Challenges managing Sclerotinia head rot of sunflowers with partially resistant hybrids and with fungicides

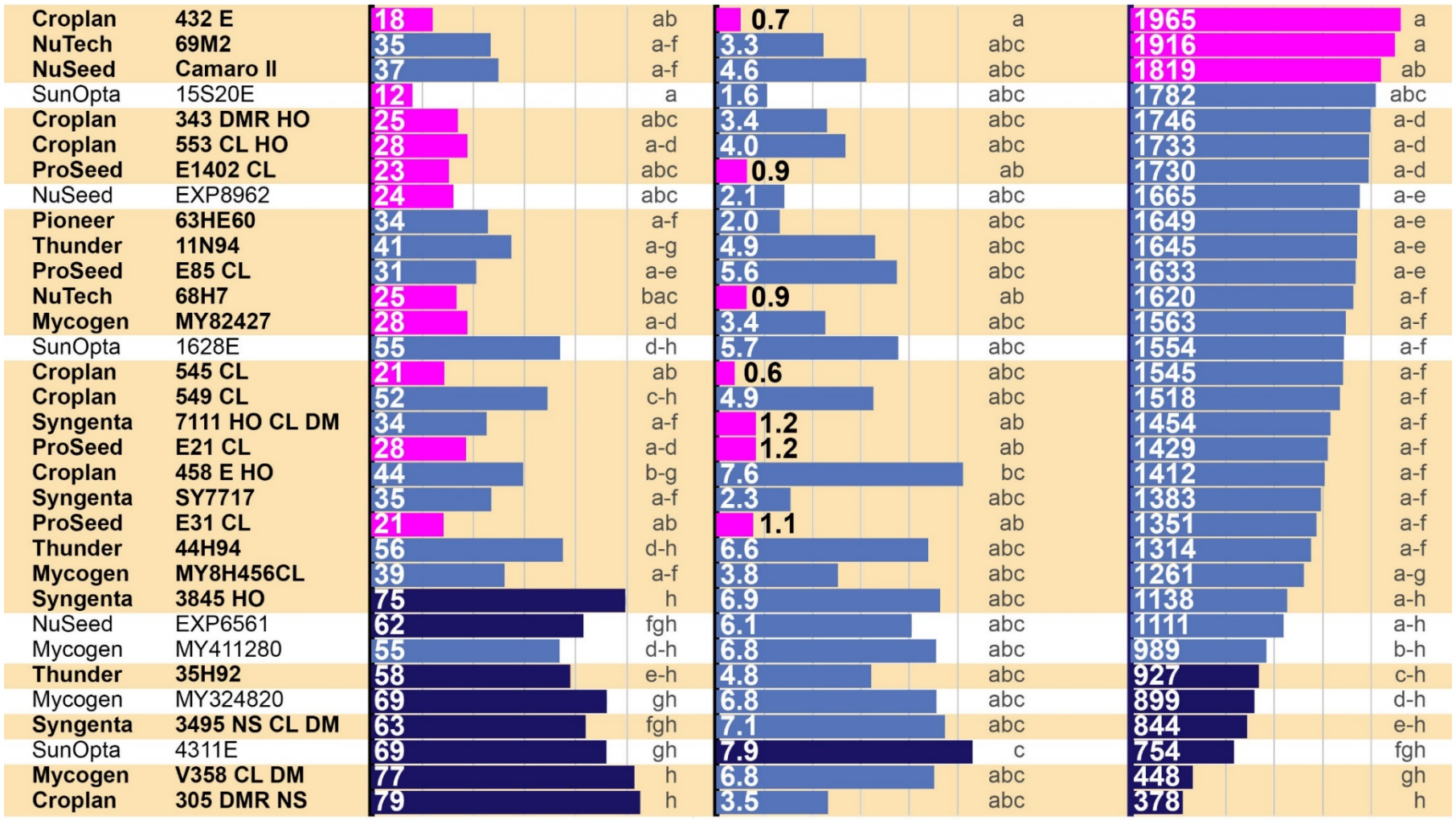
Michael Wunsch, Jesse Hafner, Billy Kraft, Suanne Kallis, Michael Schaefer and Thomas Miorini
NDSU Carrington Research Extension Center

Leonard Besemann, Kelly Cooper, Heidi Eslinger, and Seth Nelson
NDSU Robert Titus Research Farm, Oakes

Scott Halley, Amanda Arens and Pravin Gautam
NDSU Langdon Research Extension Center

Susceptibility of oilseed hybrids to Sclerotinia head rot

Carrington, ND (2015)

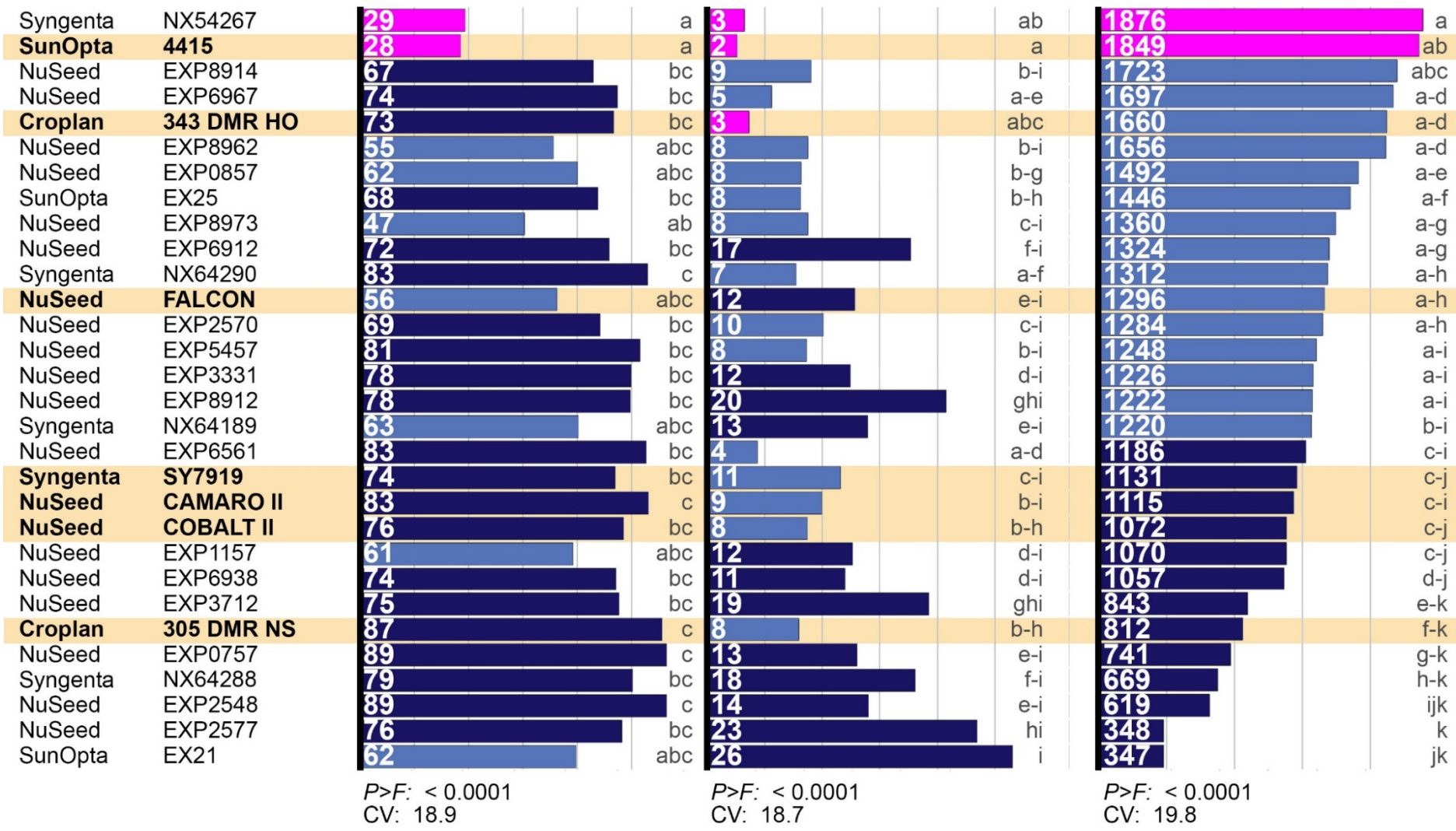


Yellow background = commercial hybrid

White background = experimental hybrid

Susceptibility of oilseed hybrids to Sclerotinia head rot

Carrington, ND (2016)

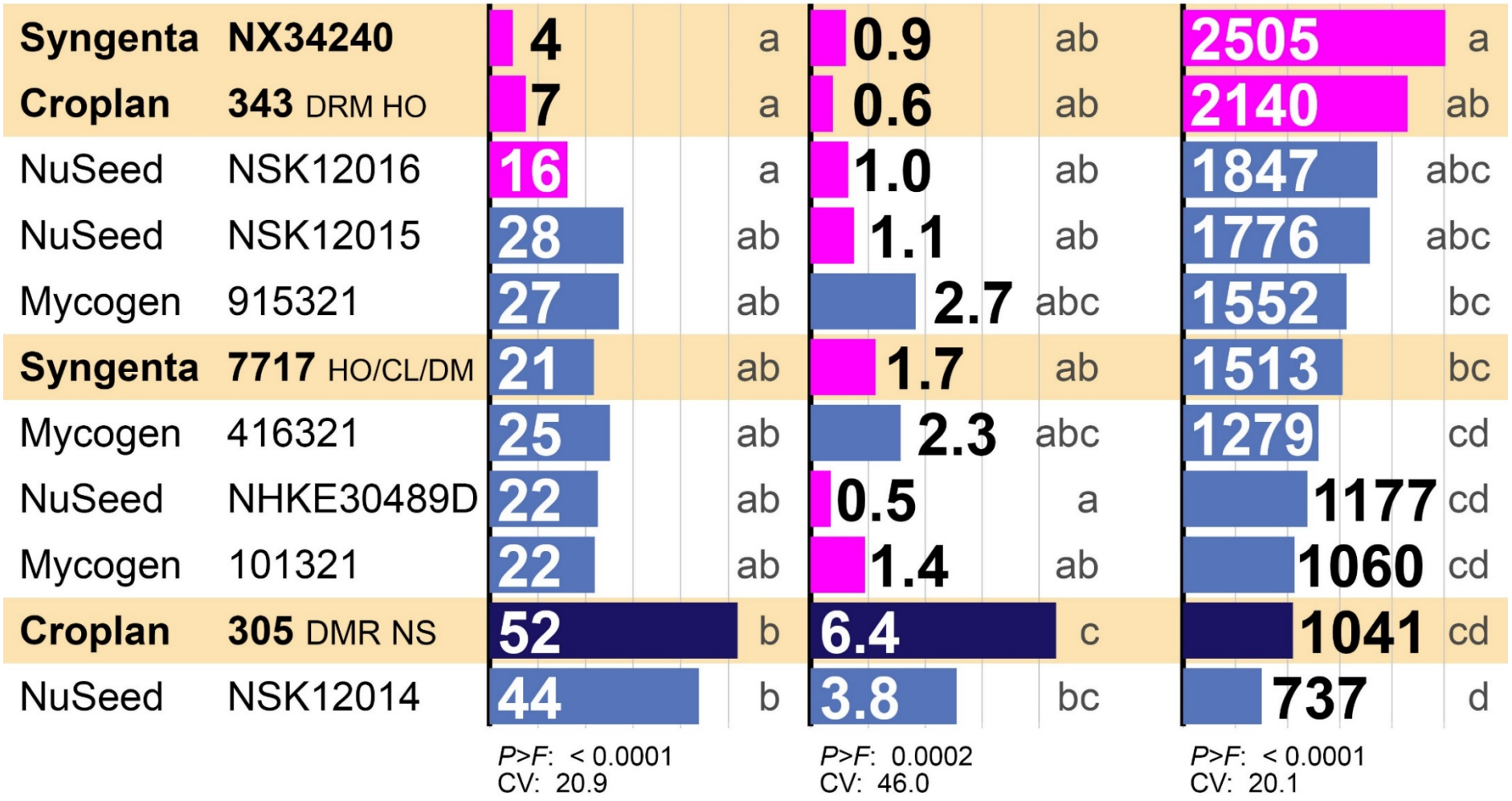


Yellow background = commercial hybrid

White background = experimental hybrid

Susceptibility of oilseed hybrids to Sclerotinia head rot

Carrington, ND (2014)



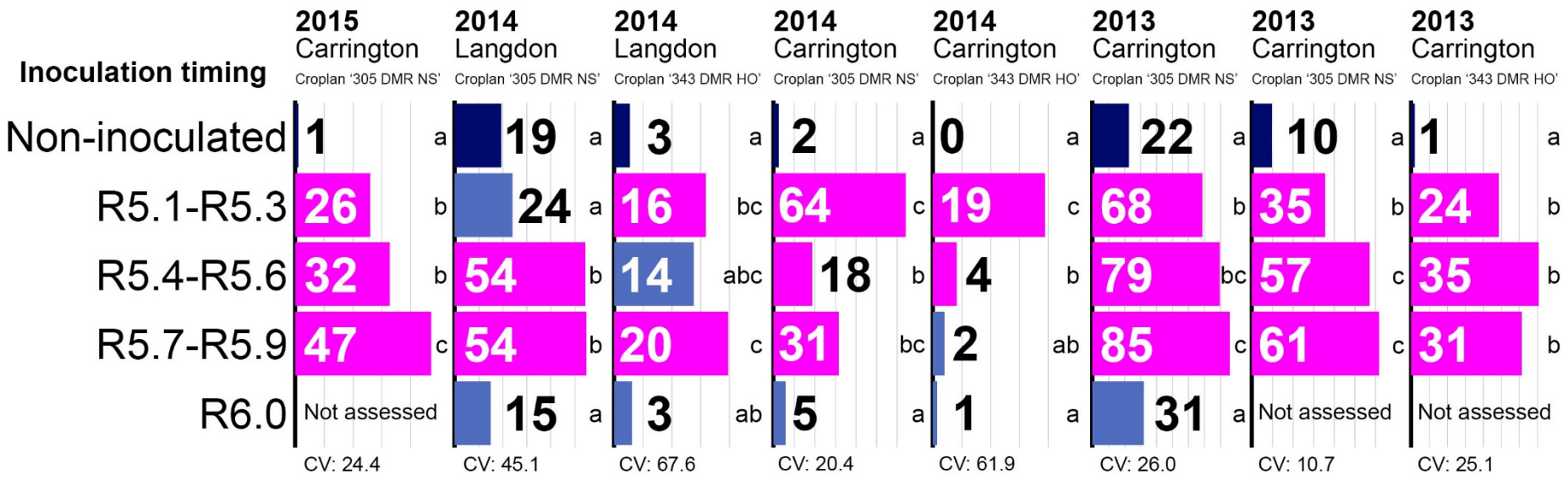
Yellow background = commercial hybrid

White background = experimental hybrid

Susceptibility to Sclerotinia head rot

relative to sunflower growth stage

Oilseed sunflowers:

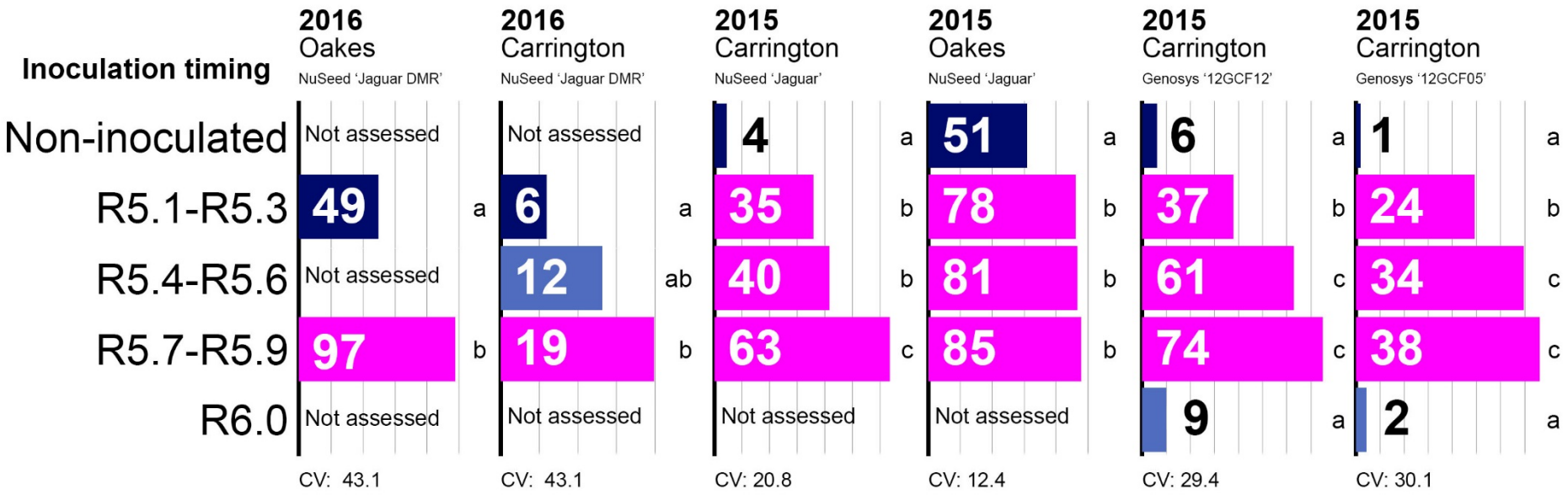


- In six of eight trials, susceptibility increased as bloom progressed
- In two trials, susceptibility was highest in the first third of bloom
- Susceptibility dropped sharply at the R6 growth stage

Susceptibility to Sclerotinia head rot

relative to sunflower growth stage

Confection (non-oil) sunflowers:



- In five of six trials, susceptibility increased as bloom progressed
- In one trial, sunflowers were equally susceptible throughout bloom
- Susceptibility dropped sharply at the R6 growth stage

Susceptibility to Sclerotinia head rot

relative to sunflower growth stage

Conclusions from infection timing studies:

Susceptibility to Sclerotinia head rot is conditioned by (1) growth stage and (2) environmental conditions.

- **Susceptibility increases as bloom progresses** unless environmental conditions strongly favor infection at early bloom and become unfavorable at late bloom
- **Susceptibility drops sharply at the end of bloom**

Susceptibility to Sclerotinia head rot

relative to sunflower growth stage

Implications for identifying partially resistant hybrids:

Obtaining unbiased, replicable results from screening nurseries is likely to be facilitated by

(1) inoculating every sunflower head at the same growth stages

- Reduces bias from differences in susceptibility related to growth stage

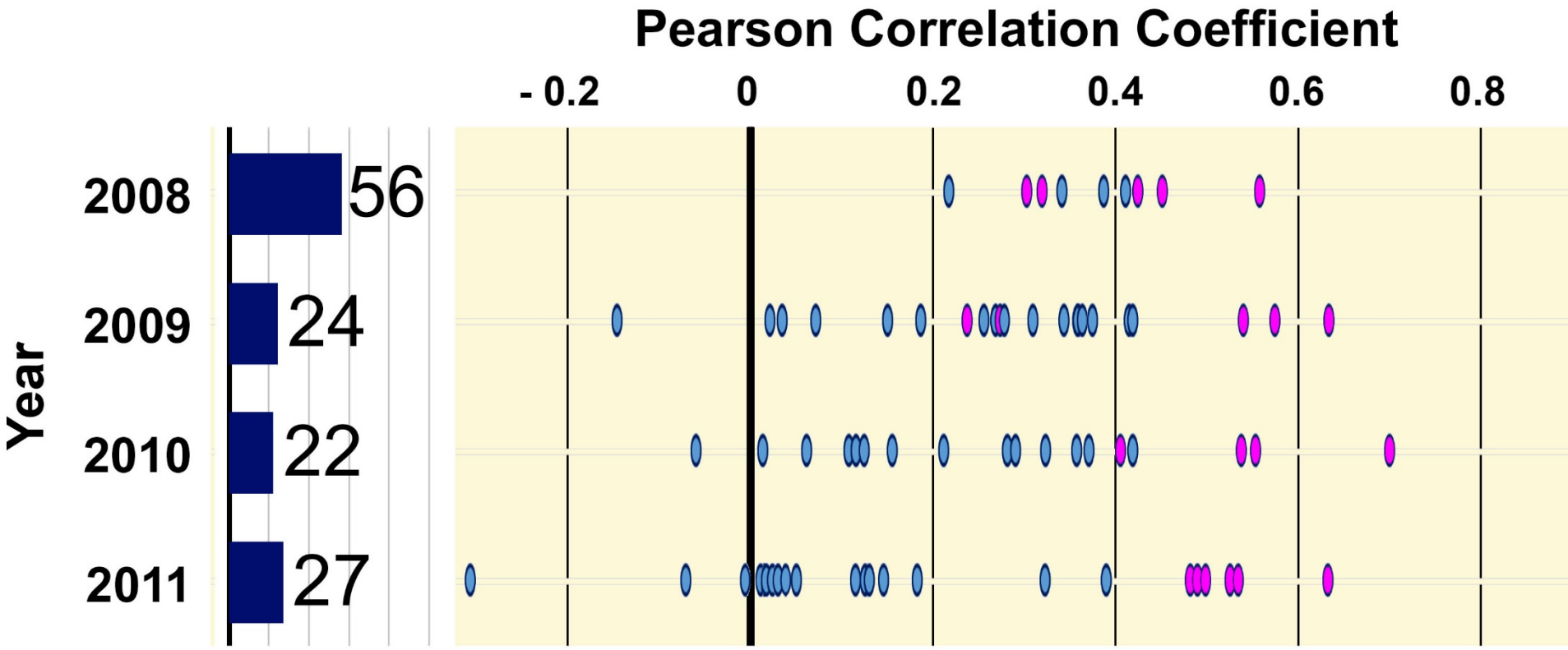
(2) inoculating each head twice (on different dates)

- Reduces bias from differences in susceptibility related to environmental conditions

2008-2011:

Before modified inoculation methods were implemented.

Multi-location nurseries conducted to screen sunflowers for resistance to Sclerotinia head rot produced highly variable results.

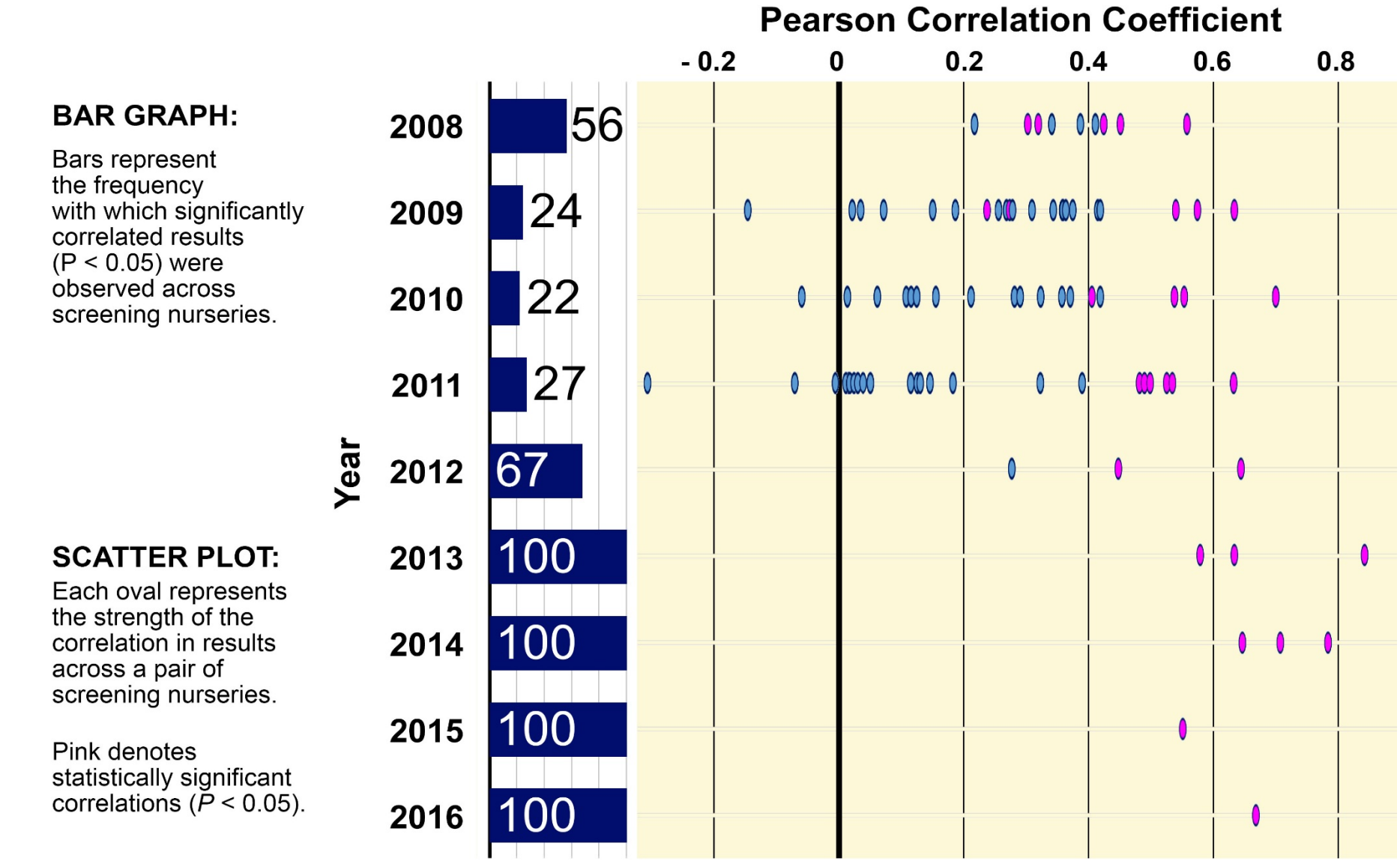


Bars ilustrate the frequency of observing significantly correlated results (*P*<0.05) **across screening nurseries.**

Each oval illustrates the strength of the correlation between trials in which the same hybrids were evaluated.

Pink denotes a statistically significant correlation ($P < 0.05$).

2012-2016:
The new inoculation procedures produced replicable results.



BAR GRAPH:

Bars represent the frequency with which significantly correlated results ($P < 0.05$) were observed across screening nurseries.

SCATTER PLOT:

Each oval represents the strength of the correlation in results across a pair of screening nurseries.

Pink denotes statistically significant correlations ($P < 0.05$).

Fungicide efficacy

Endura

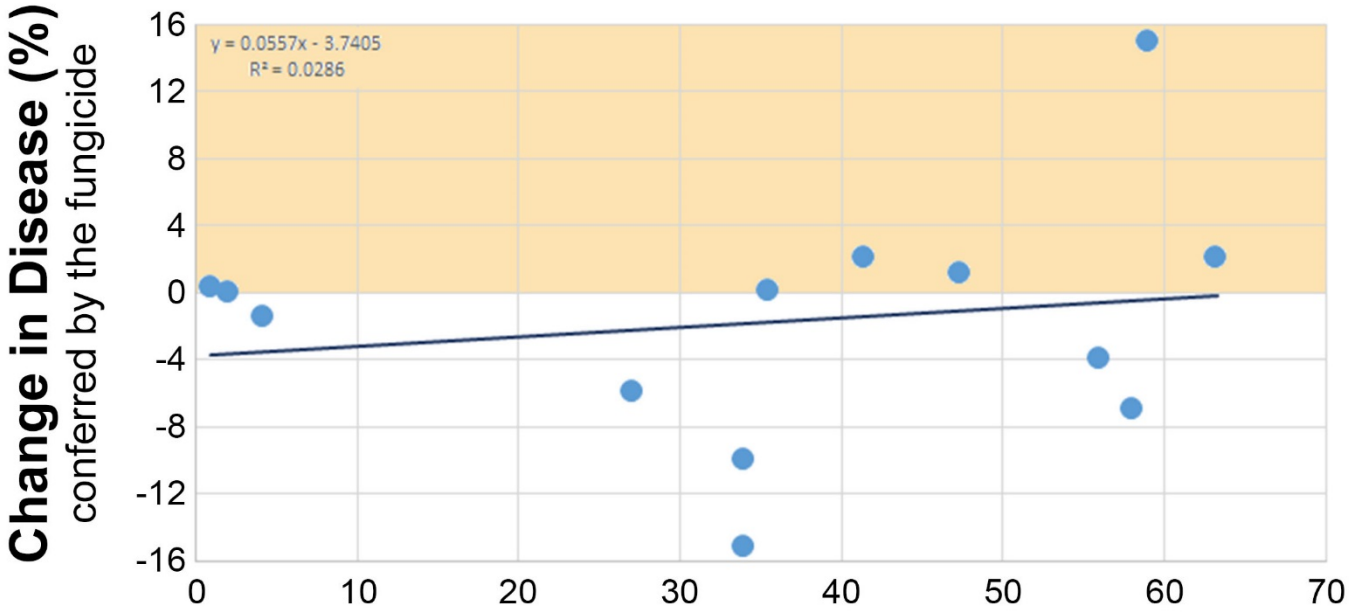
9 oz/ac

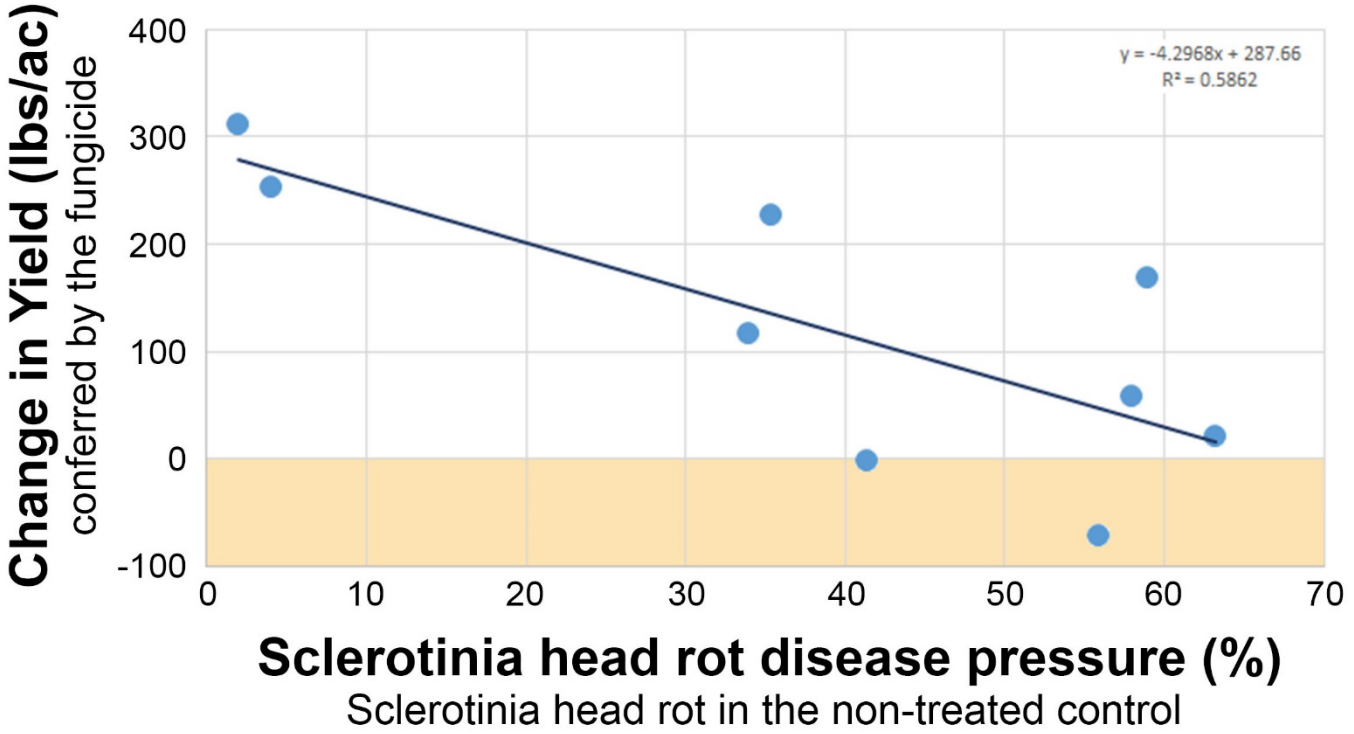
Study locations (years):
Carrington (2012, 2013, 2015)
Oakes (2013)
Langdon (2013)

Spray volume: 10, 15 or 20 gal/ac

Spray nozzles, pressure: flat-fan nozzles, fine to medium droplet size. XR8001, 35 psi; R8002, 30 psi; XR8004, 55 psi; or TT11001, 40 psi

Application method: tractor-mounted boom (11 studies), hand-boom (2 studies)





Fungicide efficacy

Proline

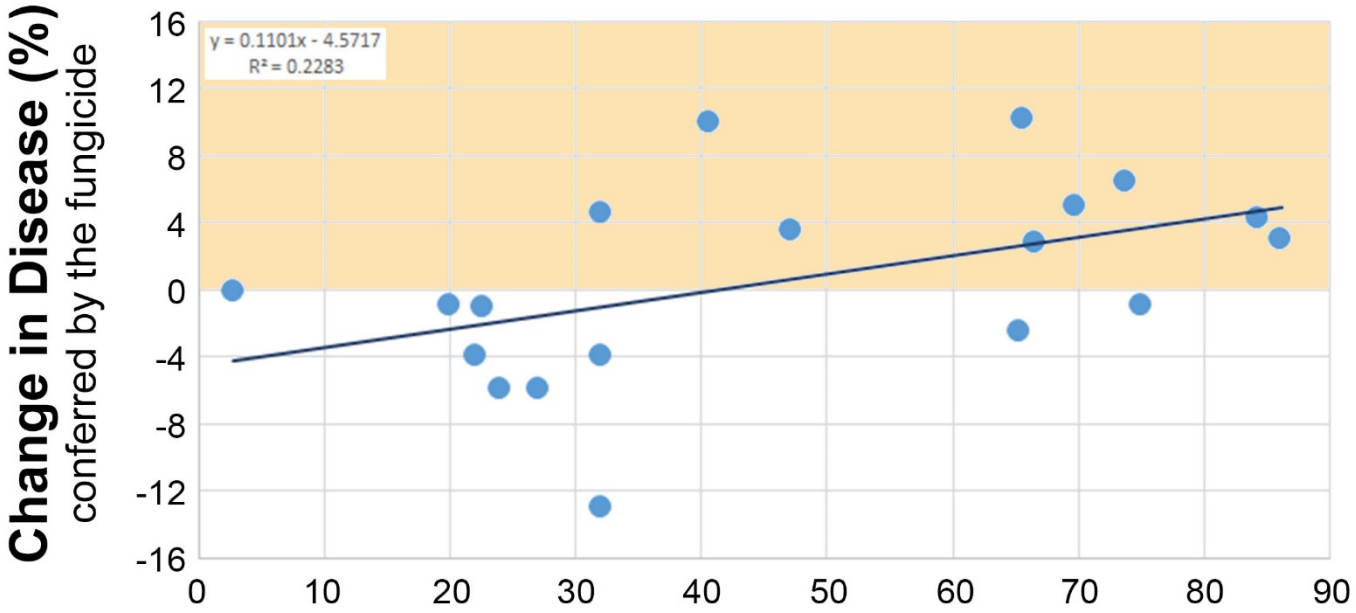
5.7 fl oz/ac

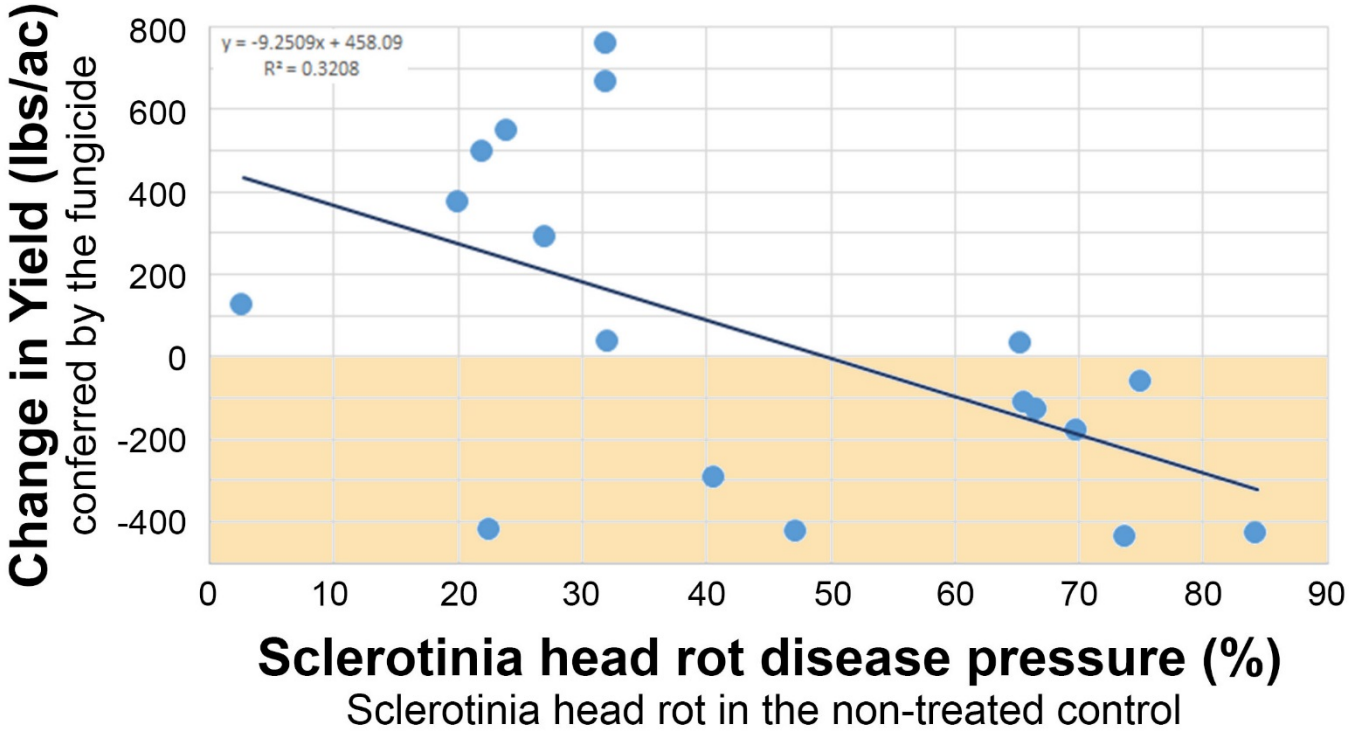
Study locations (years):
Carrington (2017, 2018)
Oakes (2017, 2018)

Spray volume: 15 gal/ac

Spray nozzles, pressure: flat-fan nozzles, very fine to fine droplet size. XR11001, 60 psi or XR11002, 40 psi

Application method: tractor-mounted boom (all studies)





Fungicide efficacy

Endura

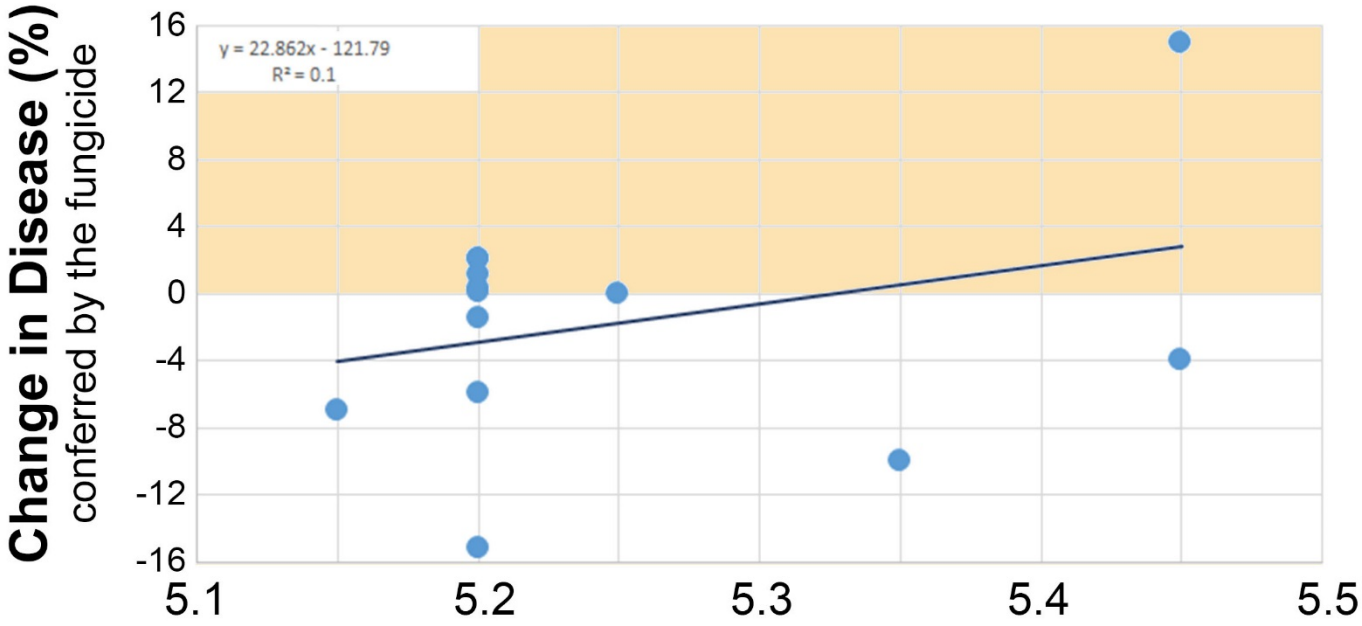
9 oz/ac

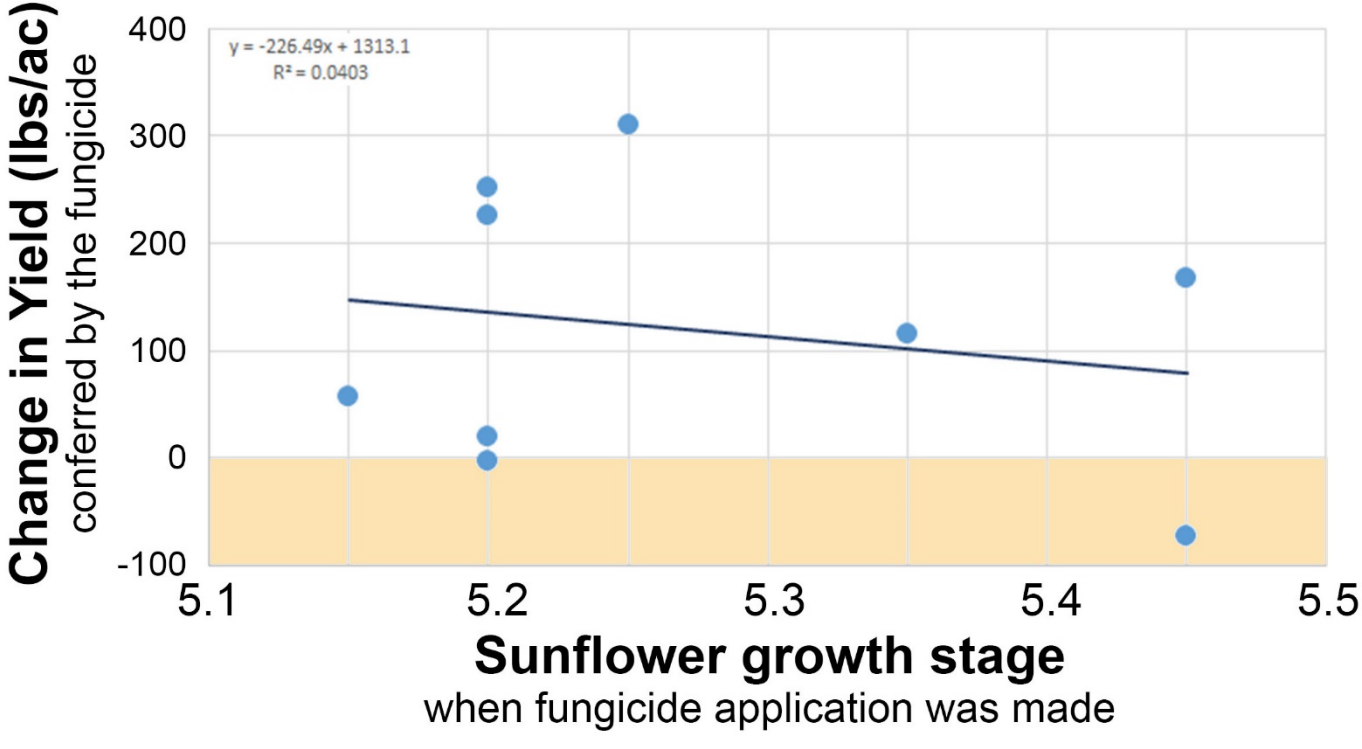
Study locations (years):
Carrington (2012, 2013, 2015)
Oakes (2013)
Langdon (2013)

Spray volume: 10, 15 or 20 gal/ac

Spray nozzles, pressure: flat-fan nozzles, fine to medium droplet size. XR8001, 35 psi; R8002, 30 psi; XR8004, 55 psi; or TT11001, 40 psi

Application method: tractor-mounted boom (11 studies), hand-boom (2 studies)





Fungicide efficacy

Proline

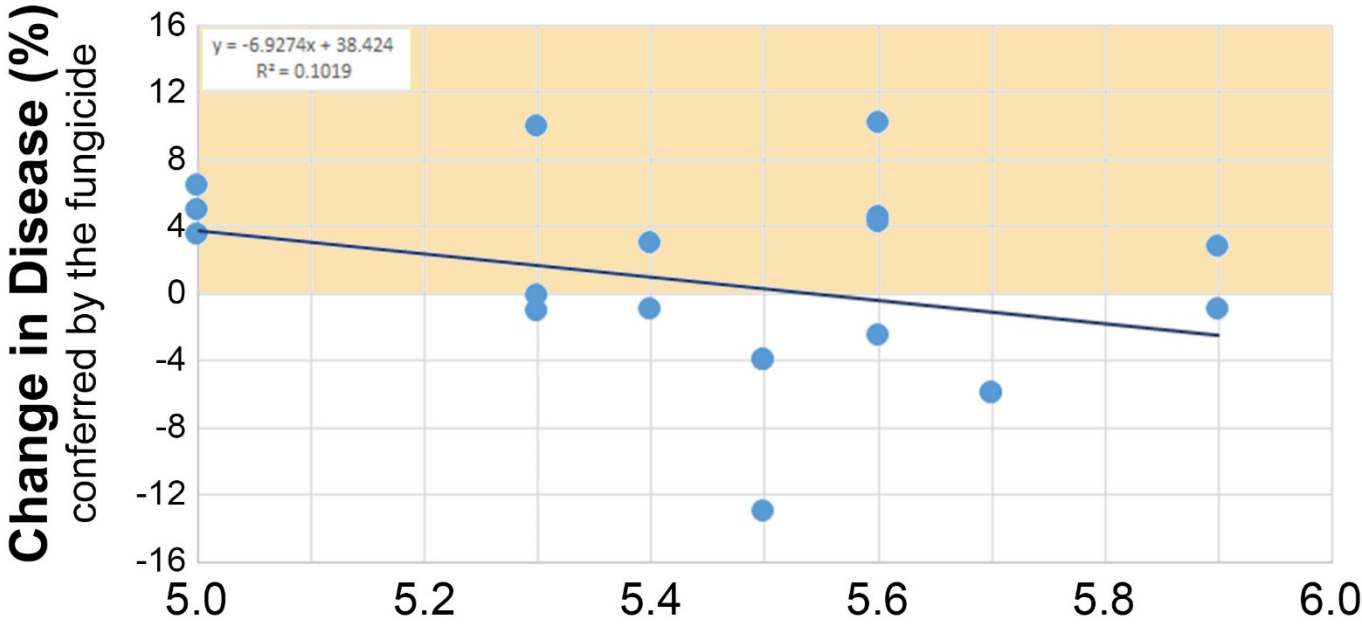
5.7 fl oz/ac

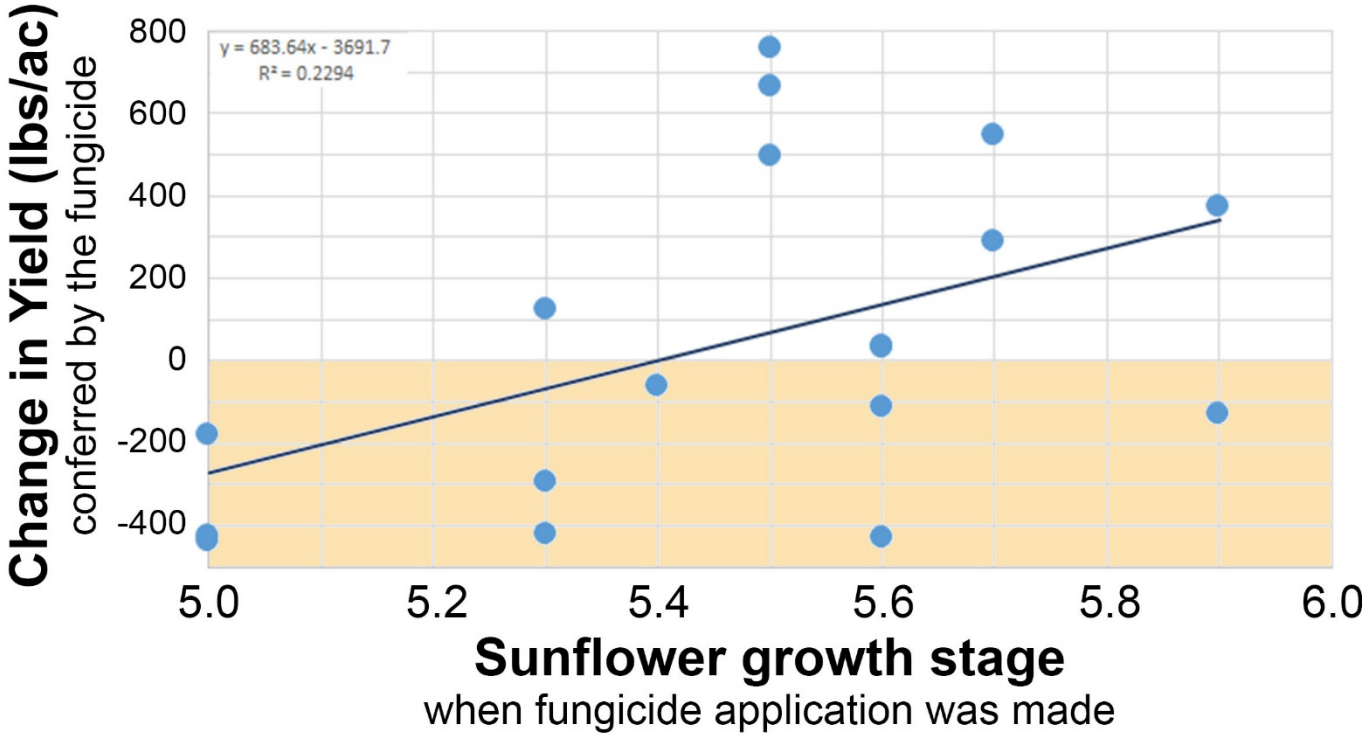
Study locations (years):
Carrington (2017, 2018)
Oakes (2017, 2018)

Spray volume: 15 gal/ac

Spray nozzles, pressure: flat-fan nozzles, very fine to fine droplet size. XR11001, 60 psi or XR11002, 40 psi

Application method: tractor-mounted boom (all studies)





Applying fungicides with drop nozzles

Managing Sclerotinia head rot with fungicides

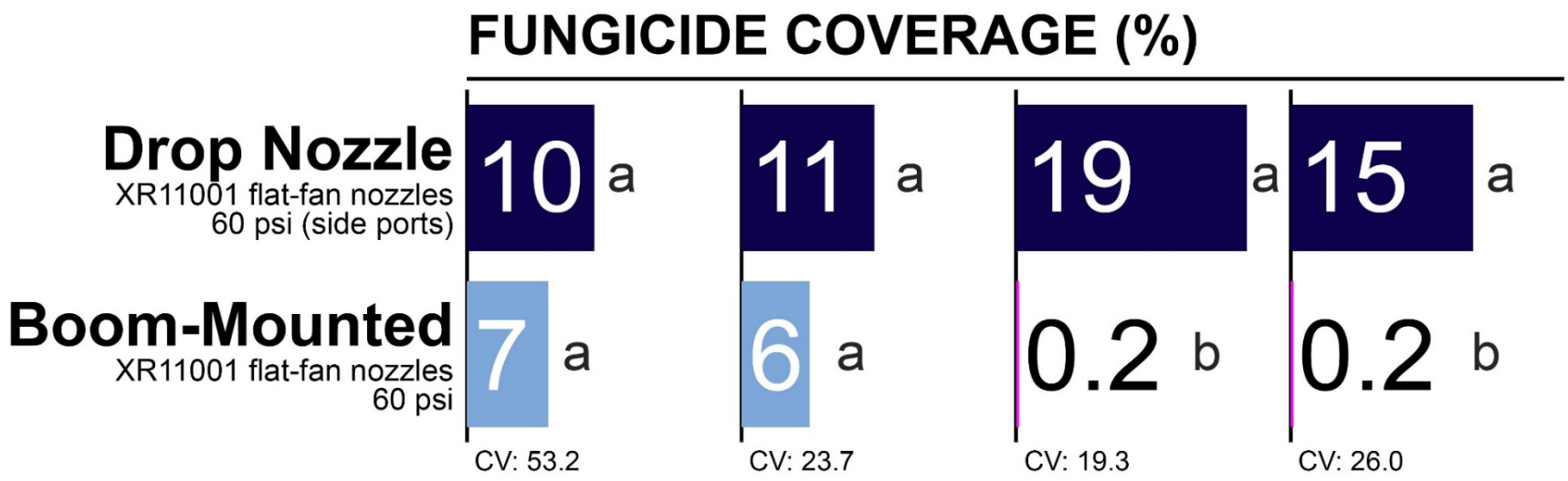
Fungicides applied with ‘360 Undercover’ drop nozzles
(360 Yield Center; Morton, IL)
equipped with 110˚ flat-fan nozzles on side ports

Fungicide application timing

Field trials conducted in 2018

Fungicide coverage relative to fungicide application method and sunflower growth stage

	Carrington 2018	Carrington 2018	Oakes 2018	Carrington 2018
Plants with open disk flowers:	**43%**	**79%**	**95%**	**100%**
Average growth stage:	**R5.0**	**R5.3**	**R5.6**	**R5.9**
Range of growth stages:	R4-R5.4	R4-R5.8	R4-R5.9	R5.1-R6.0



Fungicide efficacy – drop nozzles

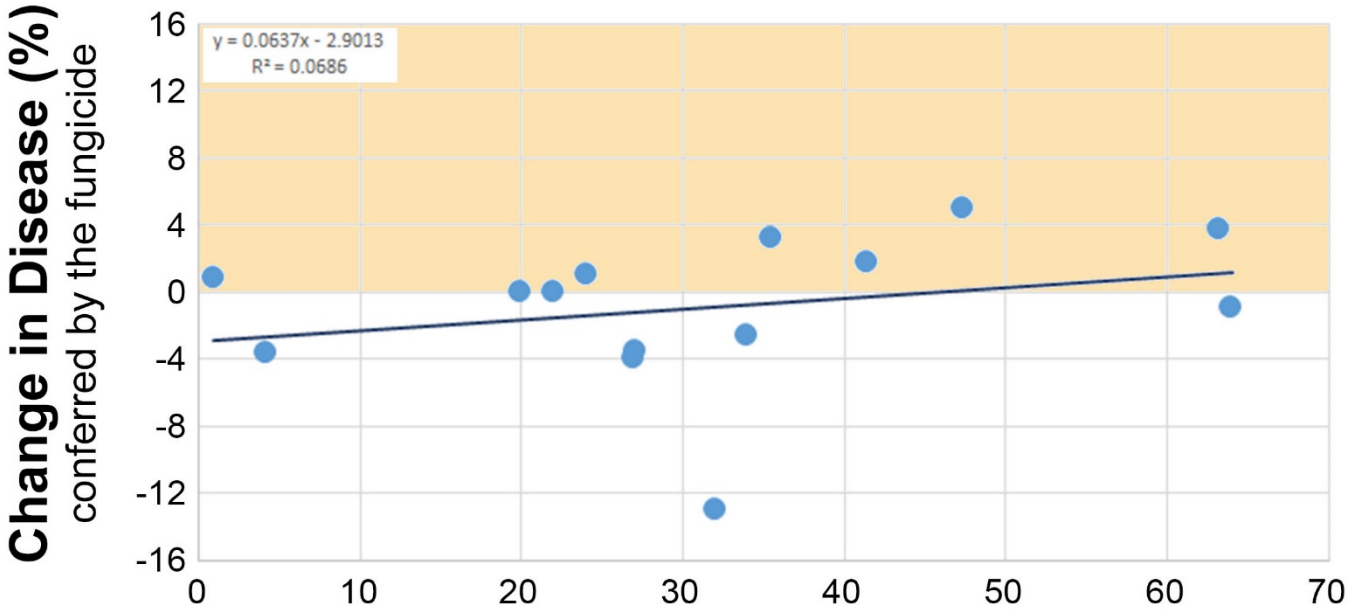
Endura
9 oz/ac

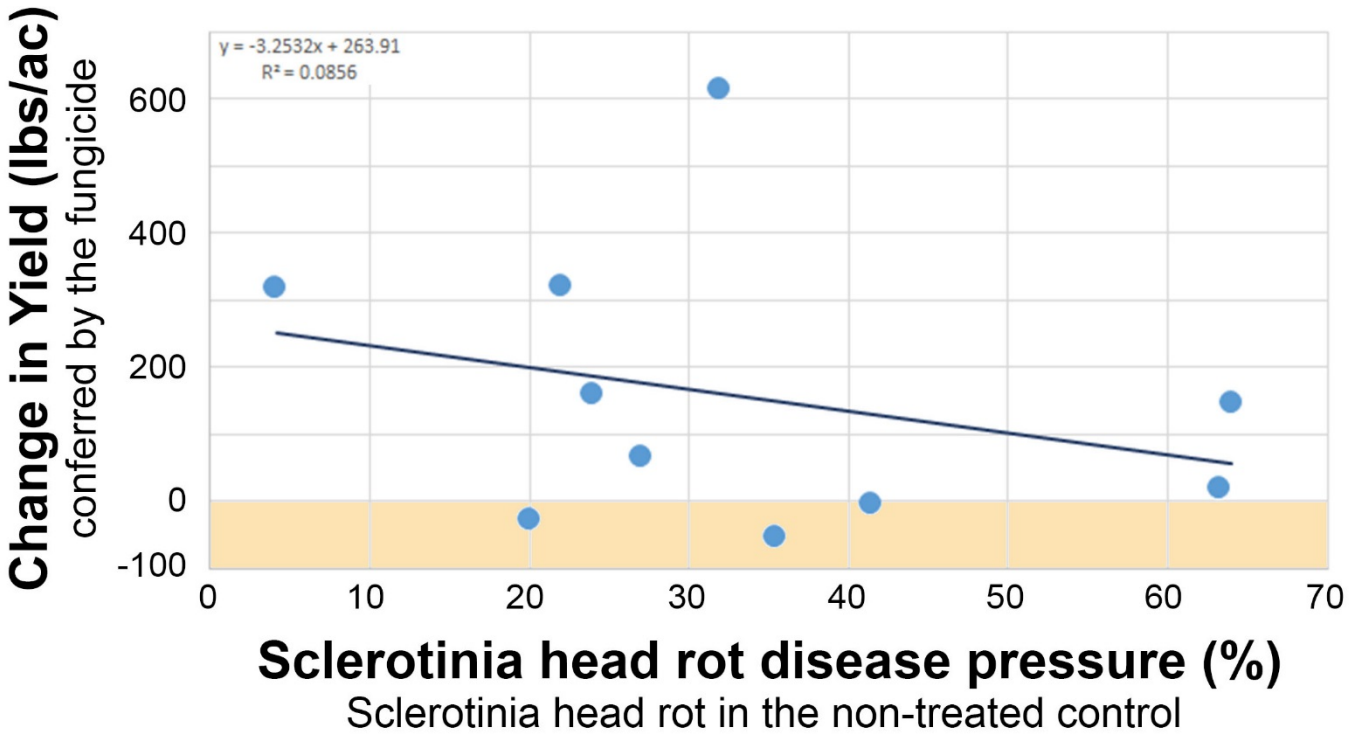
Study locations (years):
Carrington (2015, 2017)
Oakes (2017)

Spray volume: 15 gal/ac

Spray nozzles, pressure: flat-fan nozzles on side ports, fine droplet size.
XR11001, 40 psi
XR11002, 40 psi

Application method: tractor-mounted boom equipped with '360 Undercover' drop nozzles





Fungicide efficacy – drop nozzles

Proline

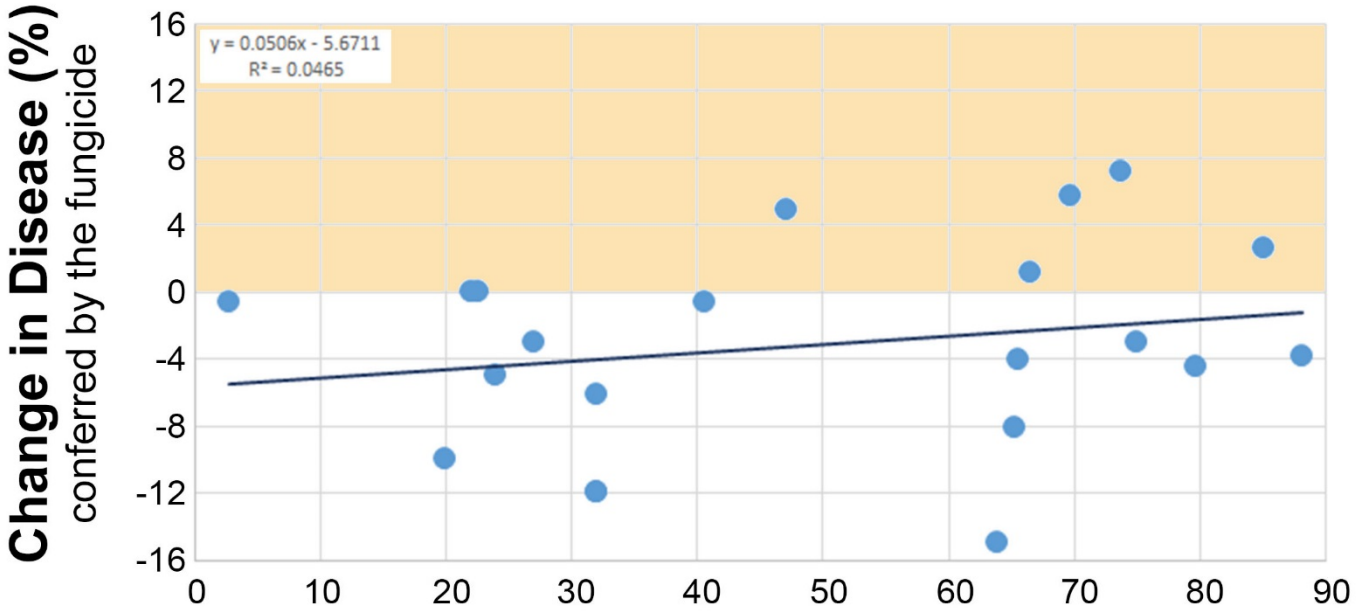
5.7 fl oz/ac

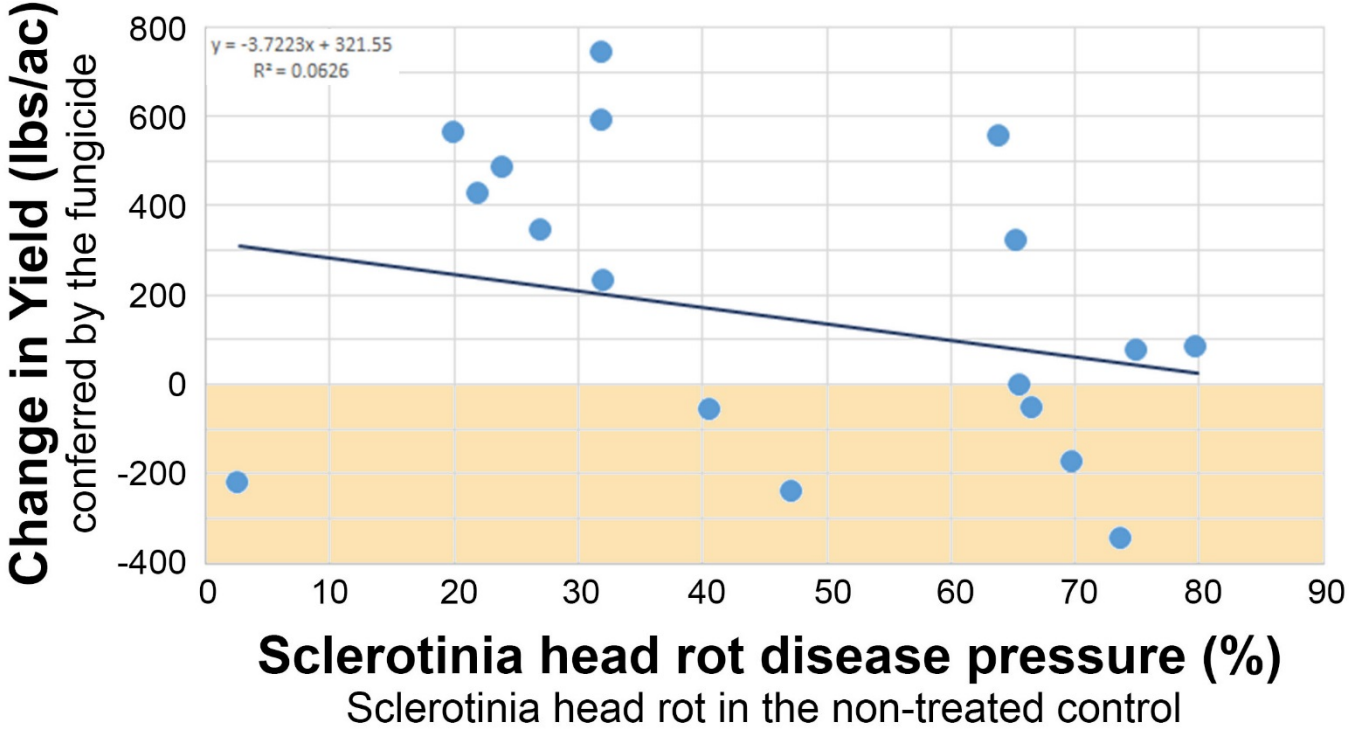
Study locations (years):
Carrington (2017, 2018)
Oakes (2017, 2018)

Spray volume: 15 gal/ac

Spray nozzles, pressure: flat-fan nozzles on side ports, fine or very fine droplet size.
XR11001, 60 psi or XR11002, 40 psi

Application method: tractor-mounted boom equipped with '360 Undercover' drop nozzles





Thank you!

This research was funded by grants from:

- USDA Specialty Crops Block Grant Program administered by the ND Department of Agriculture
- The National Sunflower Association
- USDA National Sclerotinia Initiative
- North Dakota Crop Protection Product Harmonization Board and Registration Board

National Sunflower Association

SPECIALTY CROP BLOCK GRANT PROGRAM

North Dakota Department of Agriculture