Tracking Released Clones of *Gibberella zeae* within Wheat and Barley Fields

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Research Purpose

- Knowledge of movement of *G. zeae* from local sources of inoculum is critical to FHB management decisions

Research Objective

- To understand dissemination of *G. zeae* from area sources of inoculum

Previous Research

- Fernando et al., 1997
  - 50% decline in FHB infection within 1 to 10 m
  - 90% decline within 5 to 22 m
- Stack, 1997
  - 50% decline within 2 to 3 m from small area source
  - 50% decline within 20 to 50 m from large area source

Fernando, W.G.D., Paulitz, T.C., Seaman, W.L., Dutilleul, P., and Miller, J.D. 1997. Phytopathology 87:414-421.

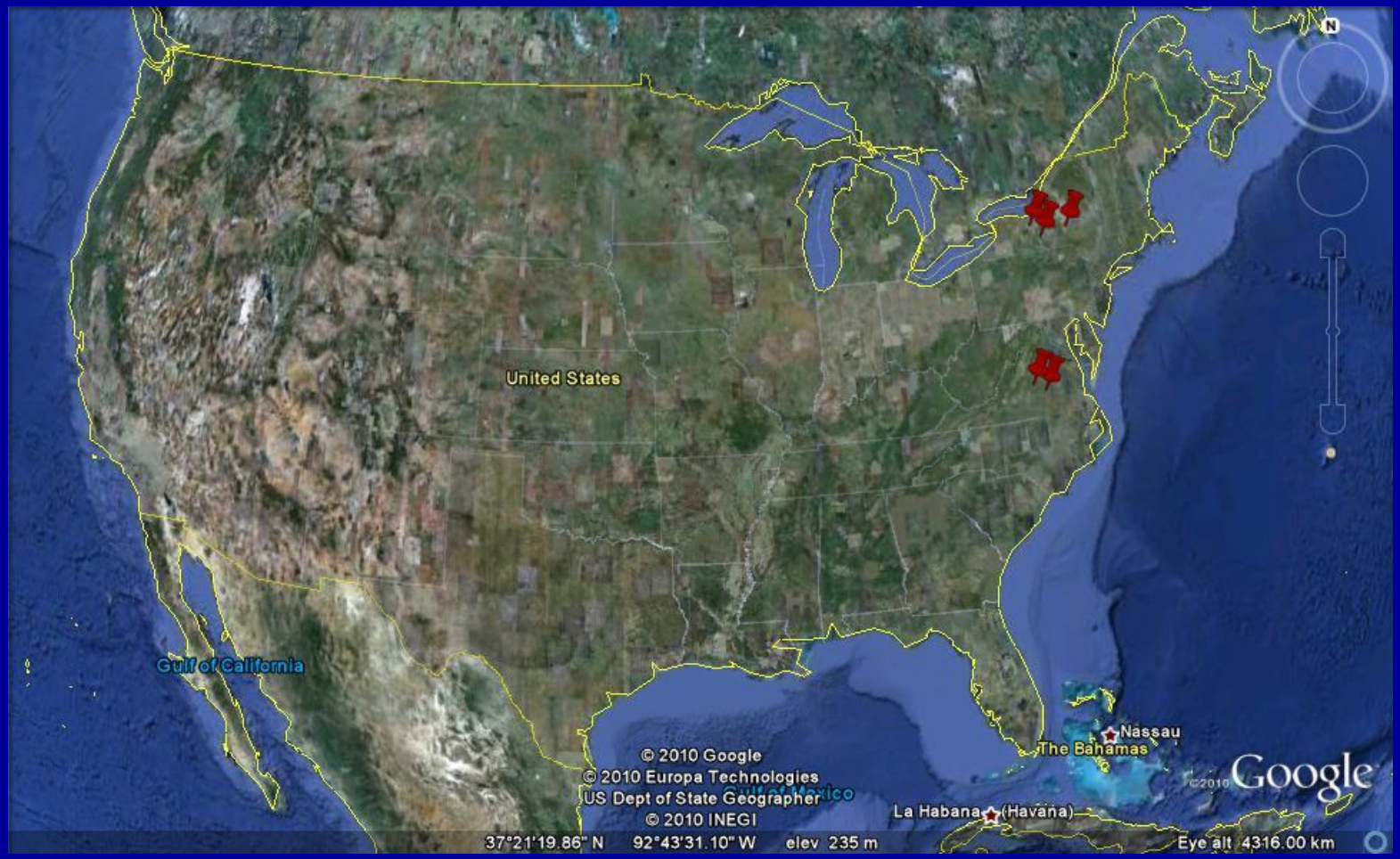
Stack, R.W. 1997. Page 60 in Proc. National Fusarium Head Blight Forum, St. Paul, MN.

Research Question

How do we unambiguously distinguish between known sources of *Gibberella zeae* and other background sources to track the movement of a released isolate in a field?

Amplified fragment length polymorphisms (AFLPs)

New York and Virginia Field Information



Inoculum Production

3-ADON

15-ADON

Inoculation/Collection of Fields

300 g of inocula

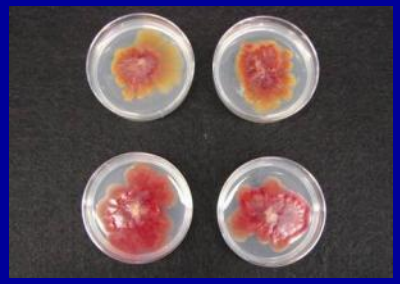
Weeks after flowering

Preparation of *G. zeae* Isolates

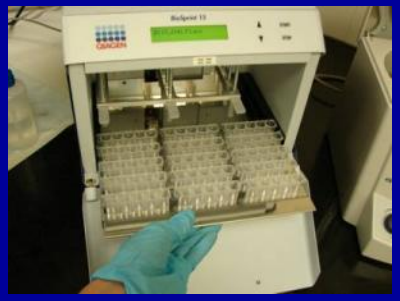
Collection

Disinfest

Selective Media

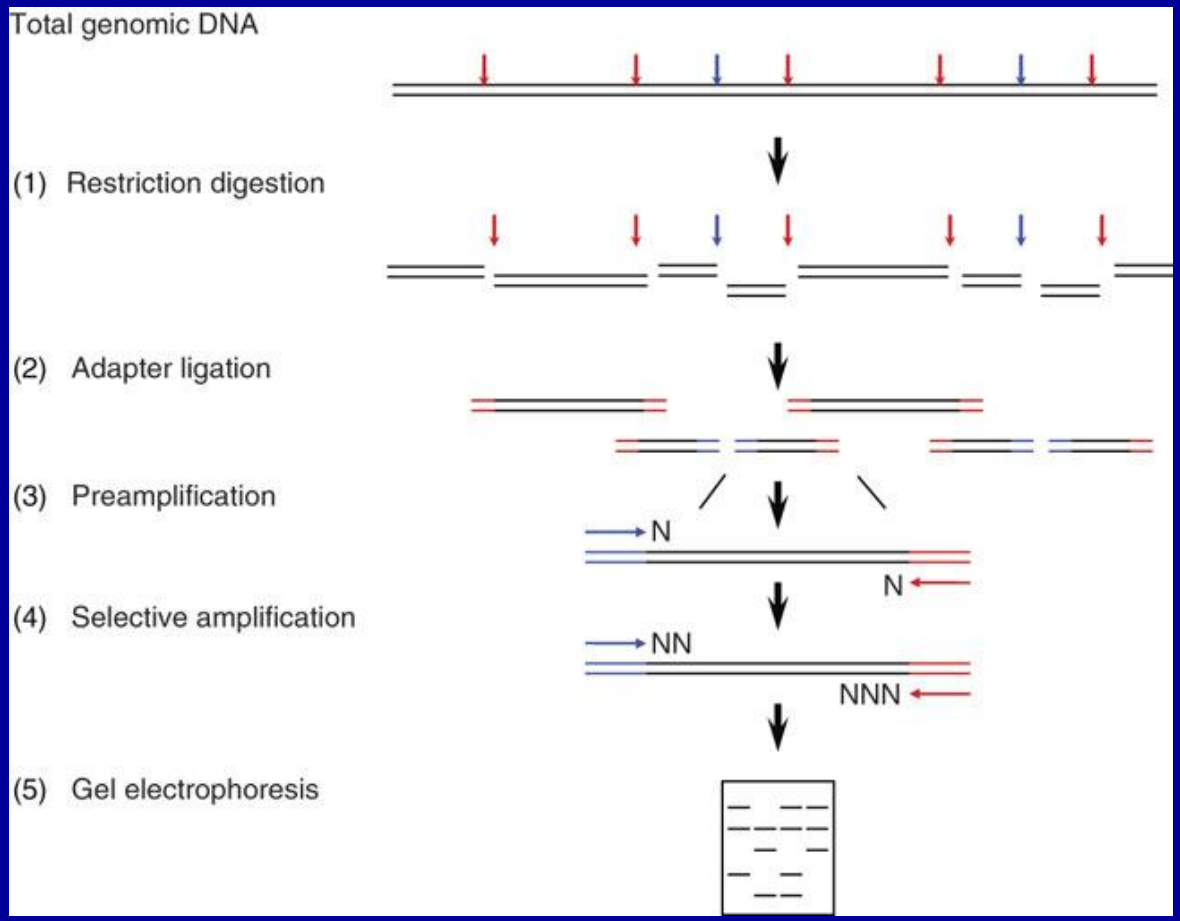


Single-Spore



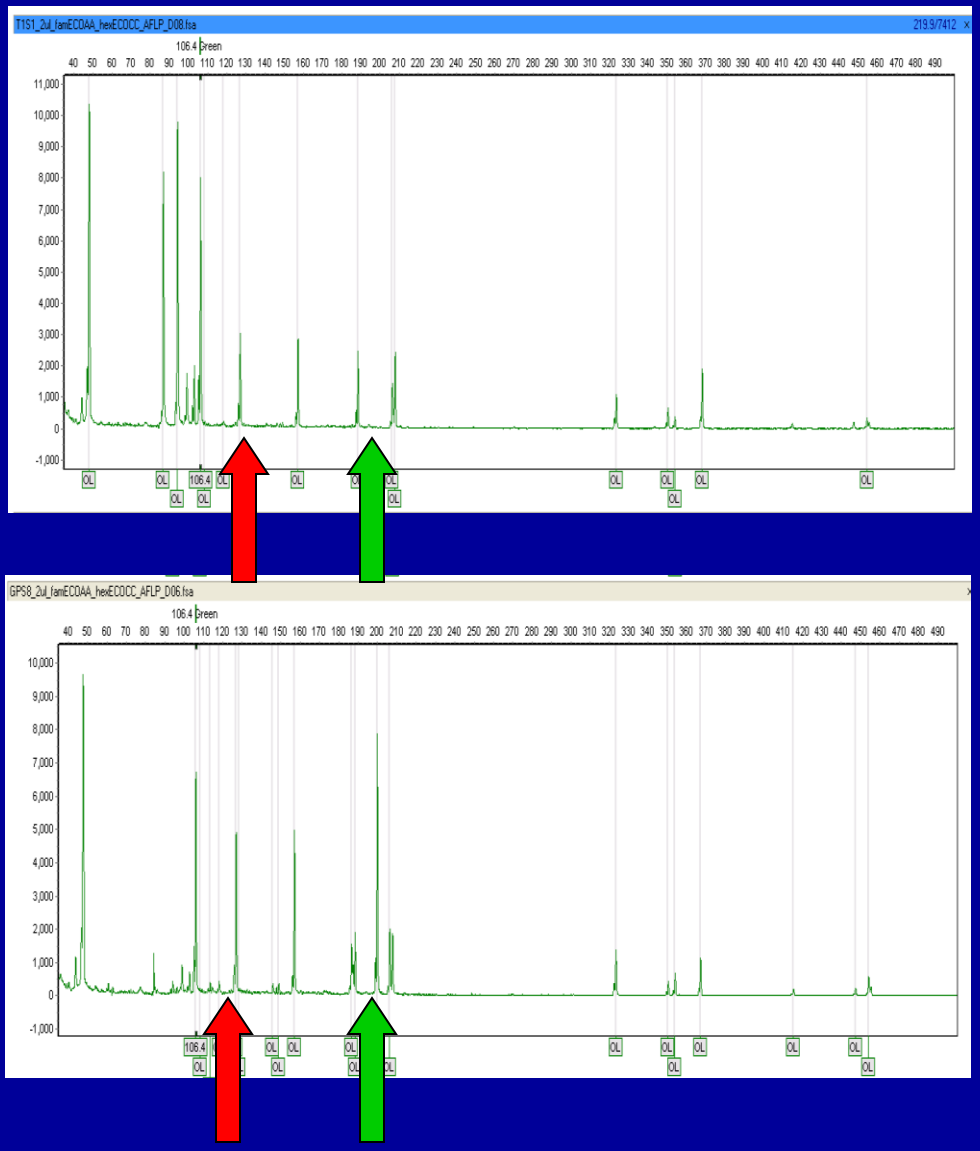
DNA Extraction

Amplified Fragment Length Polymorphisms (AFLPs)



Vuylsteke et al. 2007. Nature Protocols

AFLP Analysis



AFLPs

- Polymorphic bands (alleles) scored from 100 to 500 bp
- Nine alleles scored for each isolate for both VA and NY
- Recovery of the released clone was determined for each field plot

What we found…

< 1%

1%

2%

15%

87% decline

P < 0.001

3 m

6 m

≥24 m

15% (314/2160)
2% (35/2160)
1% (26/2160)
<1% (3/715)

What we found…

- Spike infection attributable to released clones decreased an average 90% within 3 to 6 m
  - Steeper gradient than previous research
- Incidence of spike infection caused by released clones averaged 15% directly above source plots
- No significance between plots of 3-ADON and 15-ADON clones ($P = 0.96$)

Keller, M.D., Waxman, K.D., Bergstrom, G.C., and Schmale, D.G. 2010. Local distance of wheat spike infection by released clones of *Gibberella zeae* disseminated from infested corn residue. Plant Dis. 94:1151-1155.

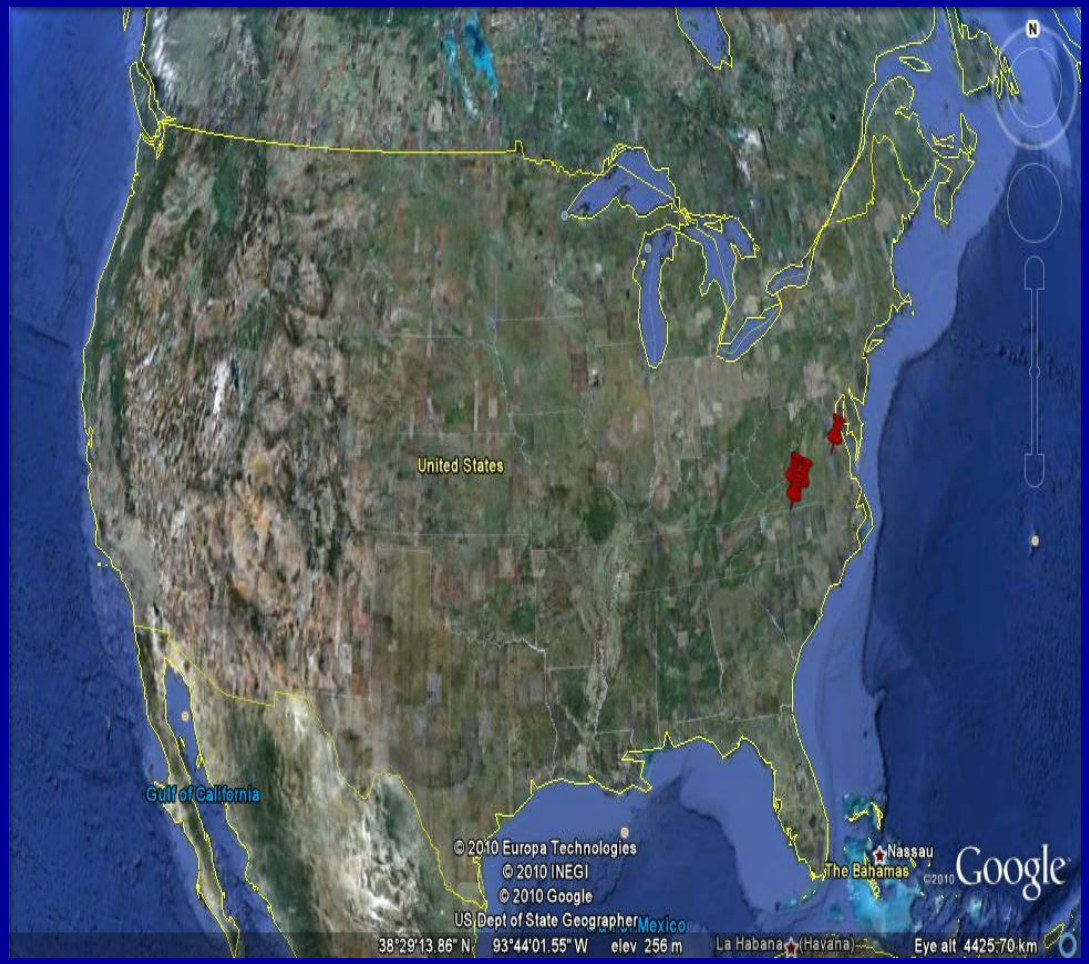
Impact of Results

- Separation of research plots 3 m and, if possible, 6 m to avoid interplot interference

Current Research Question

- How does the amount of inocula affect dissemination from a released source?

Virginia Fields – Plots with Varying Amounts of Corn Residue



Winter Barley 2008 and 2009

Winter Wheat 2009 and 2010

Winter Barley Fields

45 grams (5 stalk pieces) **410 grams (50 stalk pieces)**

- 45, 200, and 410 g of corn residue were placed into plots
- Only one *G. zeae* clone used for infestation

Winter Wheat Fields

45 grams (5 stalk pieces) **410 grams (50 stalk pieces)**

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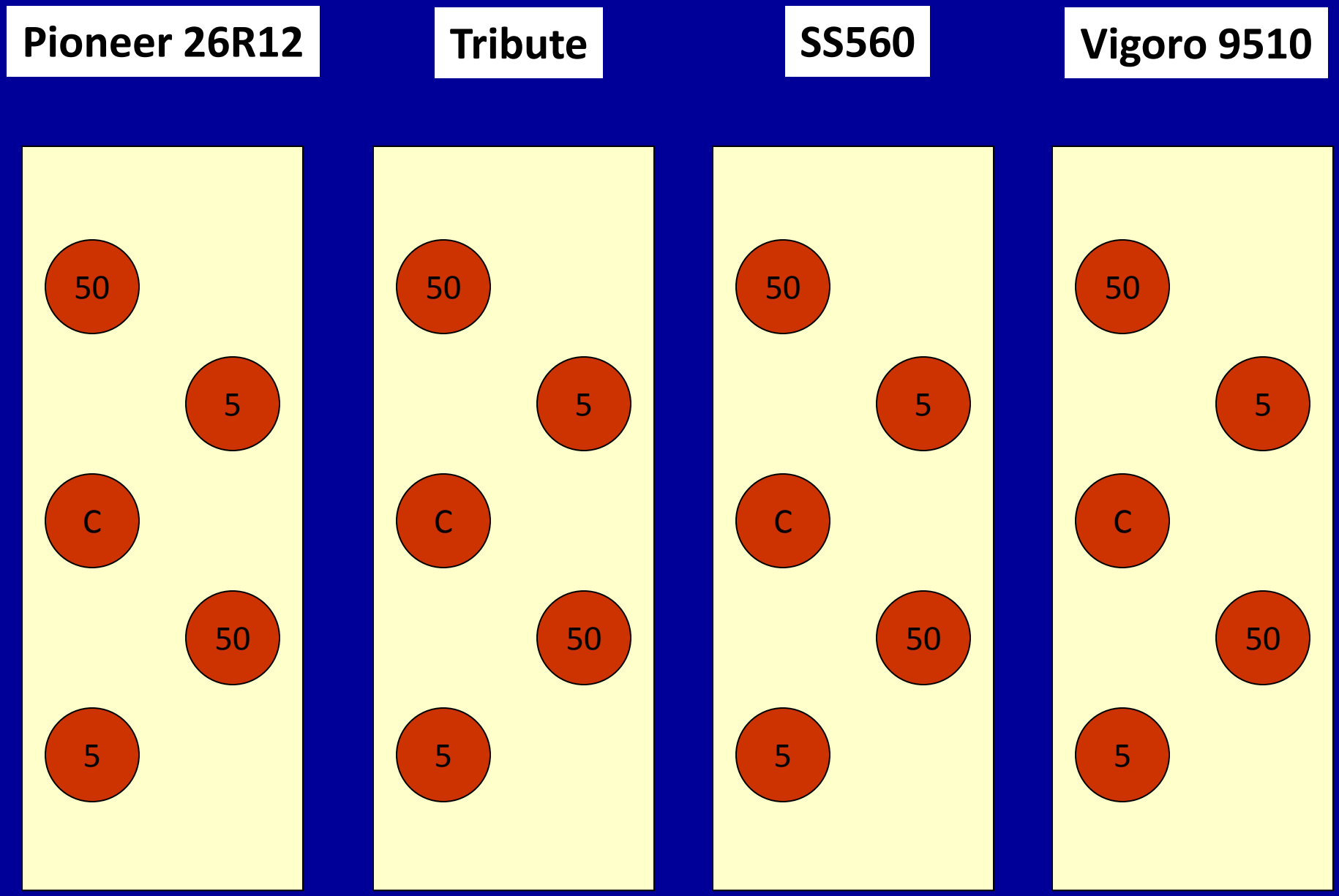
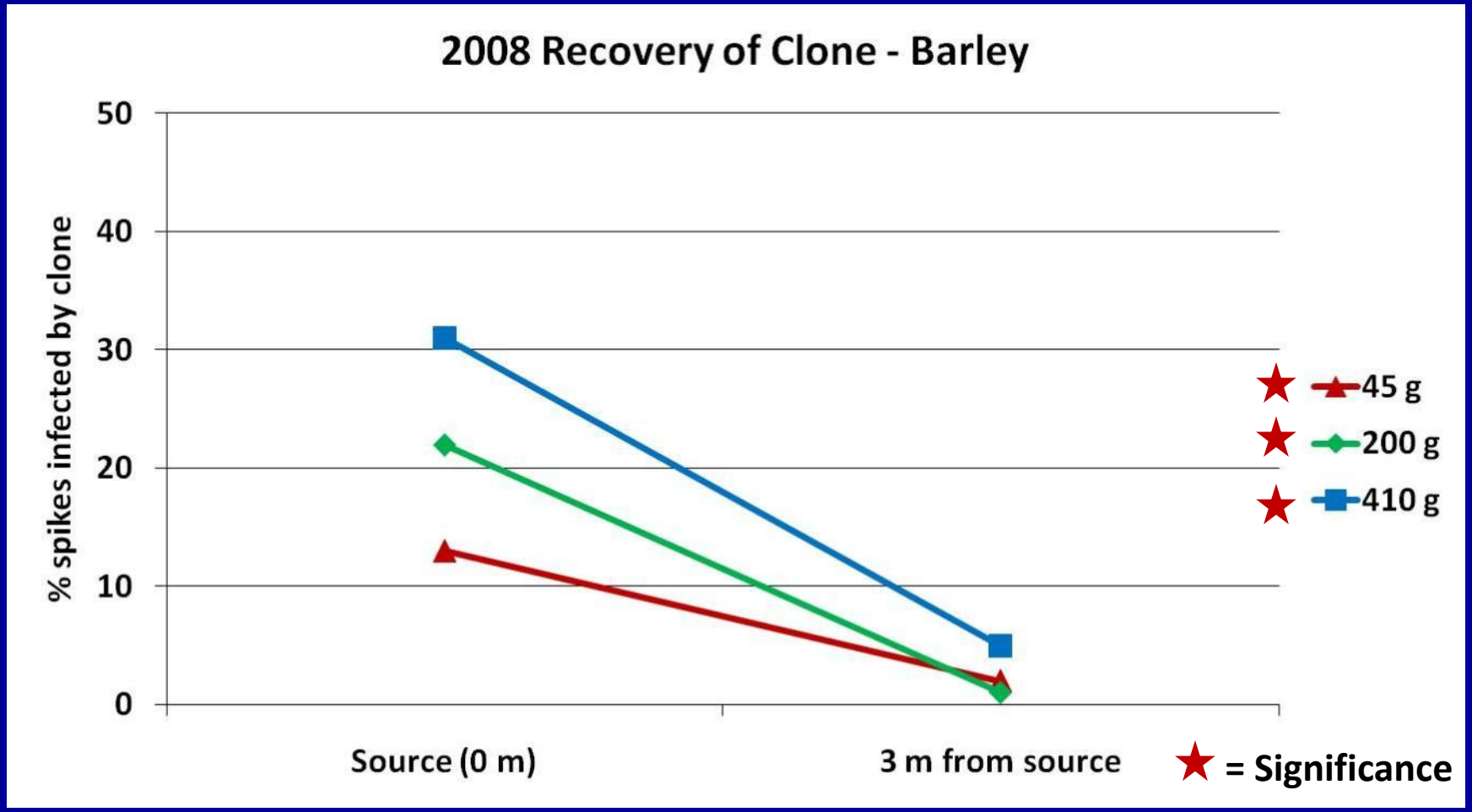
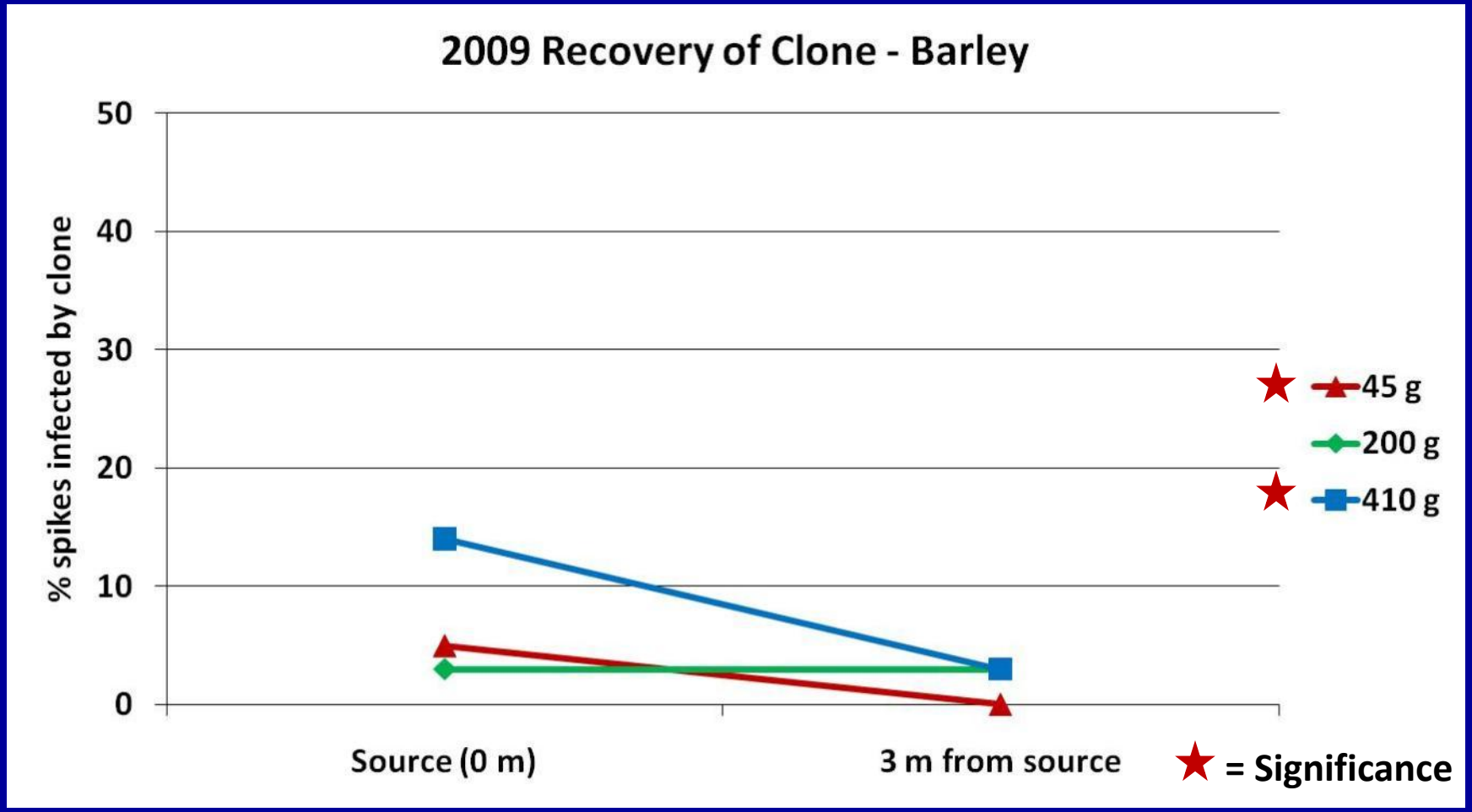

Pioneer 26R12
50
5
C
50
5
Tribute
50
5
C
50
5
SS560
50
5
C
50
5
Vigoro 9510
50
5
C
50
5

Barley - Moderate FHB Epidemic



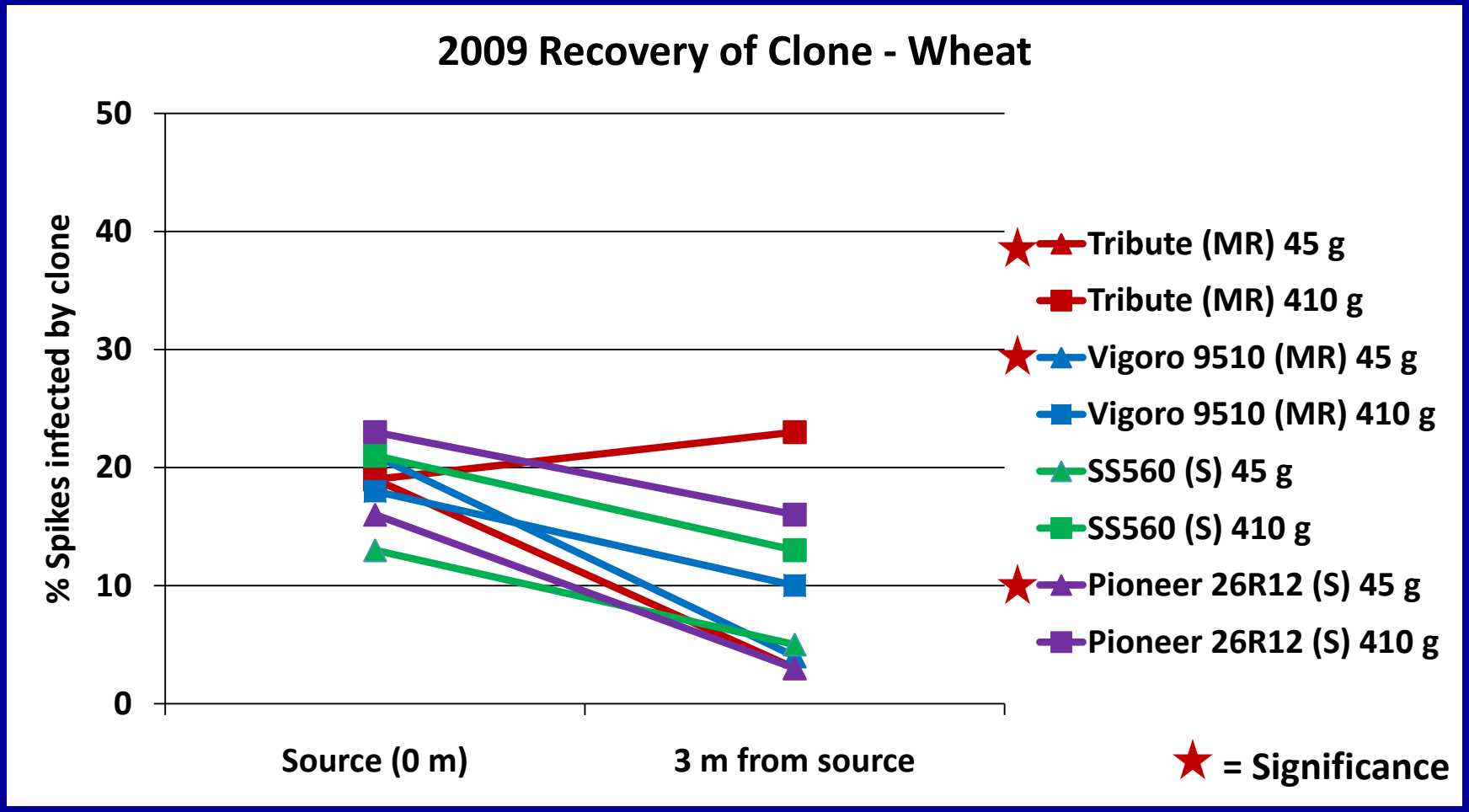
- Recovery of clone decreased from 0 to 3 m for all inoculum amounts

Barley - Low FHB Epidemic



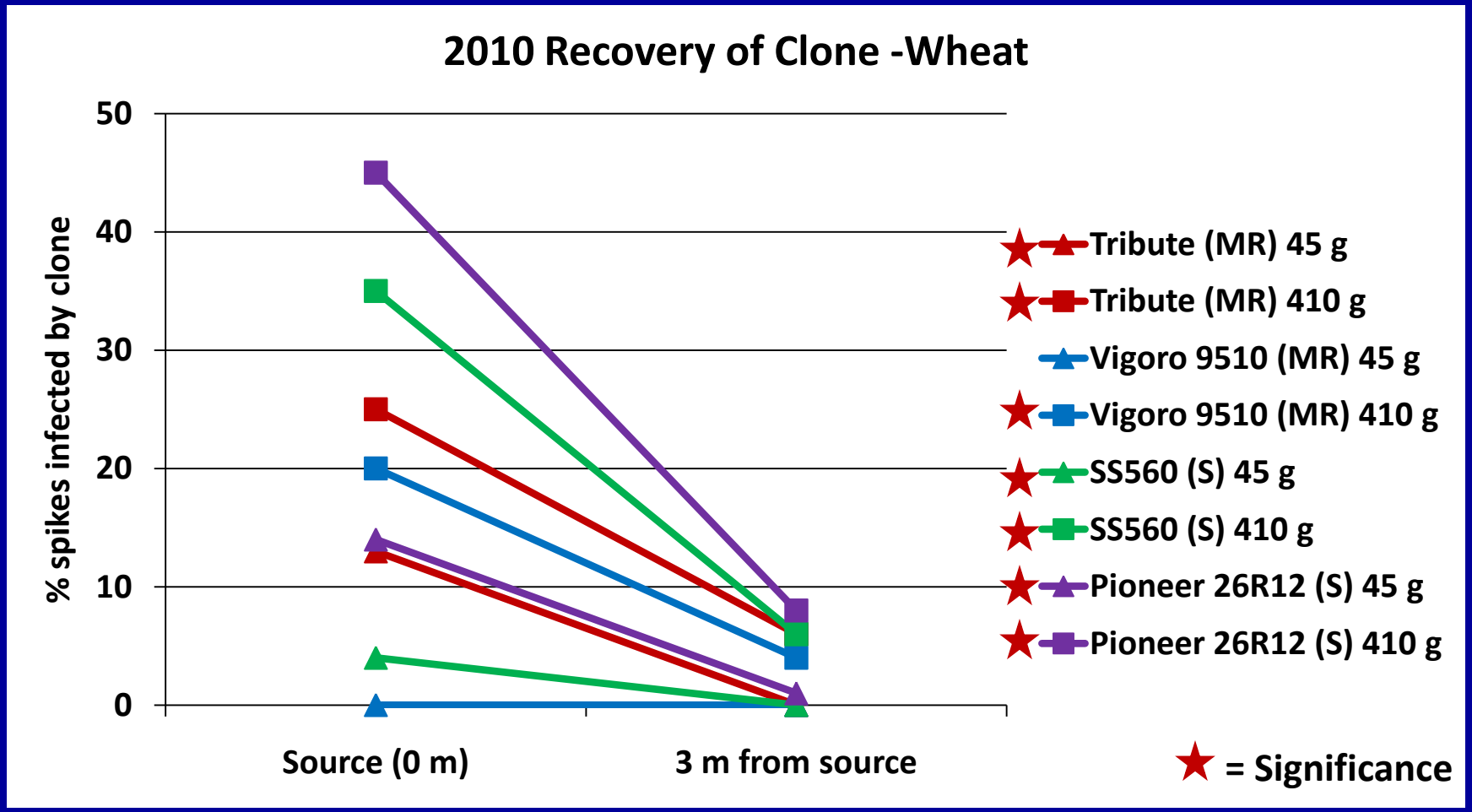
- Recovery of clone decreased from 0 to 3 m except for 200 g plots

Wheat - High FHB Epidemic

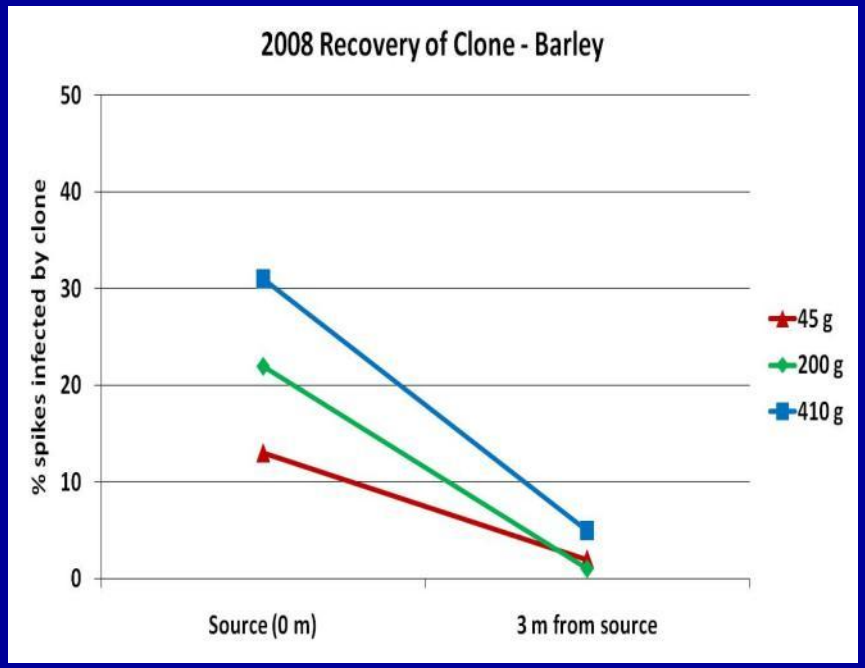


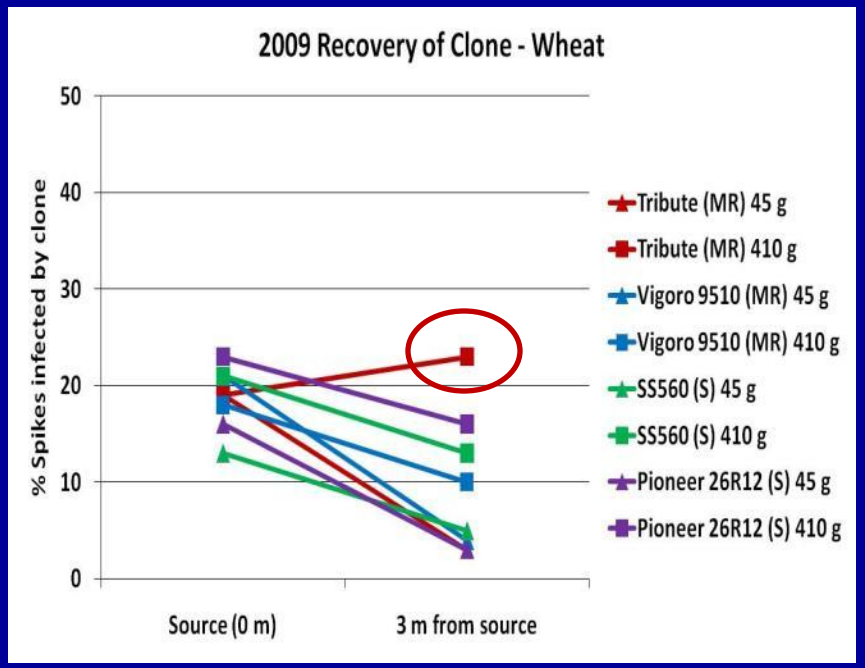
- Recovery of clone decreased for all with the exception of the cultivar Tribute (410 g plots)

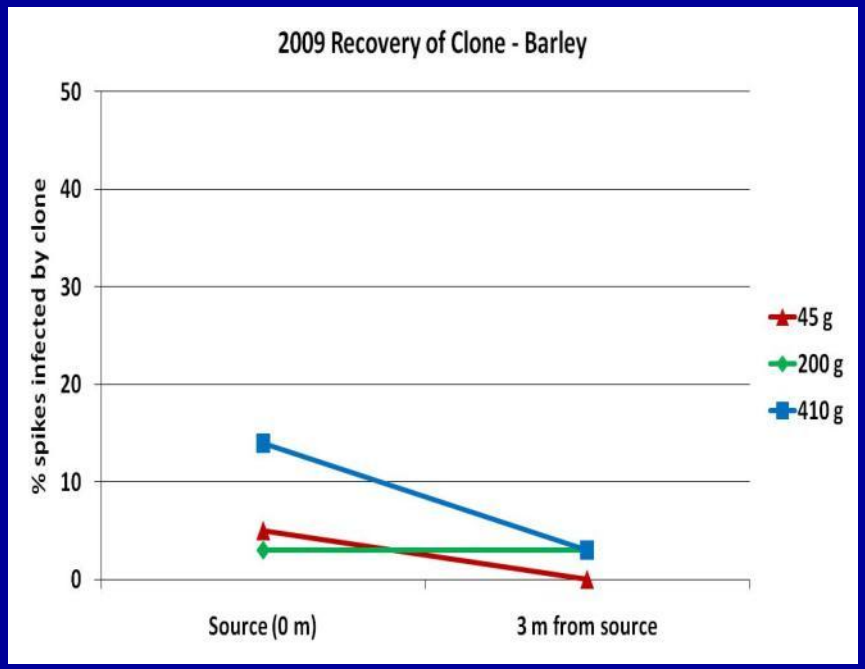
Wheat - Low/Moderate FHB Epidemic



- Recovery of clone decreased from source with the exception of Vigoro (45 g plots)


2008 Recovery of Clone - Barley
% spikes infected by clone
50
40
30
20
10
0
Source (0 m)
3 m from source
45 g
200 g
410 g


2009 Recovery of Clone - Wheat
% Spikes infected by clone
50
40
30
20
10
0
Source (0 m)
3 m from source
Tribute (MR) 45 g
Tribute (MR) 410 g
Vigoro 9510 (MR) 45 g
Vigoro 9510 (MR) 410 g
SS560 (S) 45 g
SS560 (S) 410 g
Pioneer 26R12 (S) 45 g
Pioneer 26R12 (S) 410 g


2009 Recovery of Clone - Barley
% spikes infected by clone
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40
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20
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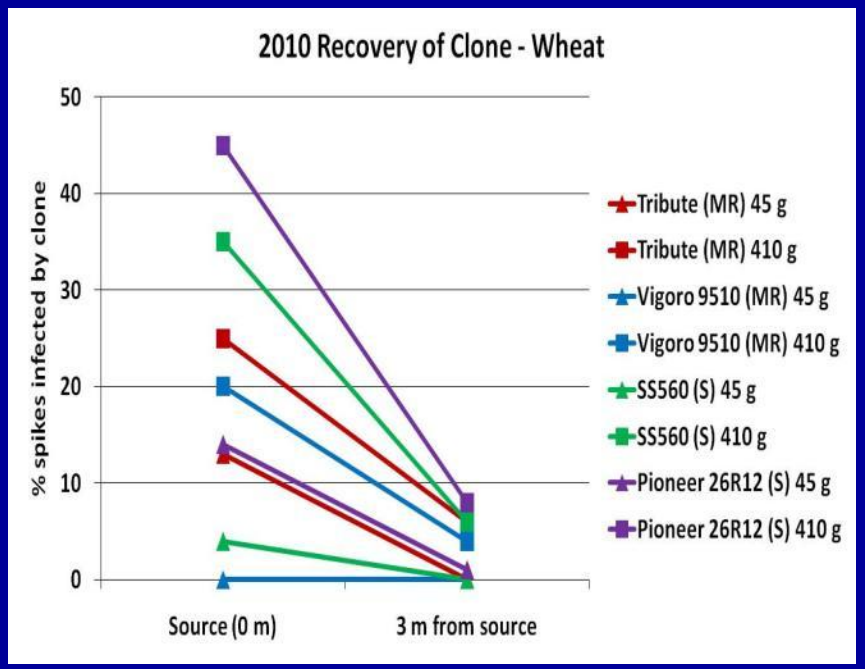
0
Source (0 m)
3 m from source
45 g
200 g
410 g


2010 Recovery of Clone - Wheat
% spikes infected by clone
50
40
30
20
10
0
Source (0 m)
3 m from source
Tribute (MR) 45 g
Tribute (MR) 410 g
Vigoro 9510 (MR) 45 g
Vigoro 9510 (MR) 410 g
SS560 (S) 45 g
SS560 (S) 410 g
Pioneer 26R12 (S) 45 g
Pioneer 26R12 (S) 410 g

% Decline from Source to 3 m

- All years:
  - 45 g – Average 78%
  - 410 g – Average 58%
- Low Epidemic Year (Barley 2009)
  - 45 g – 100%
  - 410 g – 79%
- Moderate Epidemic Year (Barley 2008, Wheat 2010)
  - 45 g – Average 76%
  - 410 g – Average 81%
- High Epidemic Year (Wheat 2009)
  - 45 g – 77%
  - 410 g – 24%

Next important epidemiological question is whether or not the same trends are seen with naturally inoculated corn residue

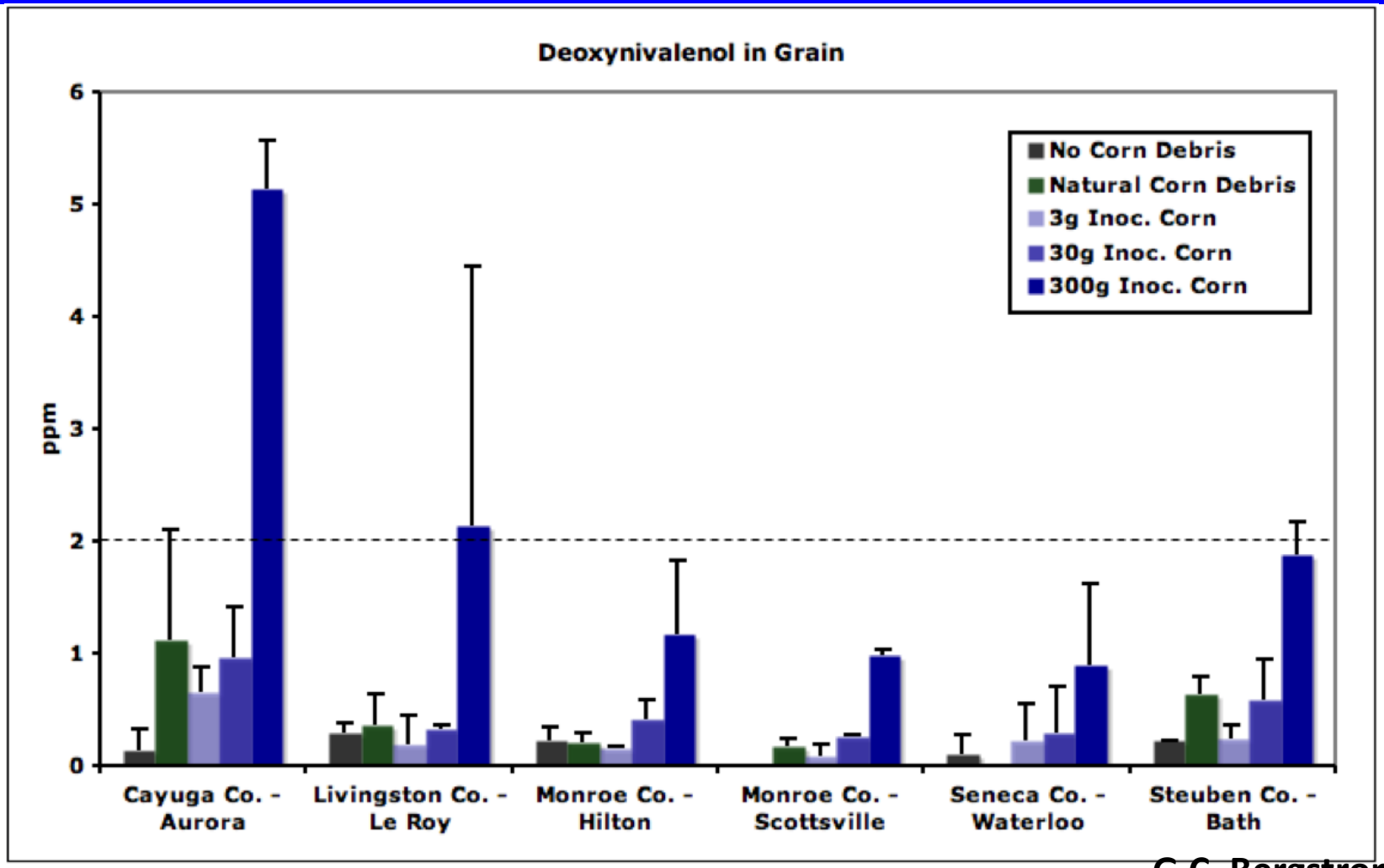
Natural Corn Debris Research

- Research led by Dr. Gary Bergstrom – Cornell University
  - Ms. Katrina Waxman

- Poster at Fusarium Head Blight Forum (2008)

Contribution of corn residue in microplots to DON contamination in six commercial New York wheat fields in 2008.

G.C. Bergstrom and K.D. Waxman



G.C. Bergstrom

Natural Corn Debris Research

- Research led by Dr. Gary Bergstrom – Cornell University
  - Ms. Katrina Waxman
- Poster at Fusarium Head Blight Forum (2008)
- Current research in 21 different environments (2010 Poster)
  - Illinois – Dr. Carl Bradley
  - Missouri – Dr. Laura Sweets
  - Nebraska – Dr. Steven Wegulo
  - New York – Dr. Gary Bergstrom/Ms. Katrina Waxman
  - Virginia – Dr. David Schmale/Ms. Melissa Keller

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Ms. Katrina Waxman – Cornell University

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Department of Statistics – Virginia Polytechnic Institute and State U.

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Virginia Small Grains Board