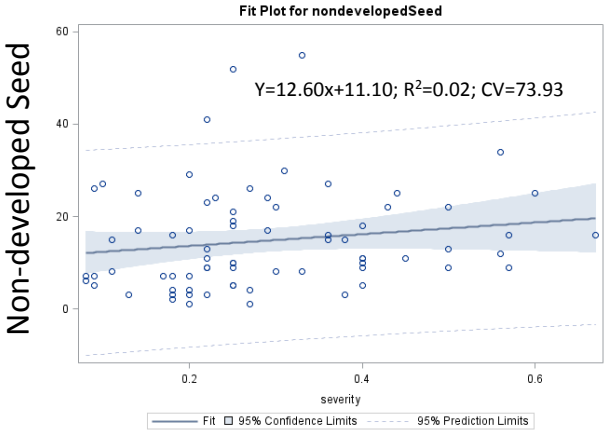
Disease Impact

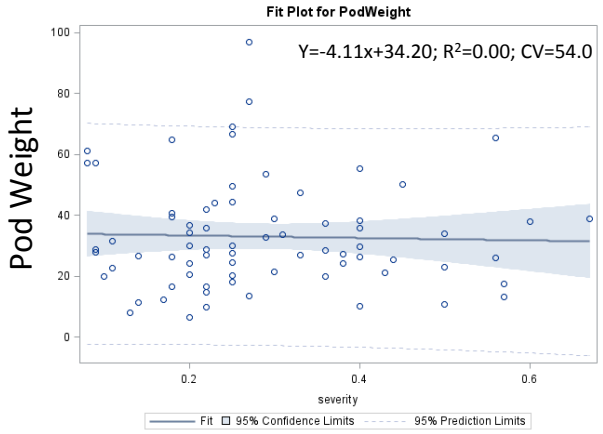
- Compared symptomatic plants to asymptomatic plants in a breeding line trial
  - Looked at:
    - Pod count & weight
    - Seed count & weight
    - Number of non-developed seeds per pod

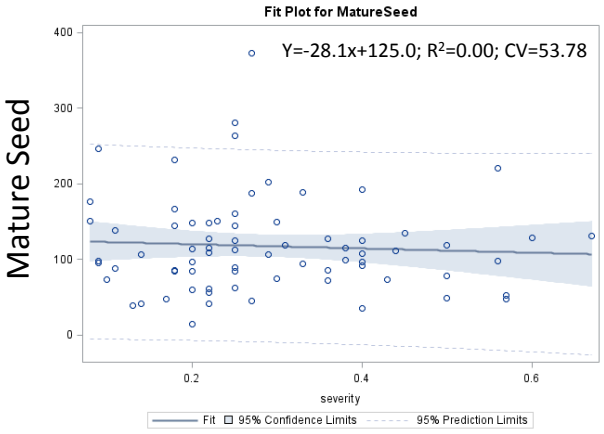
Regression Analyses (Symptomatic Only)

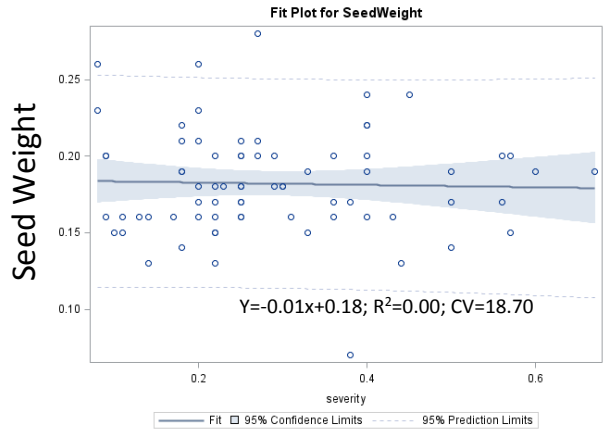




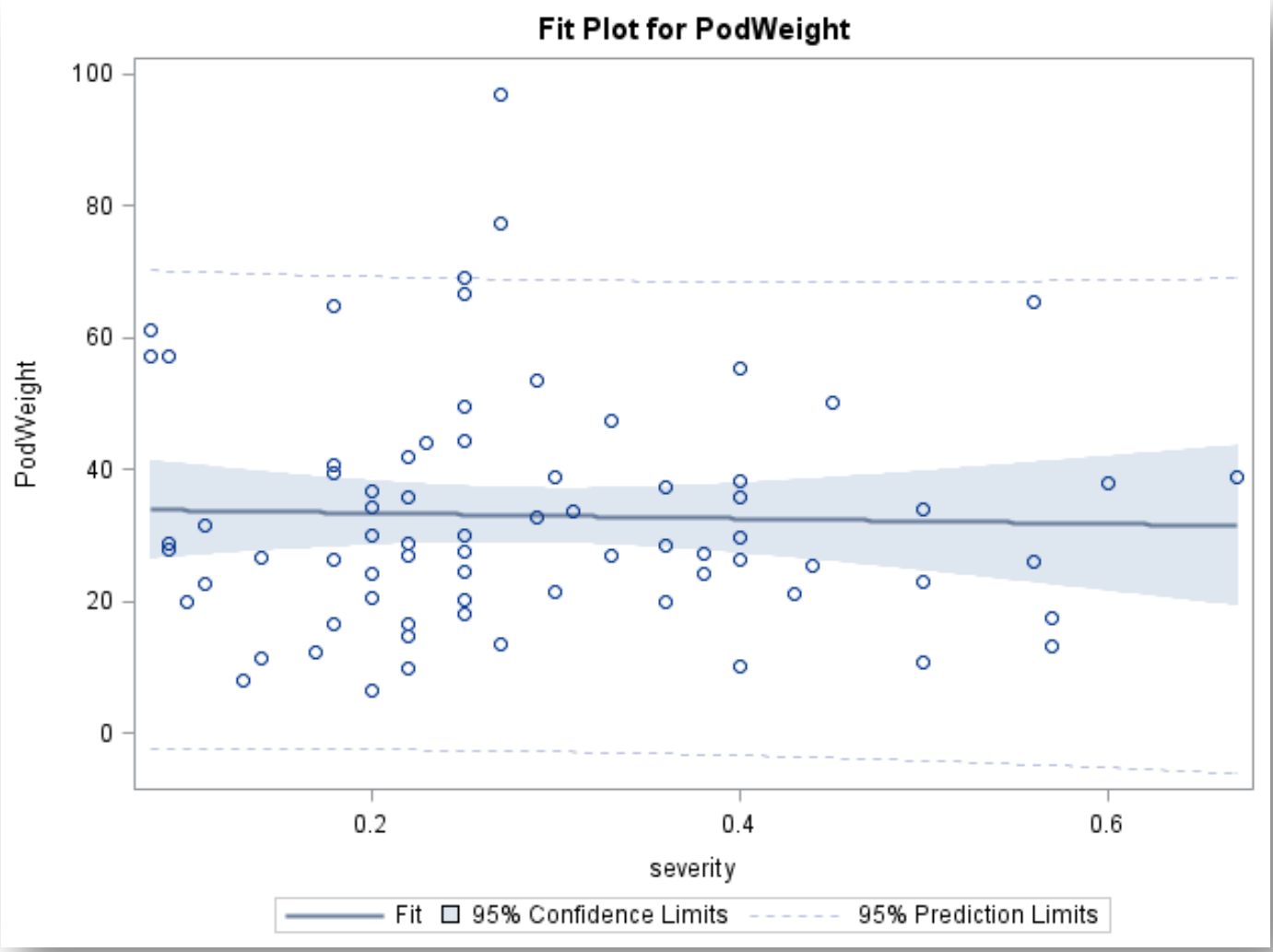




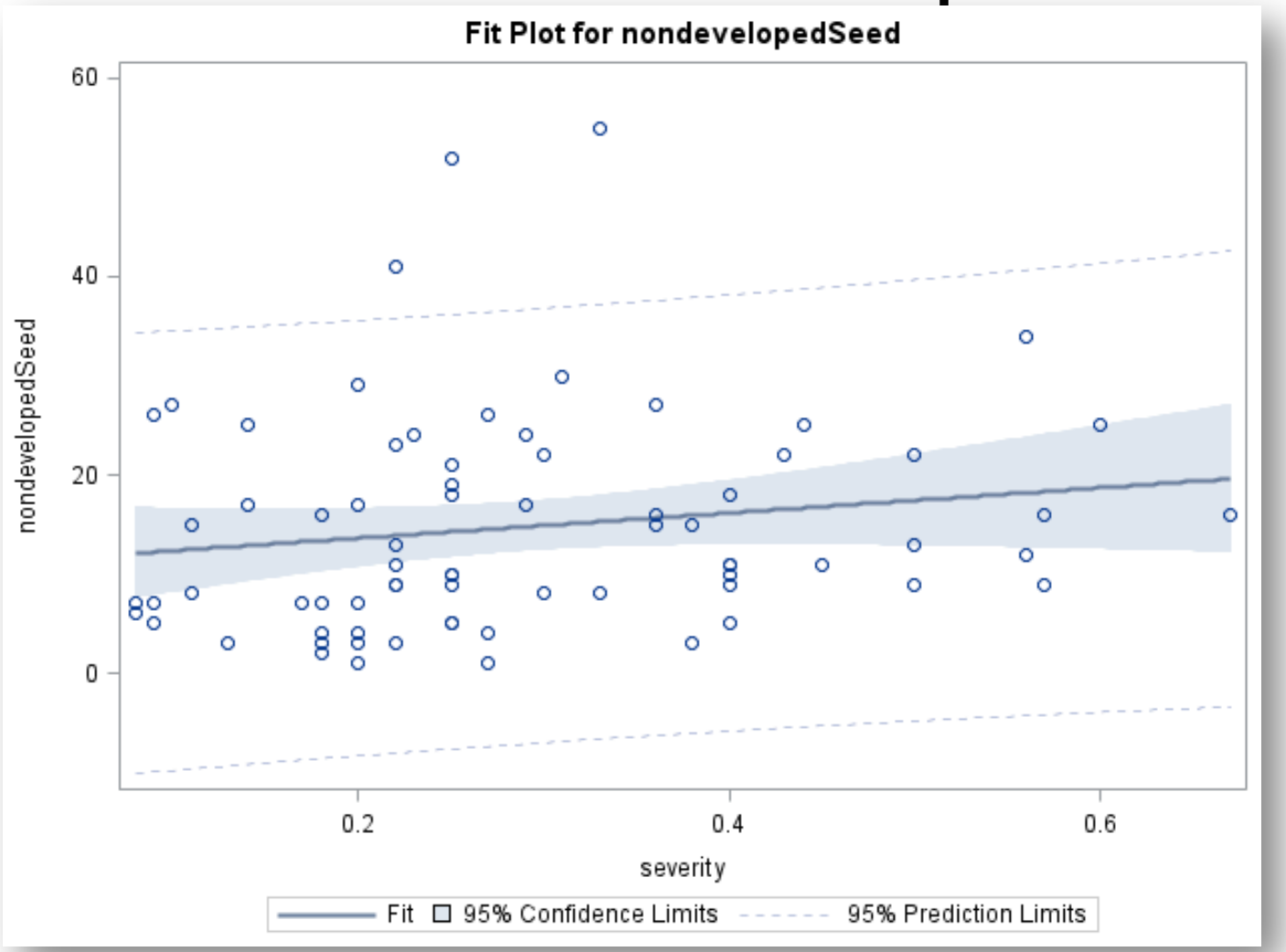




Symptomatic Plant Pod Weight



Number of Non-developed Seeds



Disease Impact: Summary

- SVNV appears to have a subtle affect on soybean
  - Increased severity has a negative relationship with pod weight
  - Increased severity has a positive relationship with number of undeveloped seed
  - Yet not statistically significant
- Further investigation is needed
  - Observe impacts of SVNV on common cultivars

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Disease Resistance

- Incidence data from Galesville, Lancaster, and Fond du Lac collected in variety trials
- 724 plots rated
- Most plots averaged 1 or fewer symptomatic plants
- Confirmed SVNV at each location

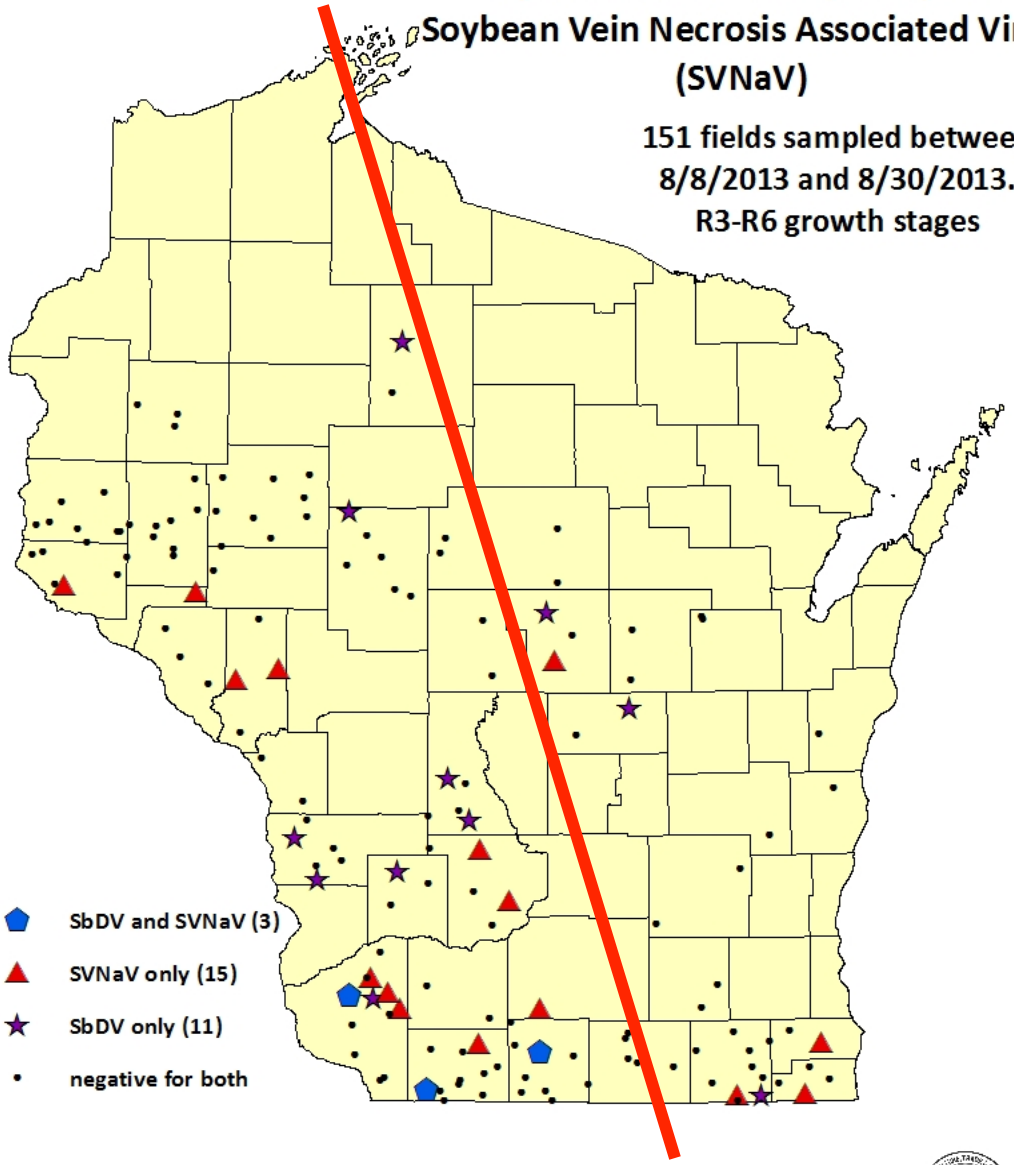
Disease Resistance

- Use nested PCR to determine symptoms associated with SVNV
  - Relatively few virus particles in tissue
- Better understand symptomology

2013 DATCP Soybean Virus Survey

Soybean Dwarf Virus (SbDV) and Soybean Vein Necrosis Associated Virus (SVNaV)

151 fields sampled between 8/8/2013 and 8/30/2013.
R3-R6 growth stages



Wisconsin Dept of Agriculture, Trade and Consumer Protection
Plant Industry Laboratory

Date: 11/1/2013

Disease Resistance: Summary

- SVNV is found across the major soybean growing region of Wisconsin
    - Identified in all study sites and multiple fields surveyed by DATCP
- Incidence of SVNV was relatively low in soybean variety trials
    - Might be easier to screen for resistance under controlled conditions
- Detection of the virus can be tricky

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Future Research: Thrips Movements

- Finish speciation of collected thrips
  - What percent is soybean thrips
  - Determine if other species are vectors of SVNV
  - Model the population dynamics of vectors
- Analyze pesticide trial data
  - Seed treatment vs. foliar treatment
  - Determine the most effective pesticide
- Formulate an integrated pest management plan for thrips

Future Research: Disease impact/resistance

- In 2013, successful mechanical inoculation (VERY HARD TO DO)
- We are attempting to transmit SVNV with western flower thrips (*Frankliniella occidentalis*) under controlled conditions
- Successful controlled transmission will facilitate further research to investigate
  - Yield drag (timing of infection)
  - Cultivar resistance

Acknowledgments

- Wisconsin Soybean Marketing Board
- SciMed Graduate Research Scholars
- Dr. Damon Smith
- Graduate Committee
  - Dr. Russell Groves
  - Dr. Shawn Conley
  - Dr. David Hogg
- Smith Lab
  - Dr. Carol Groves
  - Chase Fritz
  - Quinn Watson
  - Keegan Andersen


Questions?