

# Use of the National NPDN Database for Early Warnings and Indications Based Upon Temporal and Spatial Patterns

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# Example Databases

- Seed Corn Inspection Database (Iowa Department of Agriculture and Land Stewardship)
  - Stewarts disease
  - Gray leaf spot
- Iowa Soybean Disease Survey  
(Robertson and Nutter funded by the Iowa Soybean Association)
  - Bean pod mottle virus
- National Agricultural Pest Information Survey
  - Asian soybean rust
- NPDN National Database?

# National Plant Diagnostic Network Database

Single Record vs Multiple Records

# Single Records

- First record (State, US)
- New Threat
- Where (single point)
- When (seasonality-earlier find)
- Extent (spatially)
- Response

# Multiple Records

- Extent of new (or endemic) threat (GIS maps)
  - Within the growing season ( $y_o$ ,  $r$ )
  - Among growing season
  - Location of early-season sources of  $y_o$
  - Strength of the source(s) of early season  $y_o$
- Temporal Patterns
  - Within – season rate of increase
  - Among season (changes in  $y_o$ ,  $y_f$ )

# Assumptions (Data)

- All individuals have the same detection capabilities (visually) over time and space
- Same effort for scouting is given among individuals, counties, states
  - Sentinel plots/units area of crop equal
  - No. first detectors trained (state, unit crop area)
- Equal effort given when scouting
  - Kudzu
  - Sentinel plots
  - Commercial soybean fields
- Time of pathogen detection is the same ( $y \leq 0.01$ ,  $y = 0.2$ )
- Same time of scouting
- Growth stage of the crop
- Similar growth conditions for kudzu, sentinel and commercial fields?

Patterns !

Patterns !

Patterns !

Can Temporal and Spatial Patterns  
Still be Detected?



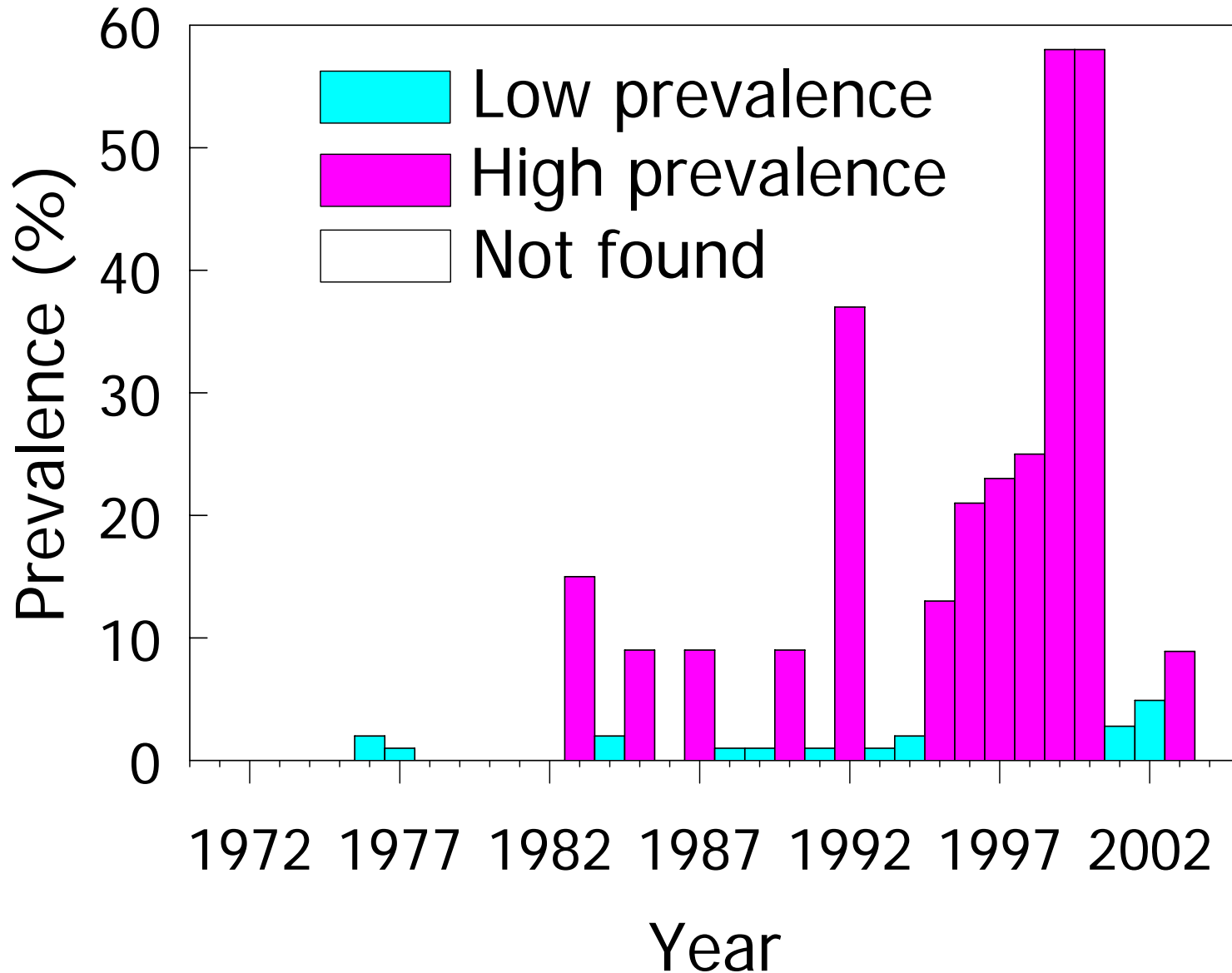
Predictions

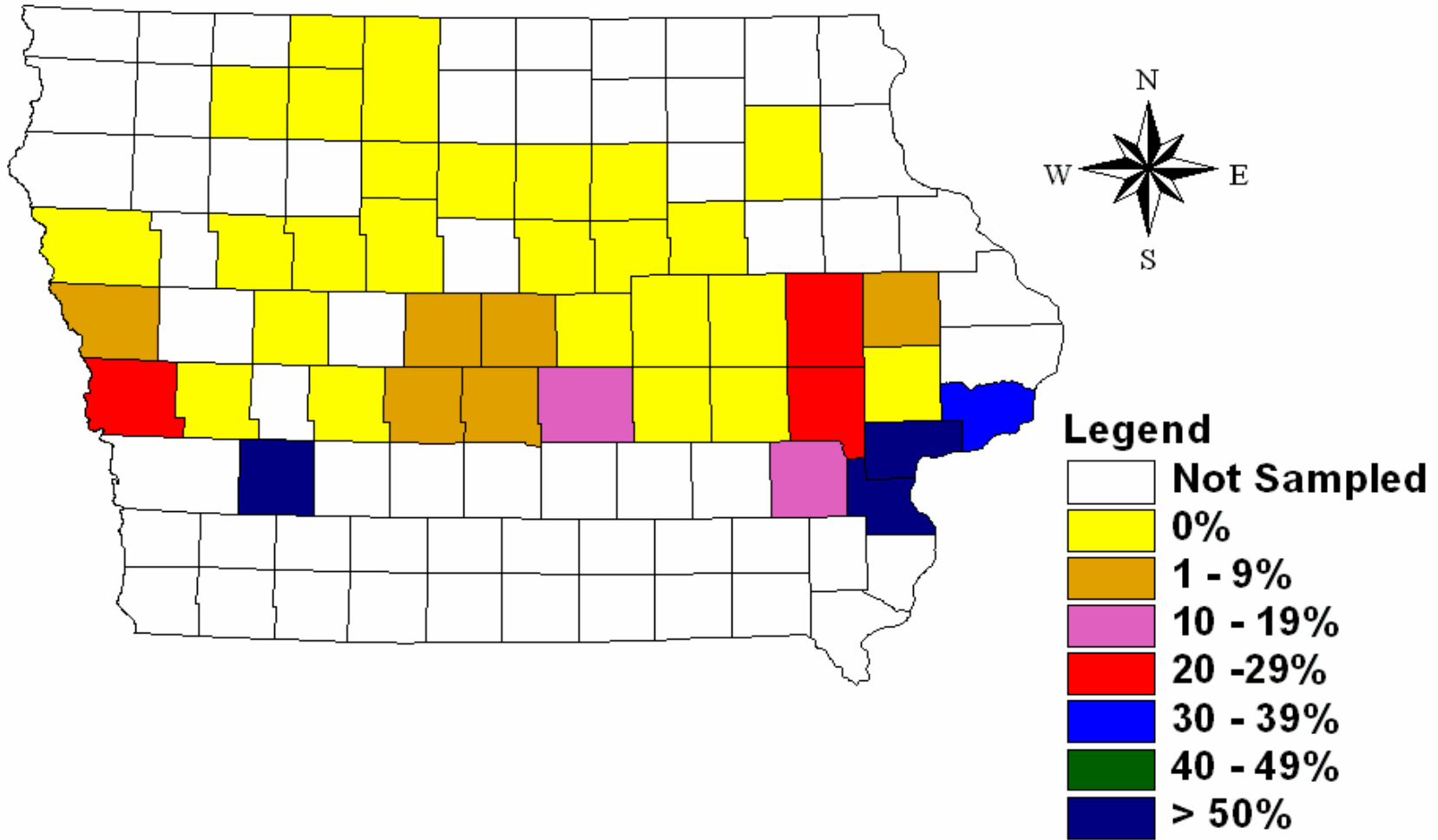
# Examples from Databases

# Patterns Among Growing Seasons

- Iowa Seed Corn Inspection Data
  - 1971 to present
  - 500 to >1,300 fields/season
- Stewart's disease

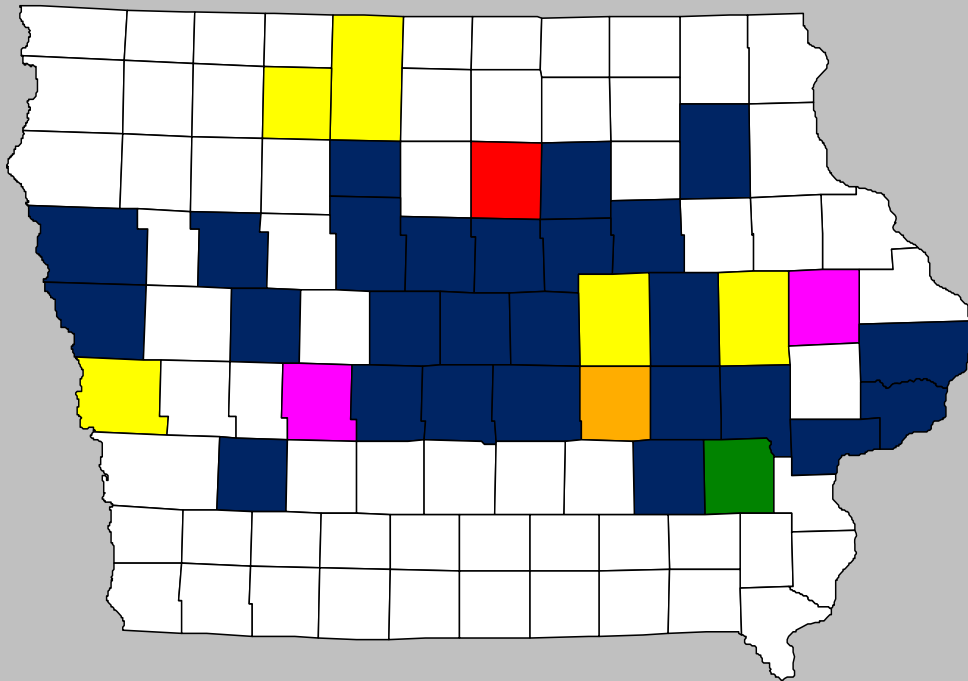
# Economic Importance





# Prevalence of Stewart's Disease in Iowa in 2002

2000



Legend

- Not Sampled
- 0%
- 1-9%
- 10-19%
- 20-29%
- 30-39%
- 40-49%
- > 50%

**Air temperature?**

**Snowfall?**

**Soil temperature?**

**Snowcover?**

**Biological?**



**+**



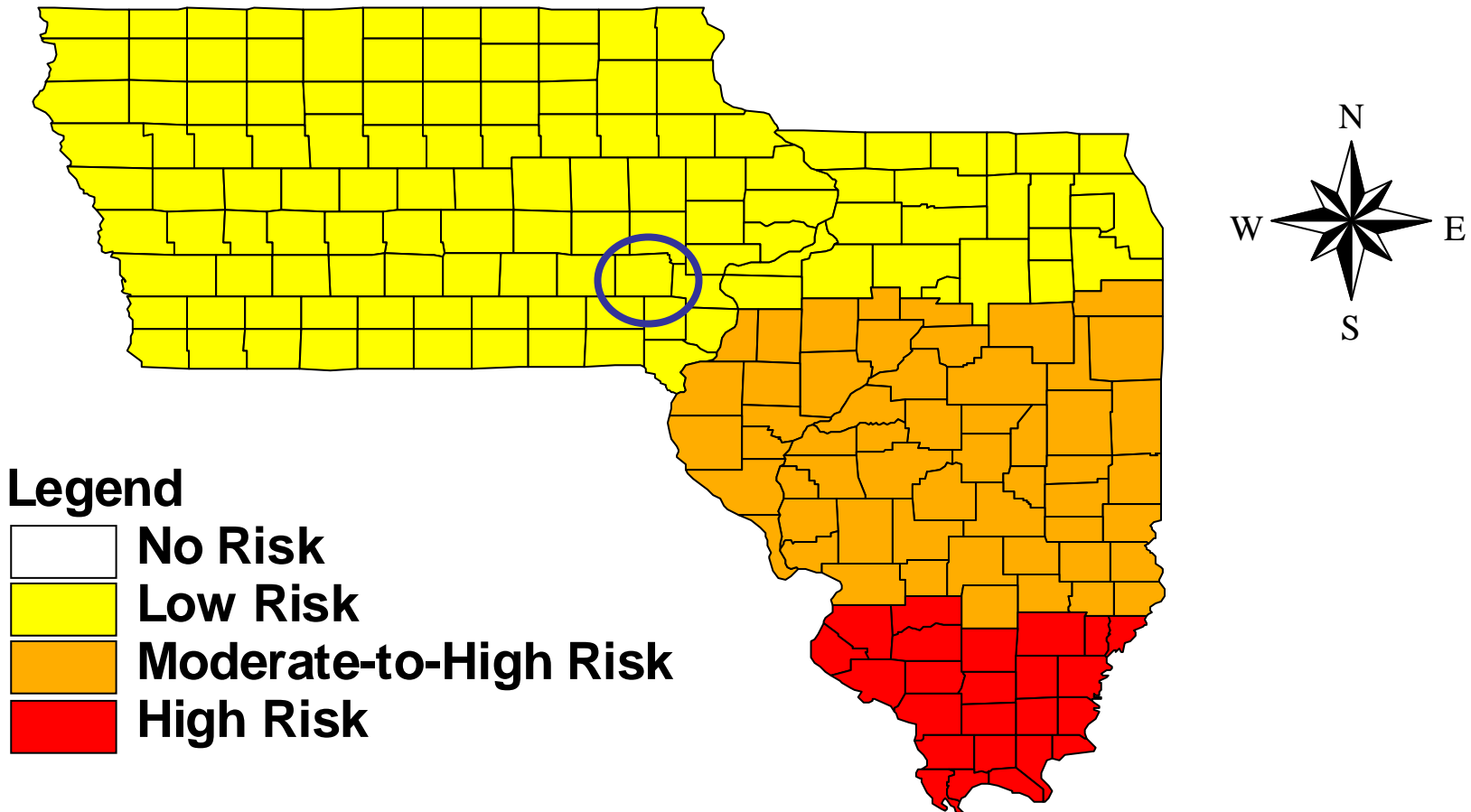
**=**



**More accurate Stewart's disease forecast?**

# Field Selection Based on Stewart's Forecast and Knowledge of Corn Flea Beetle

2003 Forecast

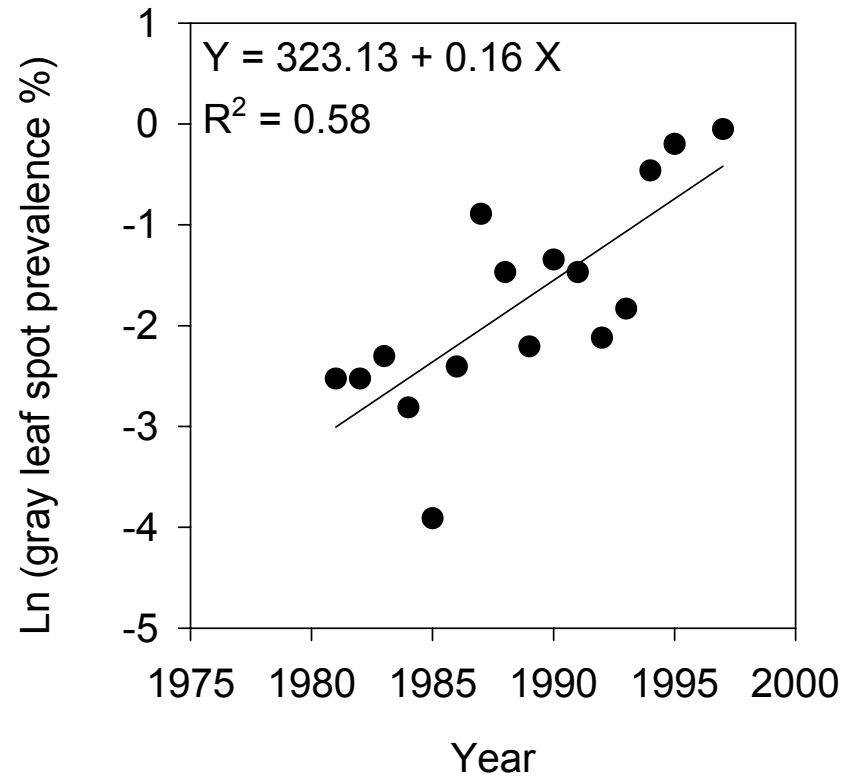
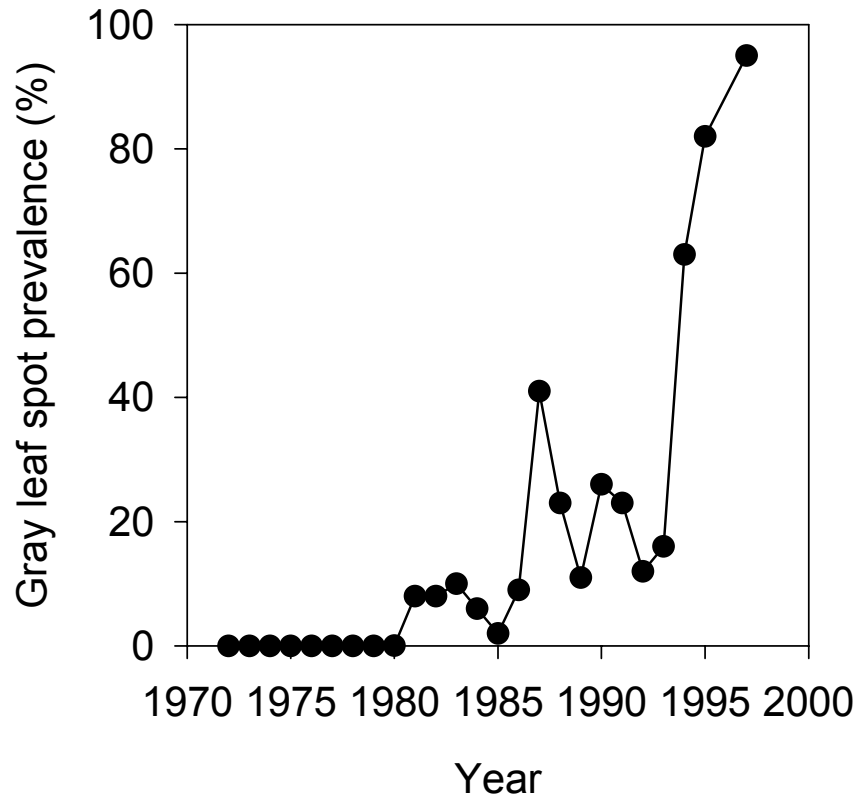


## Legend

-  No Risk
-  Low Risk
-  Moderate-to-High Risk
-  High Risk

# Temporal Patterns Among Seasons

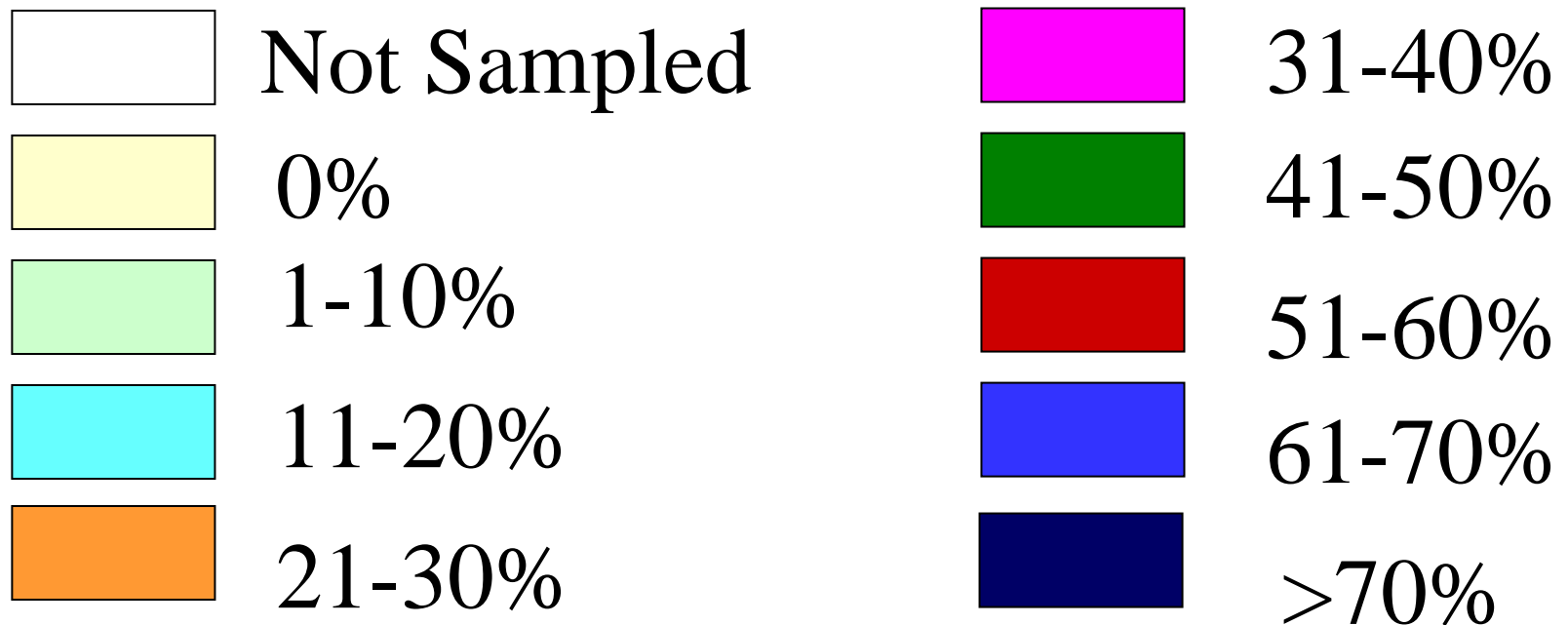
- Gray leaf spot of corn



# Spatial Changes Among Seasons

- Gray leaf spot of corn

# Gray Leaf Spot Prevalence in Iowa 1982-1997









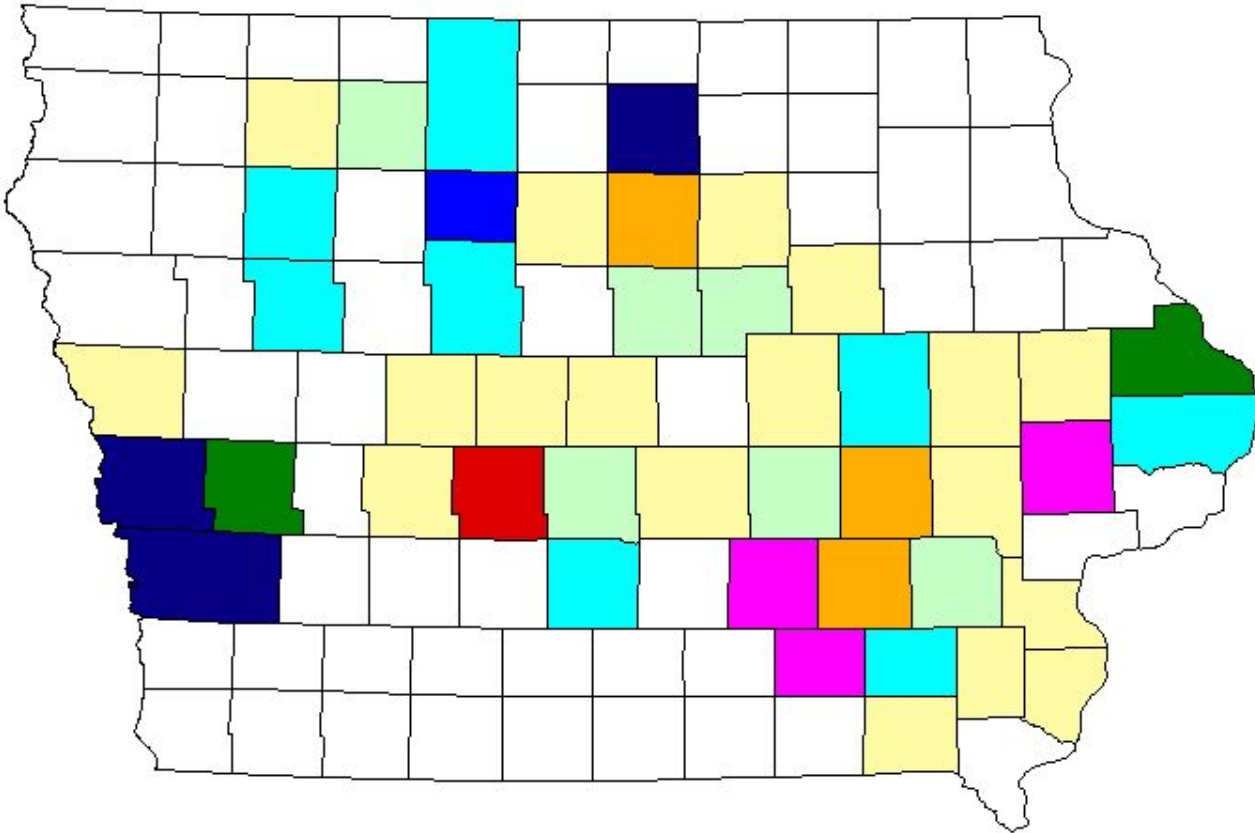




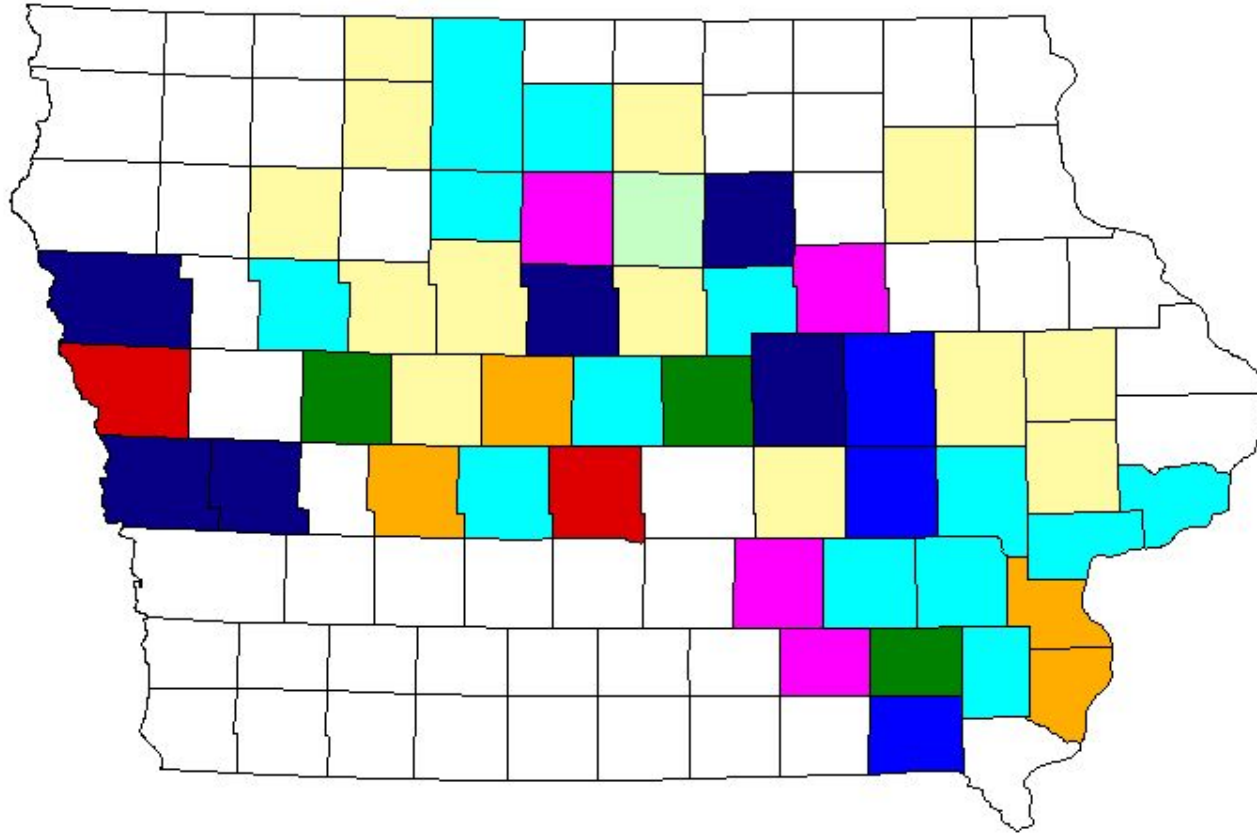




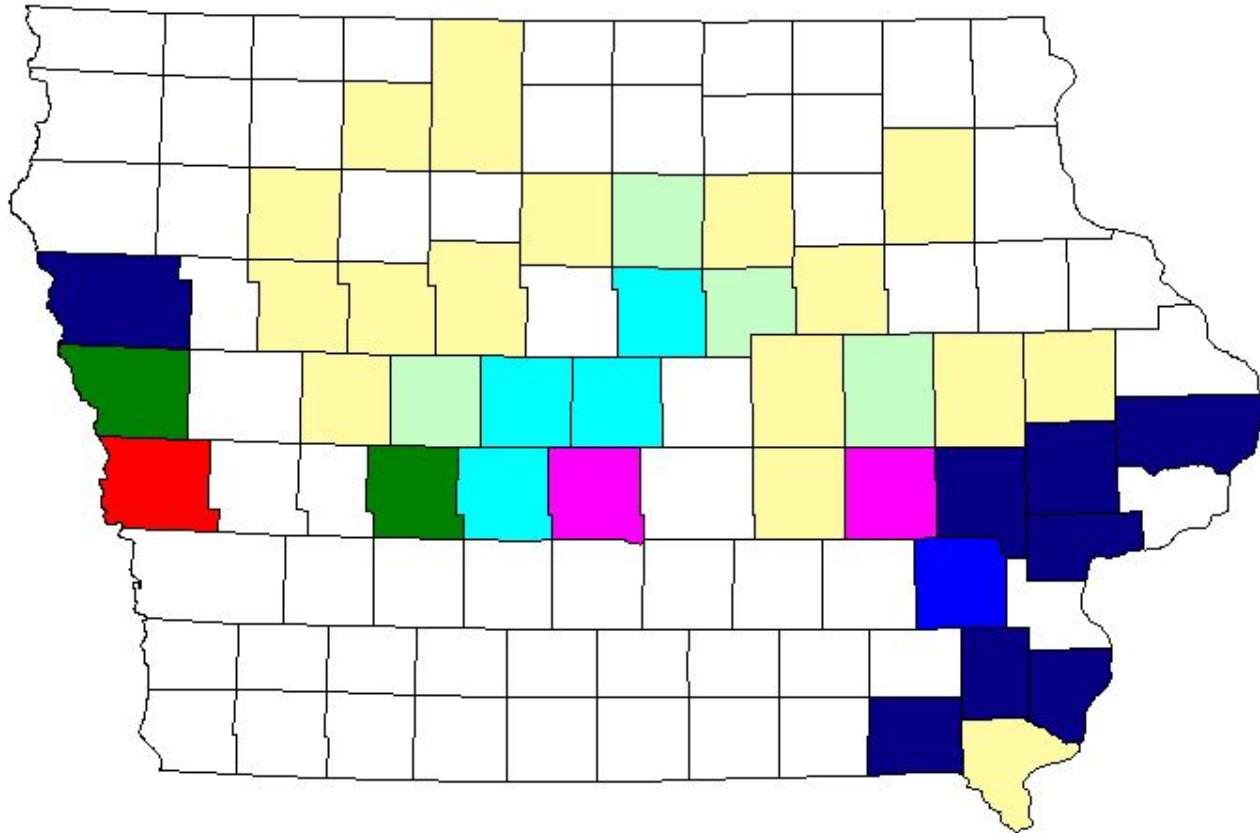
1989



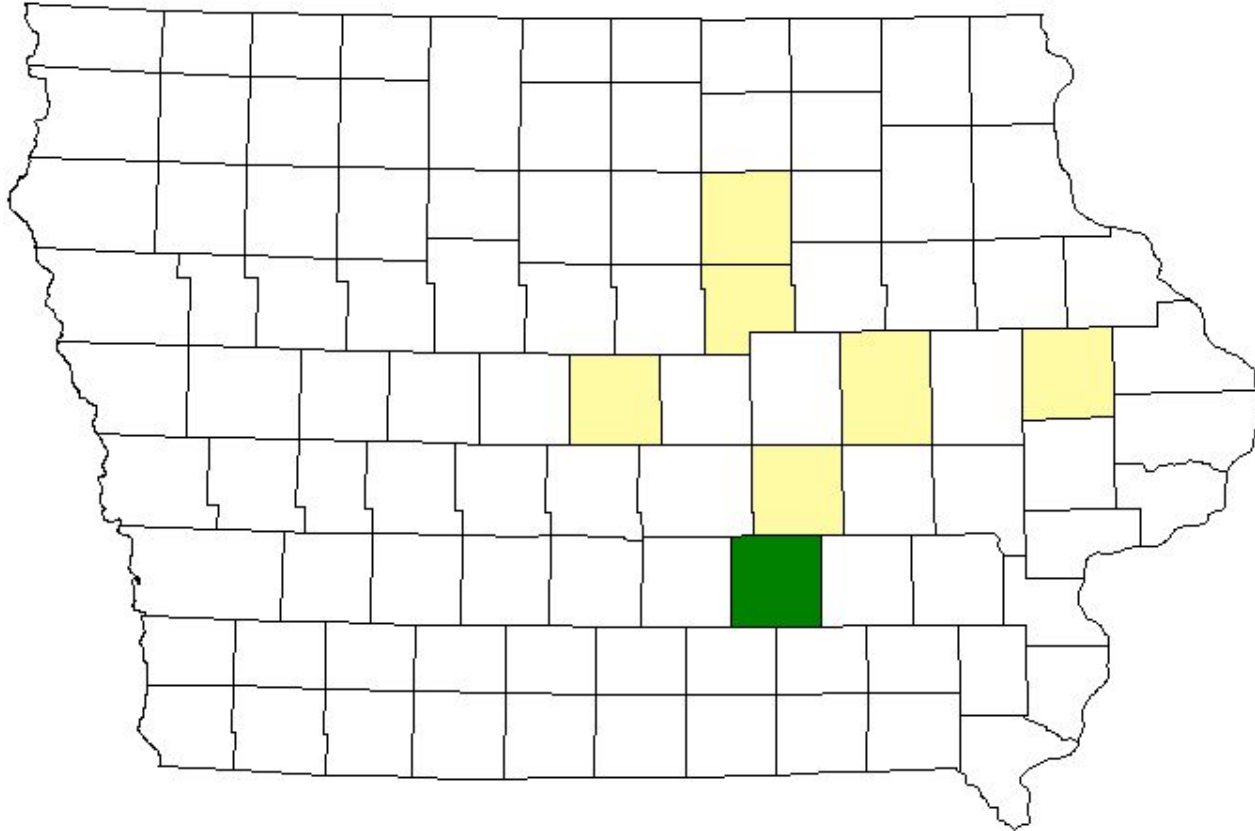
# 1990



# 1991



# 1992

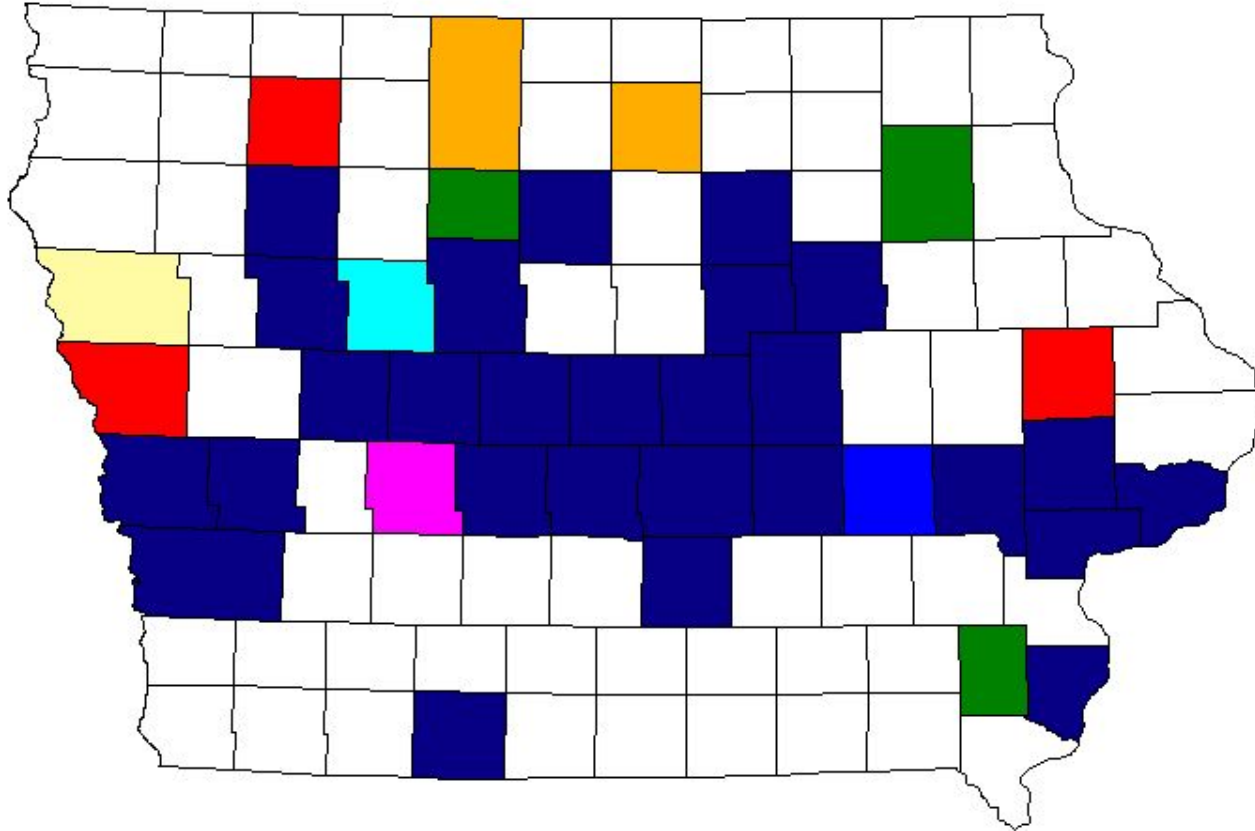




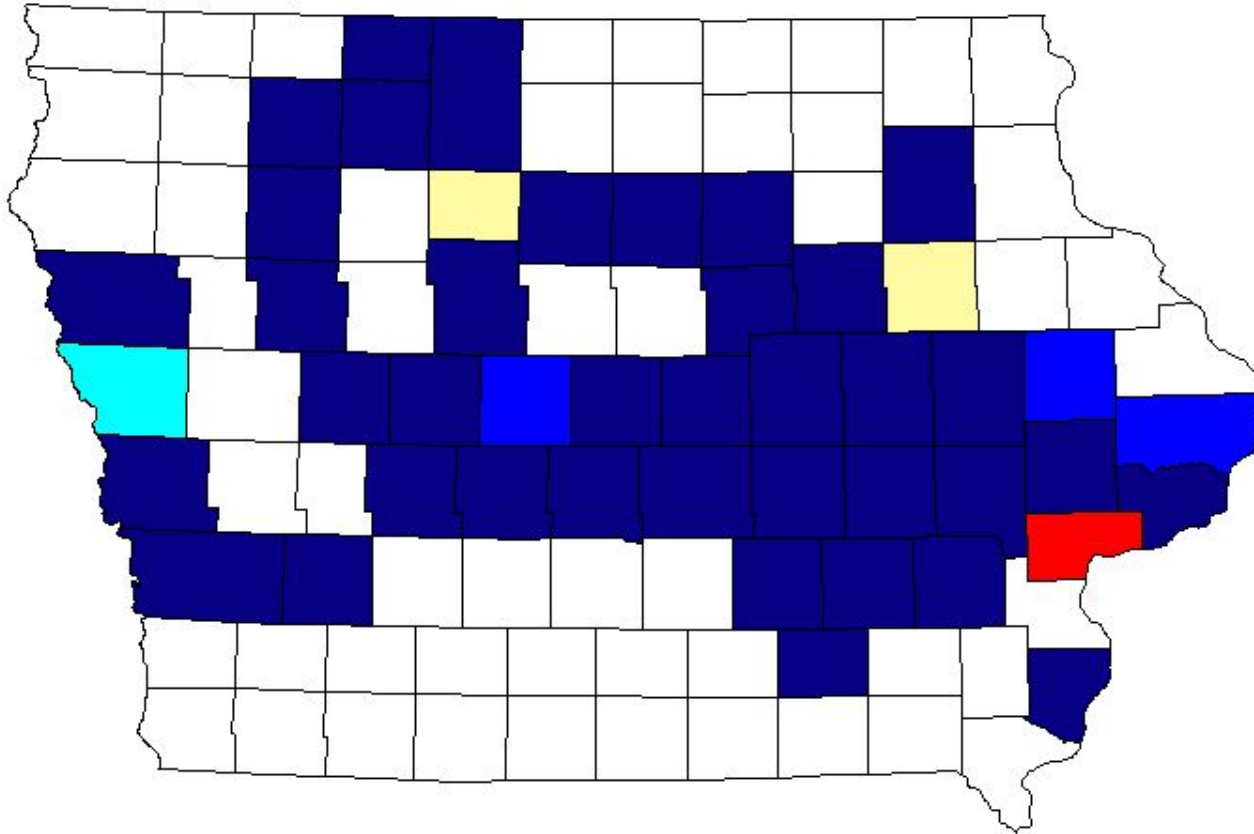




# 1996



# 1997

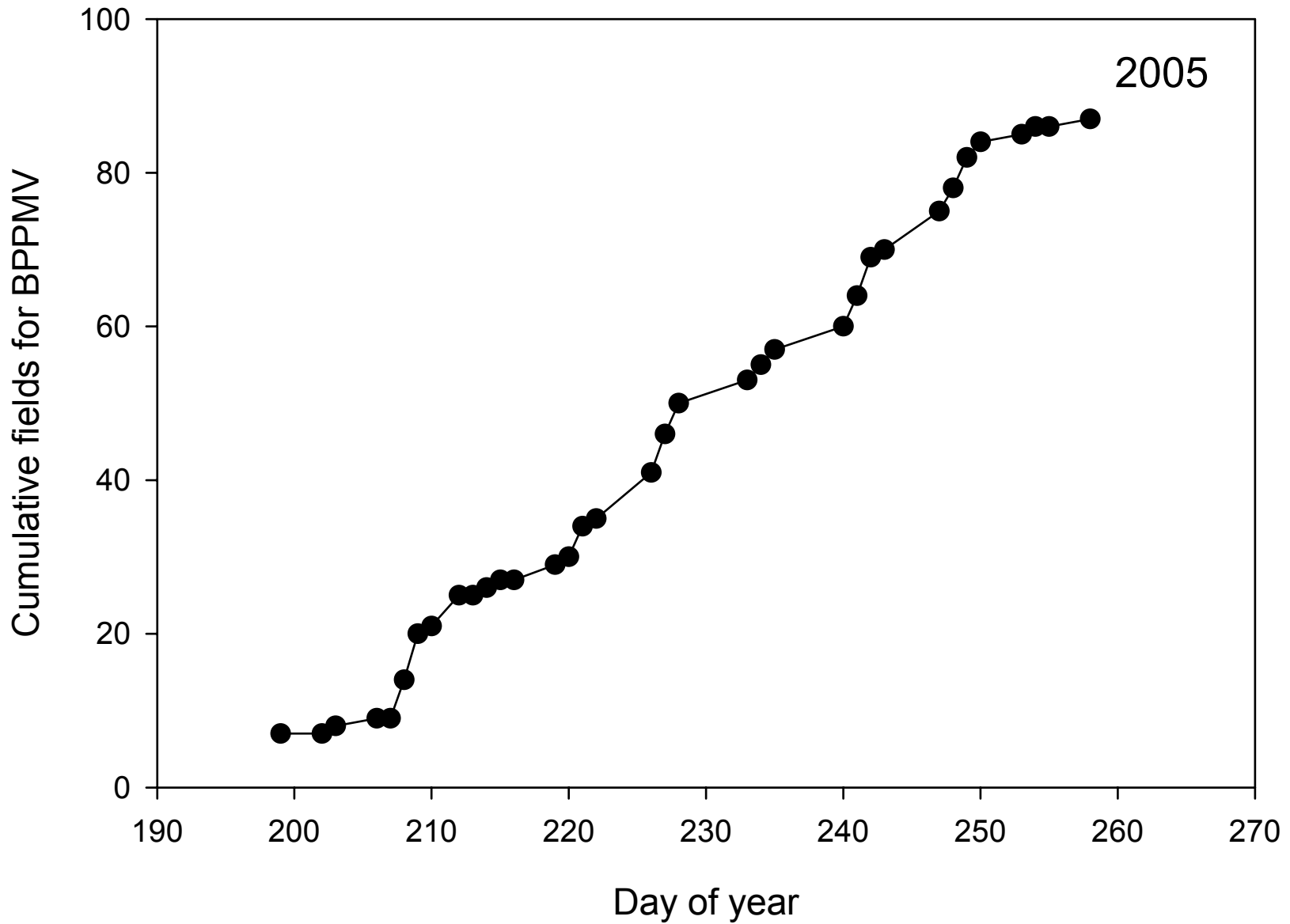


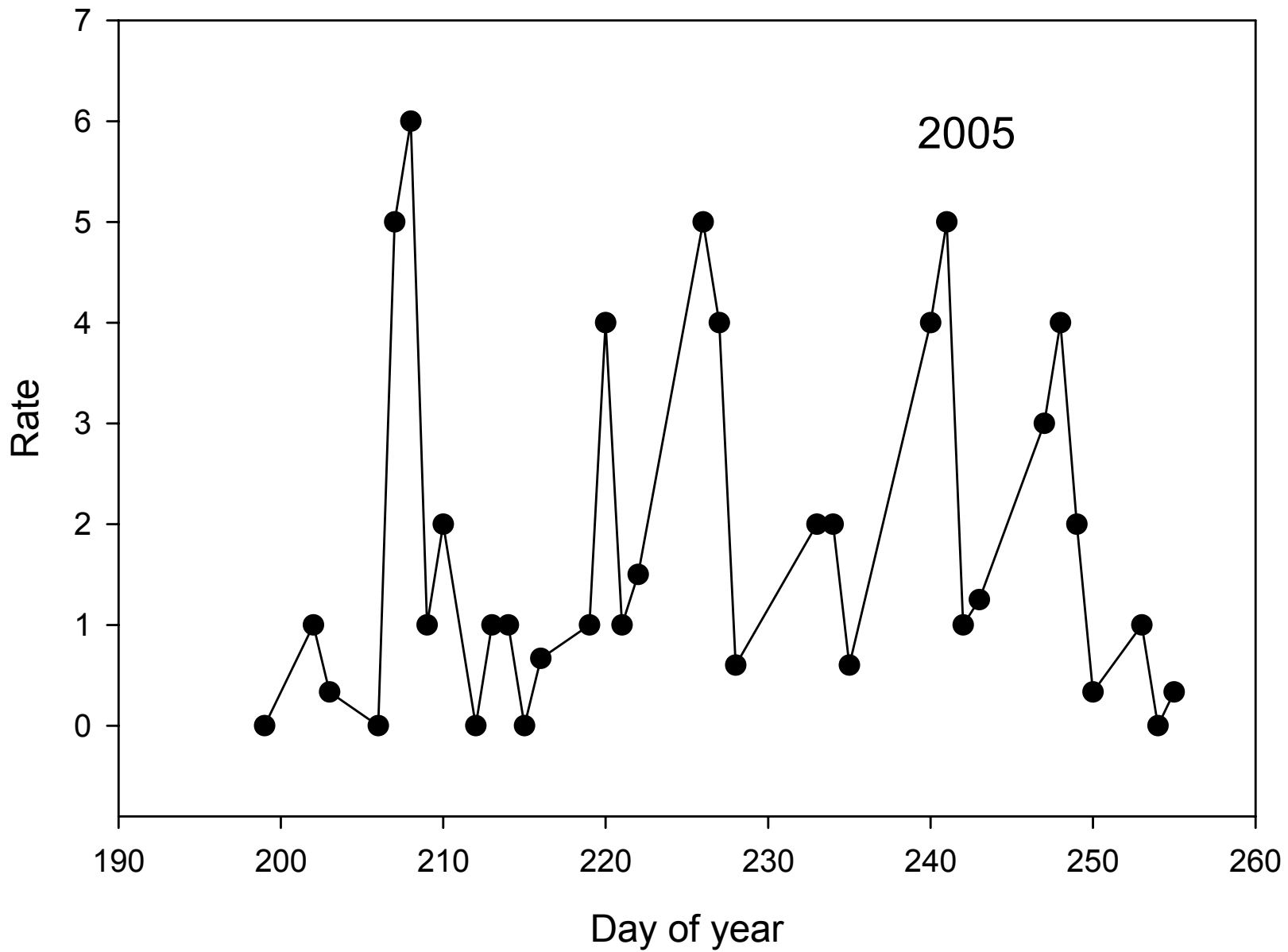
# Disease Management Implications ?

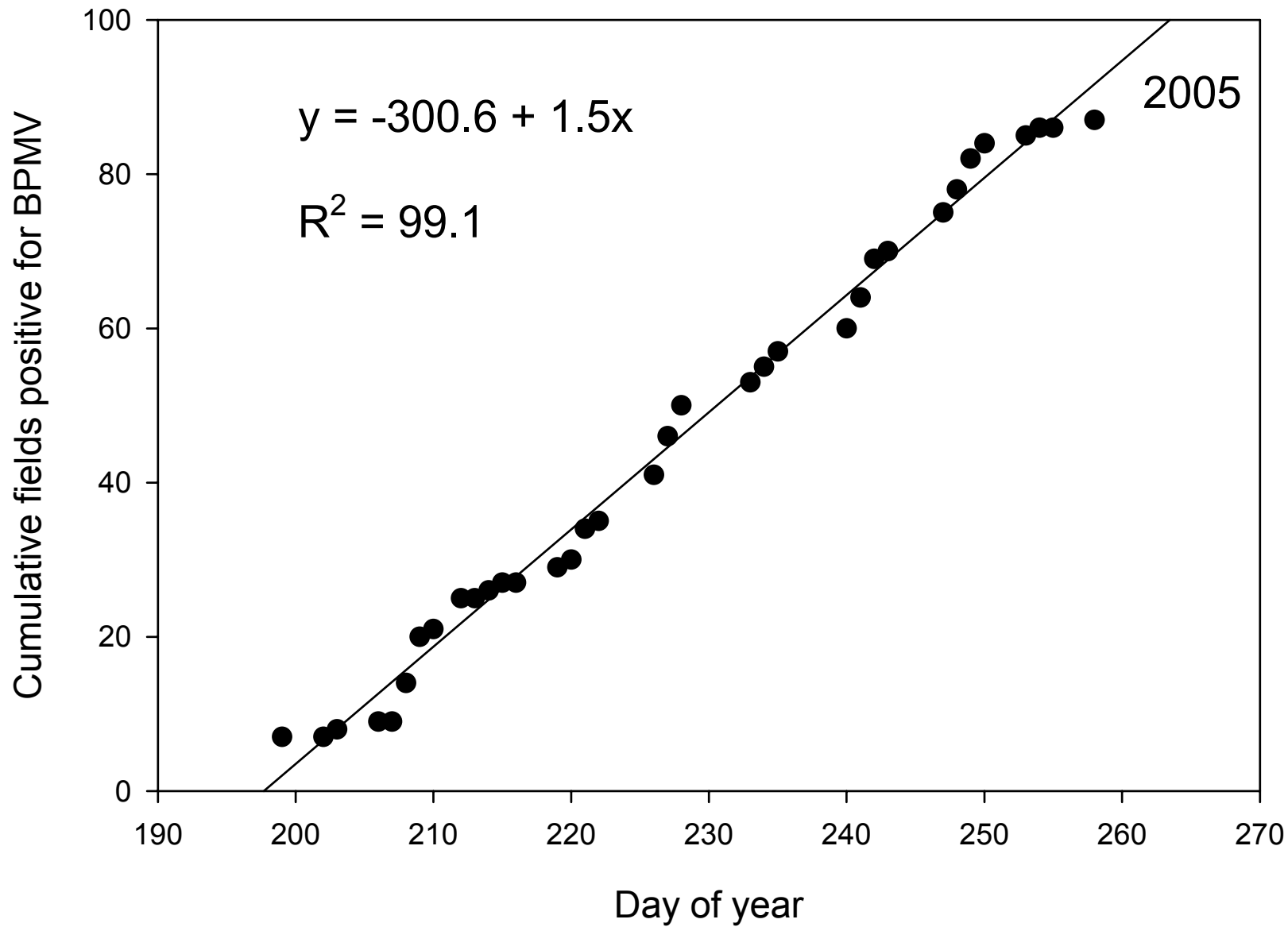
- Change from managing from “ $y_0$ ” to  
managing “ $r$ ”

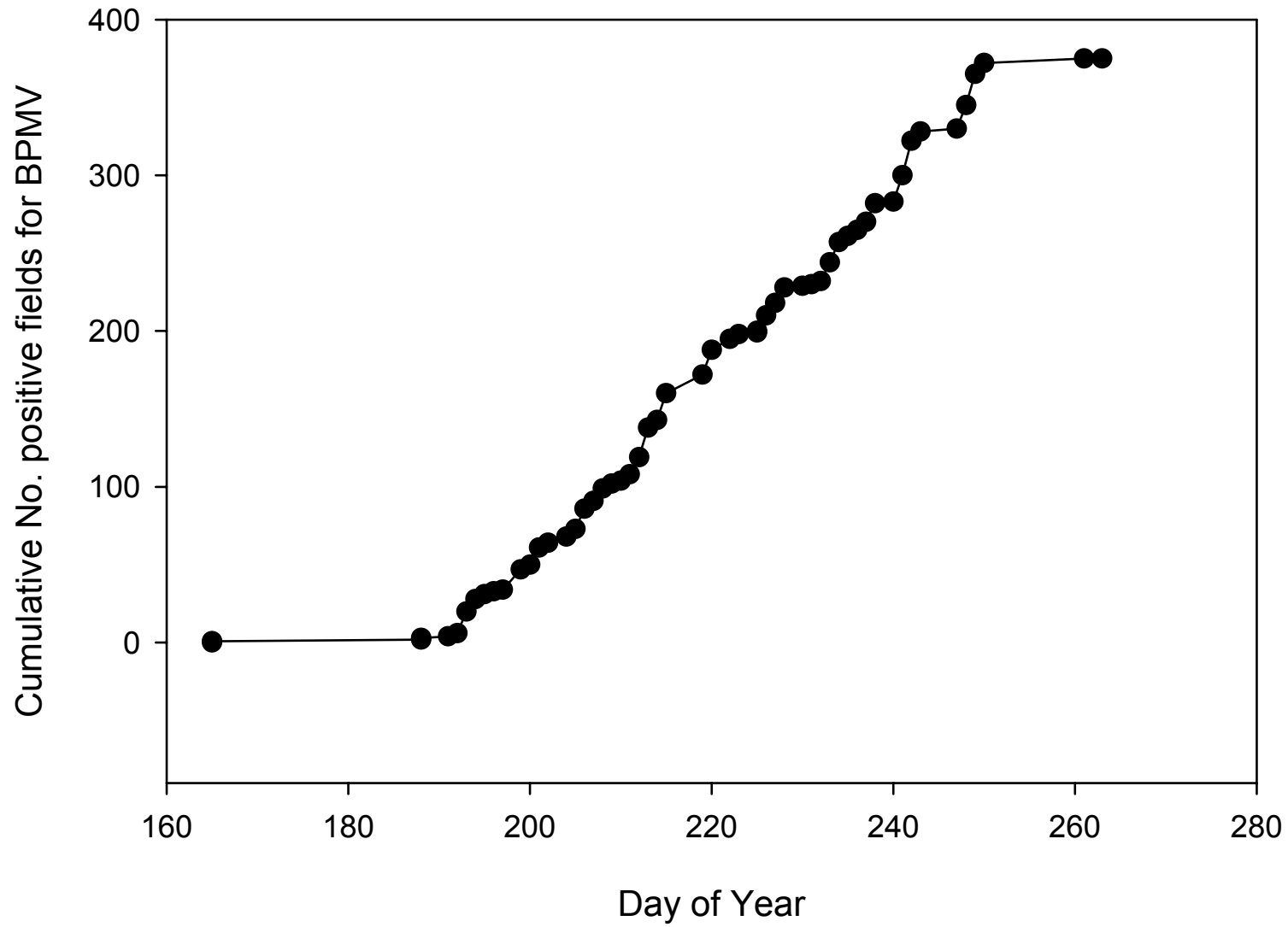
# Temporal Patterns for Bean Pod Mottle Virus in Iowa

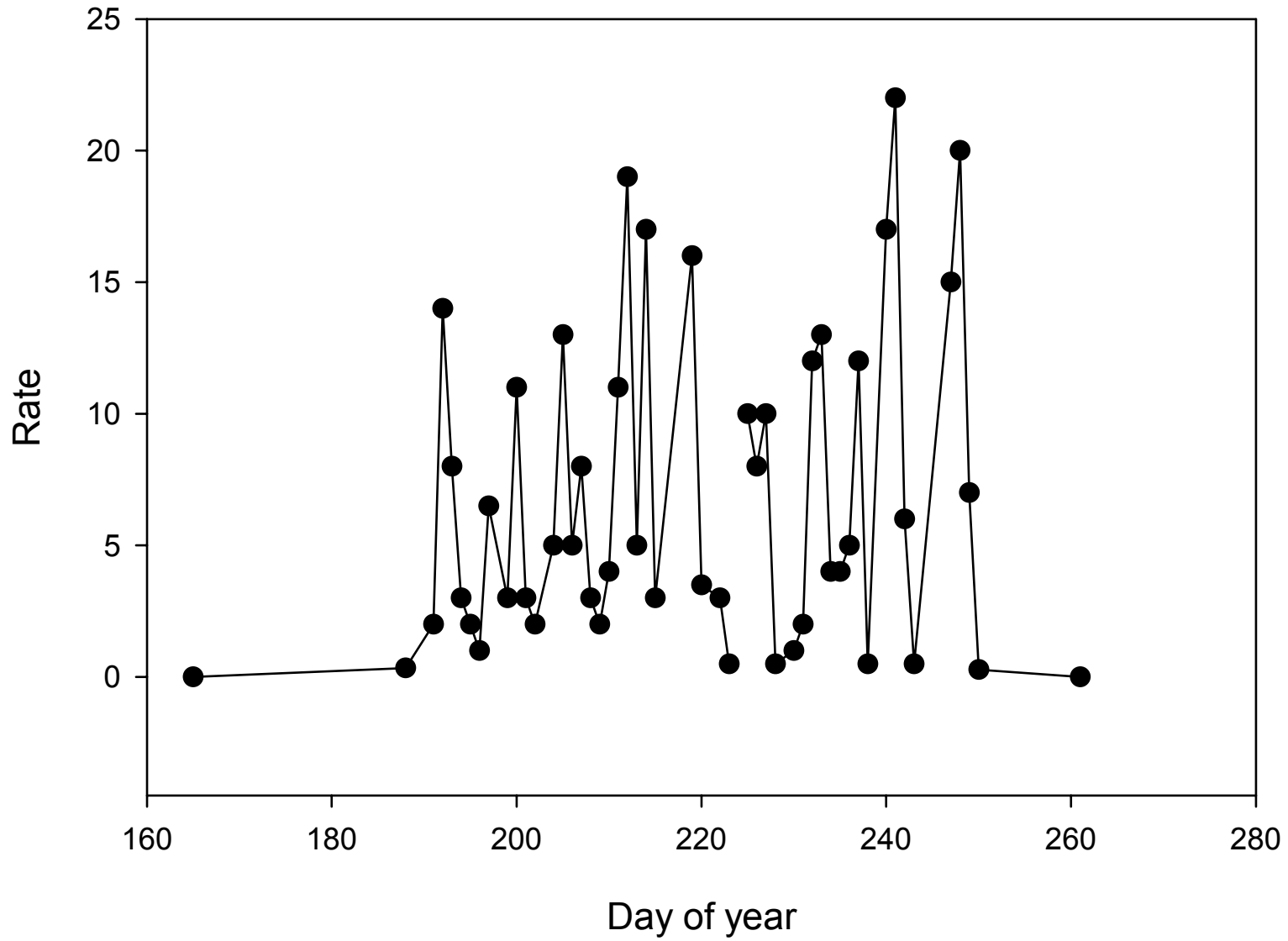
- 2005 (902 soybean fields)
- 2006 (1058 soybean fields)

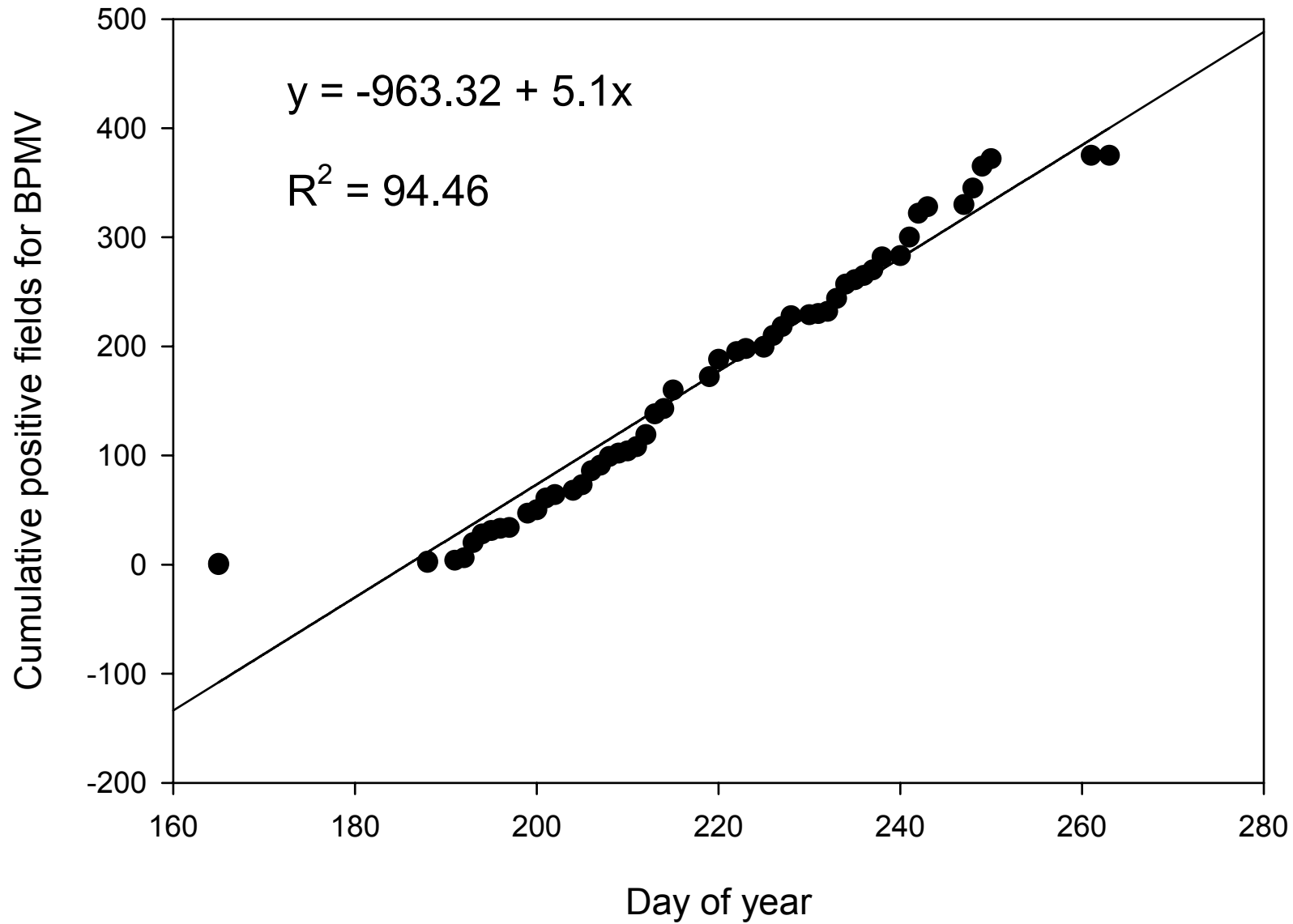








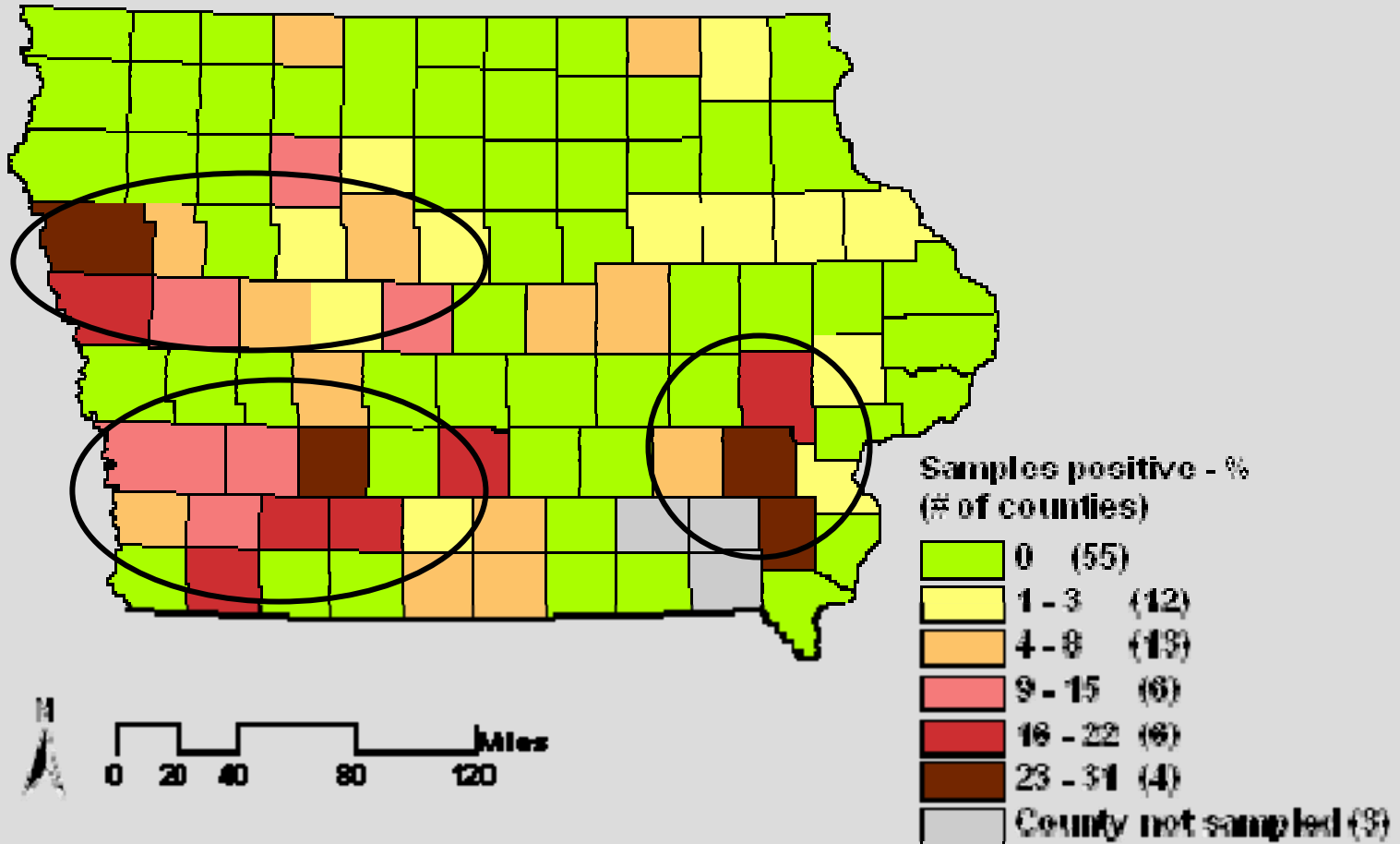




# Spatial Patterns for Bean Pod Mottle Virus in Iowa

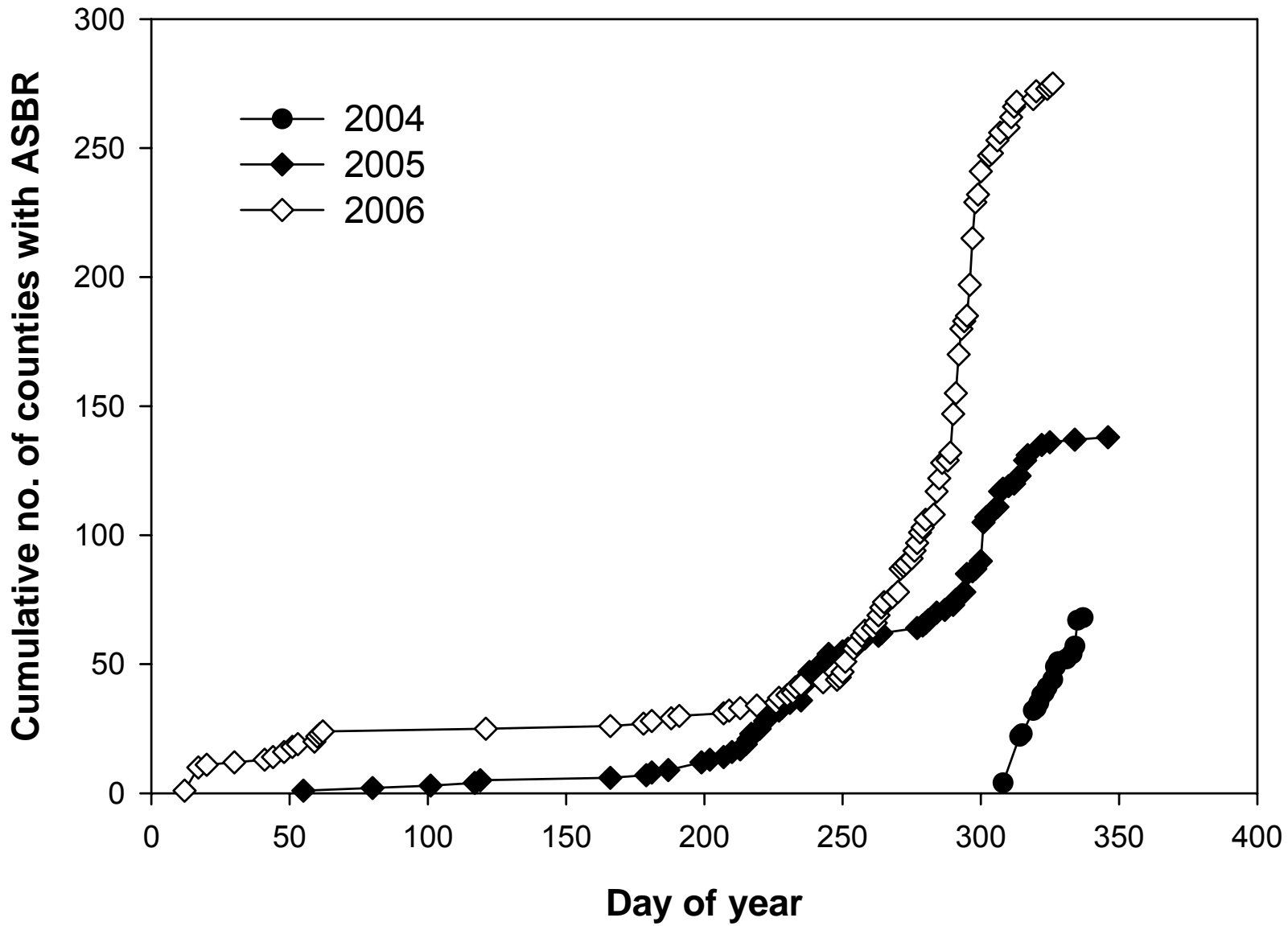
- 2005

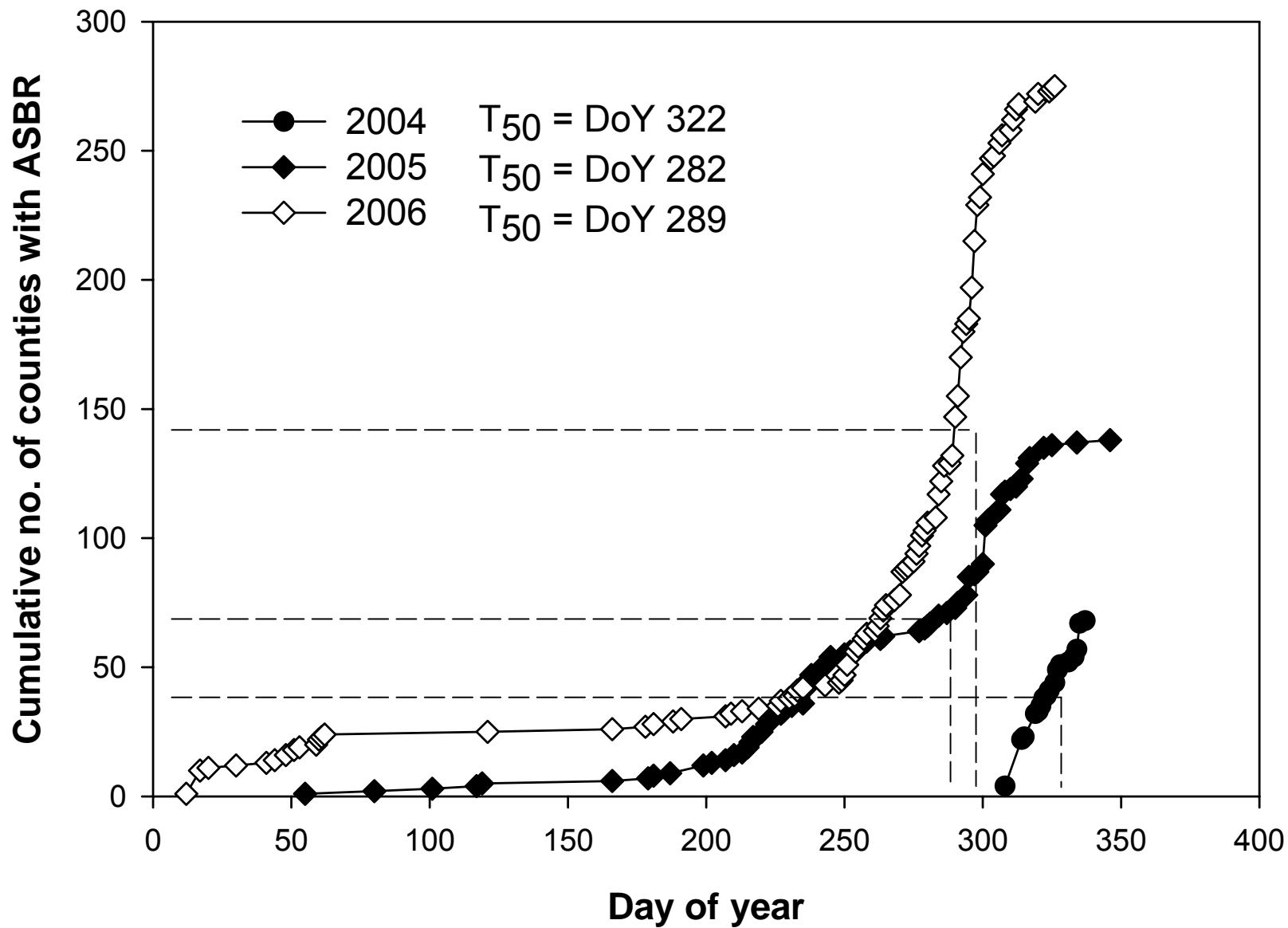
# Incidence of BPMV in Iowa

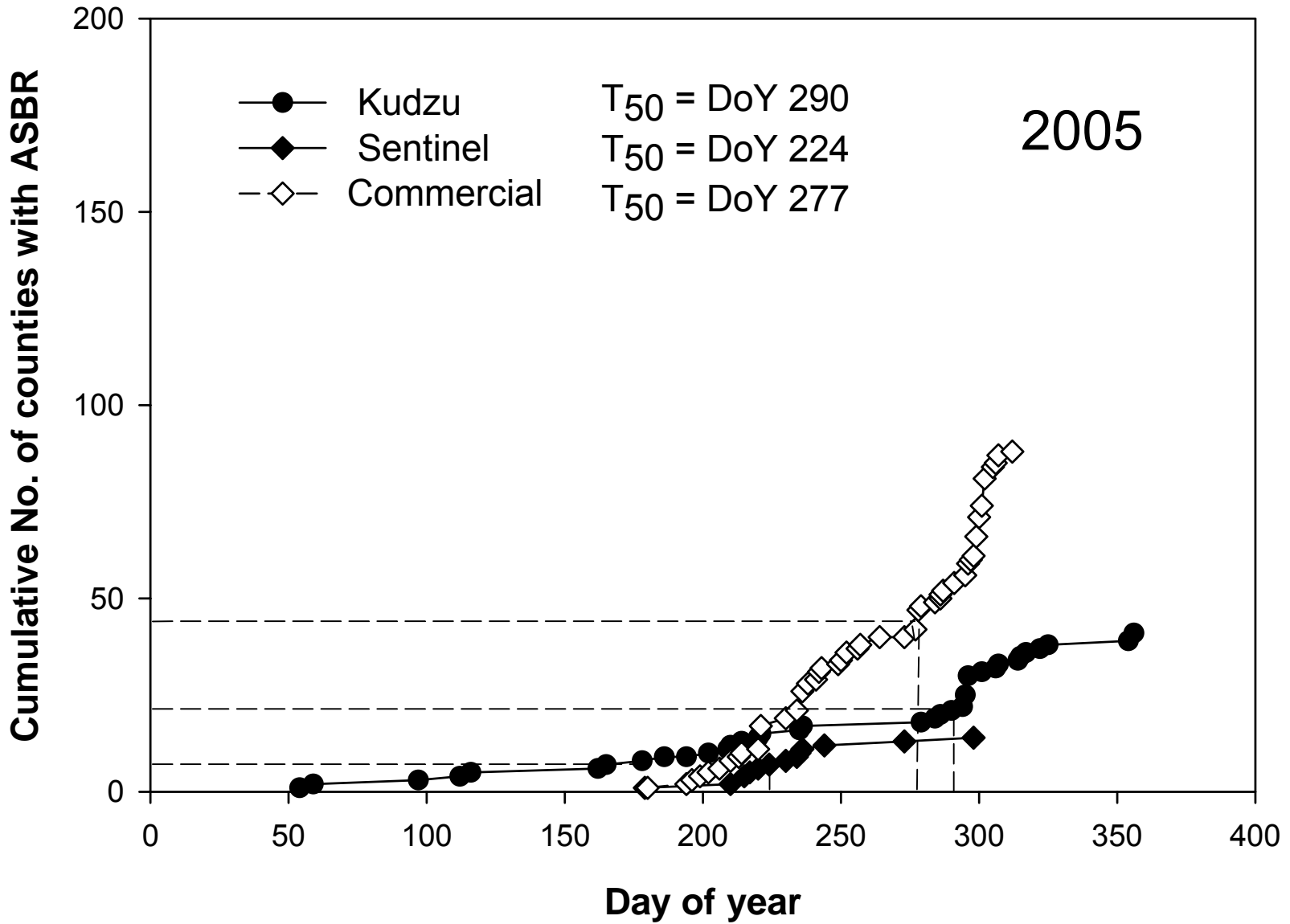


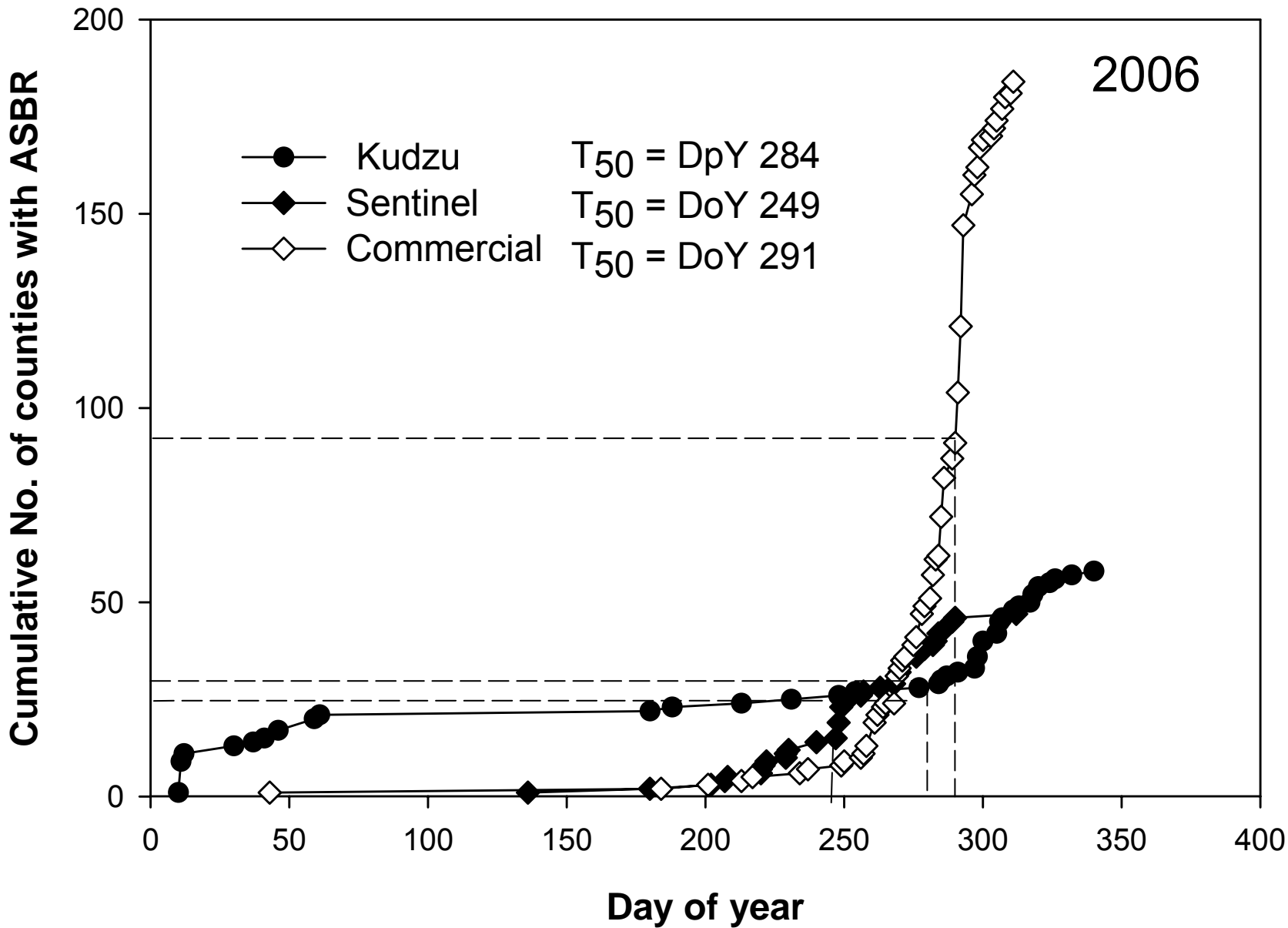
# Temporal Patterns for Asian Soybean Rust (county level)

- Within seasons (2004-2006)
- Among seasons (2004-2006)
  - Commercial soybean
  - Sentinel plots
  - Kudzu

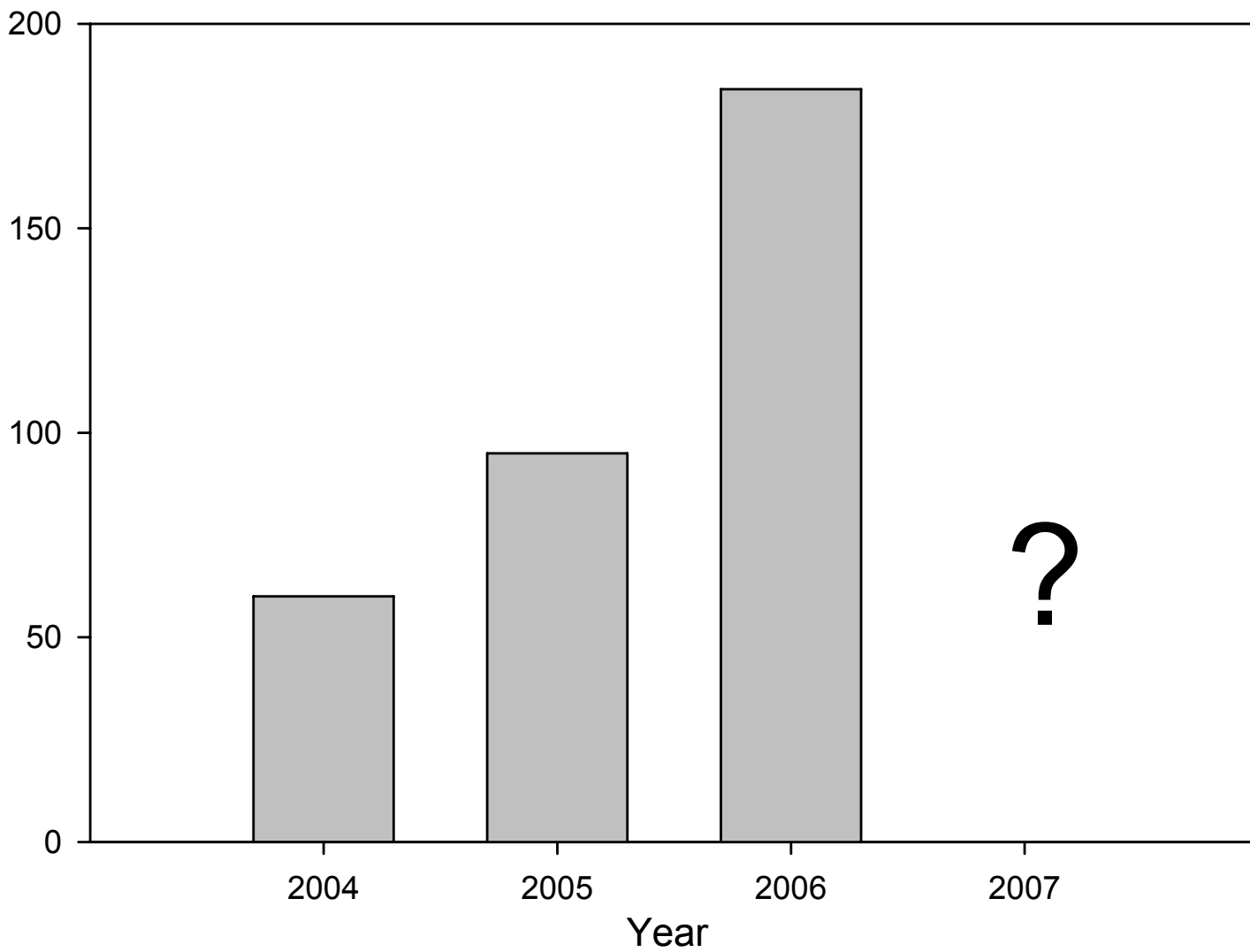


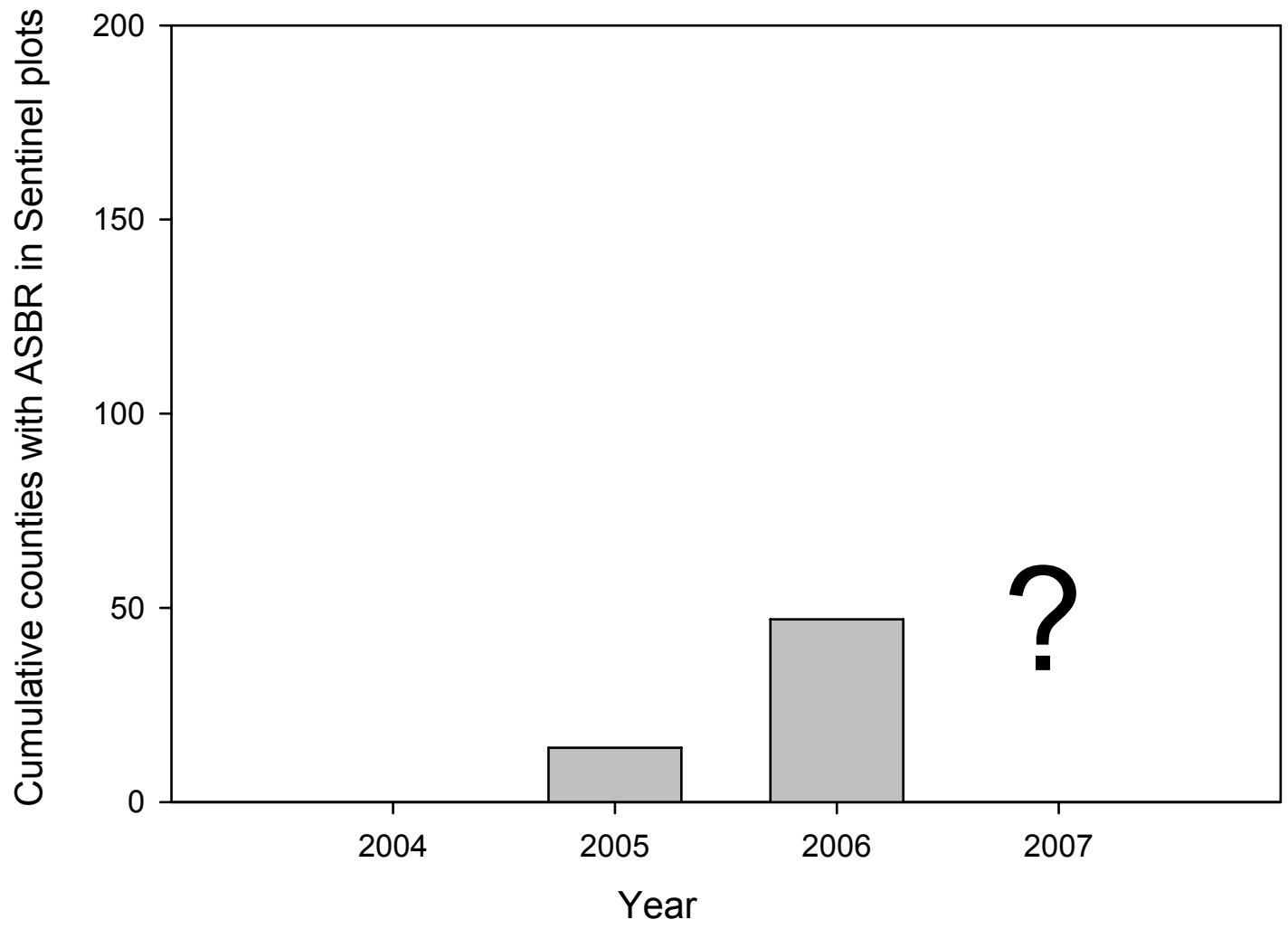


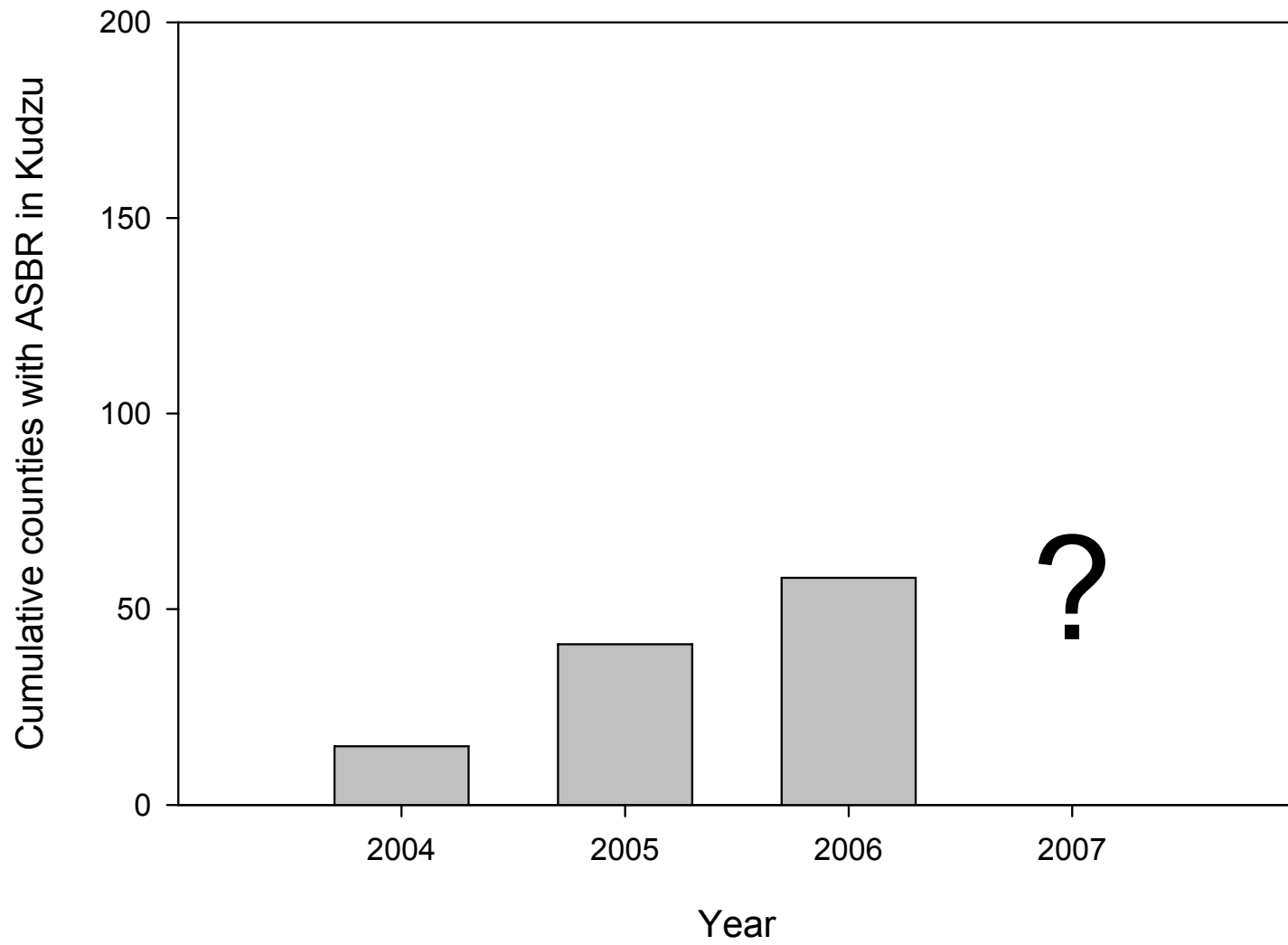


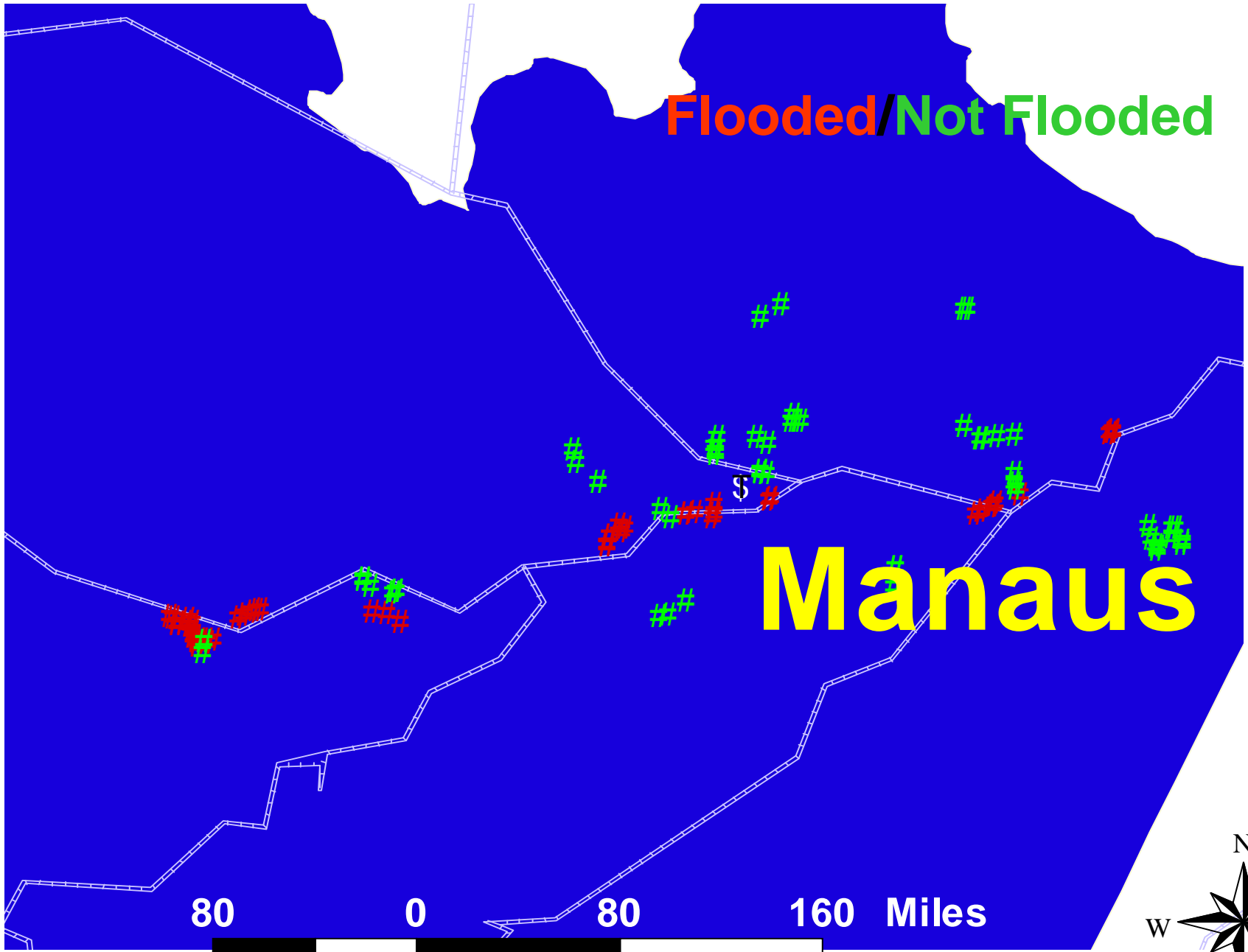


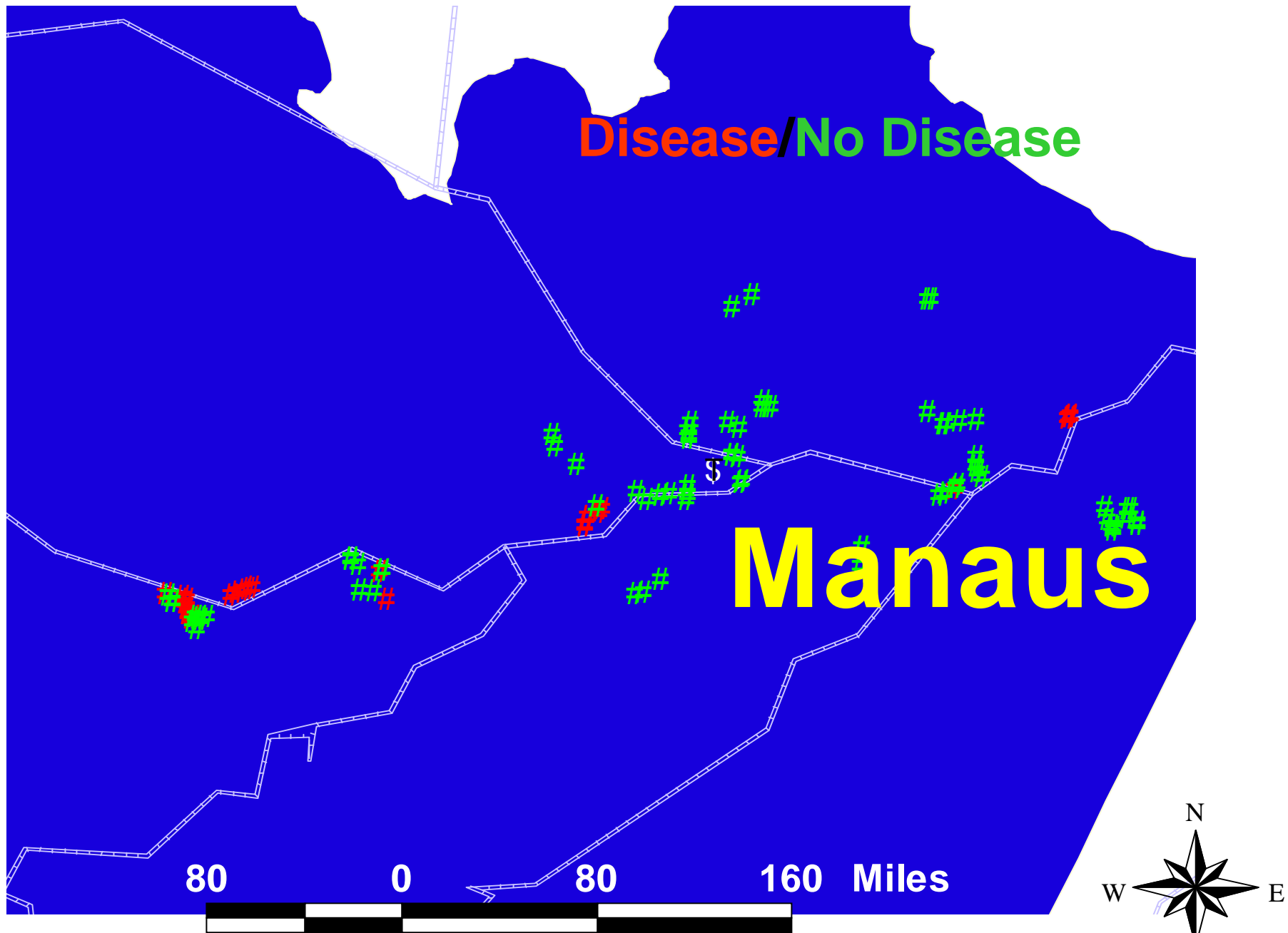
Cumulative counties with ASBR in Commercial fields











# Moko

# Flooded

	Yes	No
Yes	30	22
No	1	54

$\chi^2 = 40.55, df = 1, P < 0.001, n = 107$