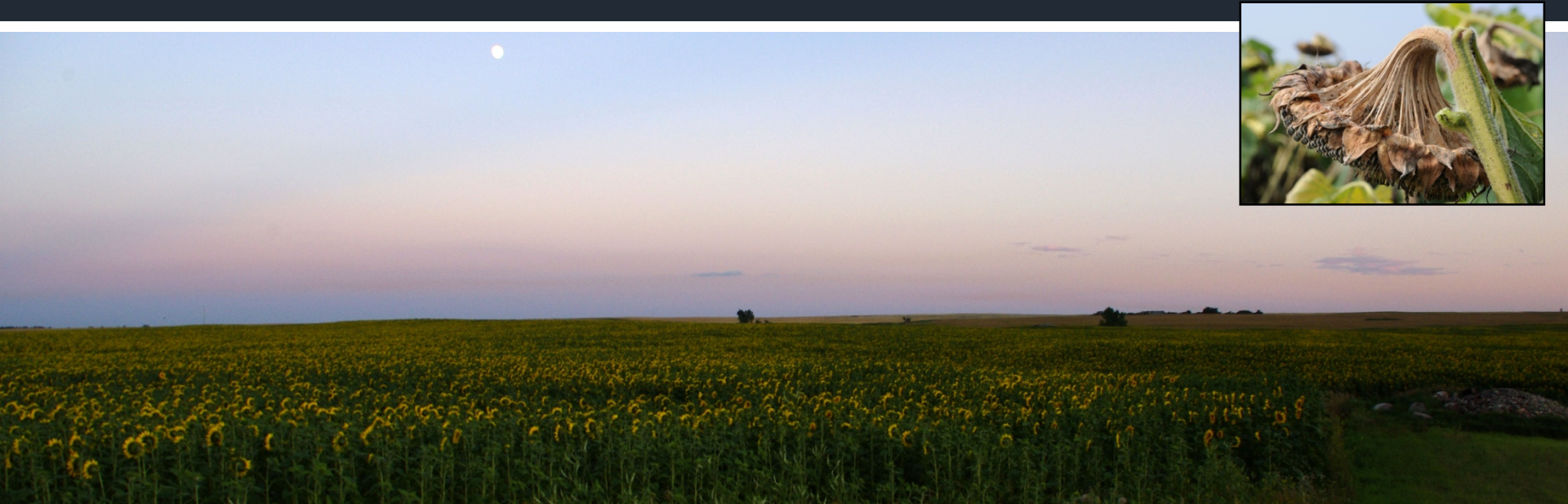


Challenges managing Sclerotinia head rot of sunflowers with partially resistant hybrids and with fungicides



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Susceptibility of oilseed hybrids to Sclerotinia head rot

Carrington, ND (2015)

Sclerotinia Head Rot

R9 growth stage
% incidence

Sclerotia in Grain

uncleaned grain
% by weight

Yield

10% moisture
pounds/acre

Croplan 432 E	18	ab	0.7	a	1965	a
NuTech 69M2	35	a-f	3.3	abc	1916	a
NuSeed Camaro II	37	a-f	4.6	abc	1819	ab
SunOpta 15S20E	12	a	1.6	abc	1782	abc
Croplan 343 DMR HO	25	abc	3.4	abc	1746	a-d
Croplan 553 CL HO	28	a-d	4.0	abc	1733	a-d
ProSeed E1402 CL	23	abc	0.9	ab	1730	a-d
NuSeed EXP8962	24	abc	2.1	abc	1665	a-e
Pioneer 63HE60	34	a-f	2.0	abc	1649	a-e
Thunder 11N94	41	a-g	4.9	abc	1645	a-e
ProSeed E85 CL	31	a-e	5.6	abc	1633	a-e
NuTech 68H7	25	bac	0.9	ab	1620	a-f
Mycogen MY82427	28	a-d	3.4	abc	1563	a-f
SunOpta 1628E	55	d-h	5.7	abc	1554	a-f
Croplan 545 CL	21	ab	0.6	abc	1545	a-f
Croplan 549 CL	52	c-h	4.9	abc	1518	a-f
Syngenta 7111 HO CL DM	34	a-f	1.2	ab	1454	a-f
ProSeed E21 CL	28	a-d	1.2	ab	1429	a-f
Croplan 458 E HO	44	b-g	7.6	bc	1412	a-f
Syngenta SY7717	35	a-f	2.3	abc	1383	a-f
ProSeed E31 CL	21	ab	1.1	ab	1351	a-f
Thunder 44H94	56	d-h	6.6	abc	1314	a-f
Mycogen MY8H456CL	39	a-f	3.8	abc	1261	a-g
Syngenta 3845 HO	75	h	6.9	abc	1138	a-h
NuSeed EXP6561	62	fgh	6.1	abc	1111	a-h
Mycogen MY411280	55	d-h	6.8	abc	989	b-h
Thunder 35H92	58	e-h	4.8	abc	927	c-h
Mycogen MY324820	69	gh	6.8	abc	899	d-h
Syngenta 3495 NS CL DM	63	fgh	7.1	abc	844	e-h
SunOpta 4311E	69	gh	7.9	c	754	fgh
Mycogen V358 CL DM	77	h	6.8	abc	448	gh
Croplan 305 DMR NS	79	h	3.5	abc	378	h

P>F: < 0.0001
CV: 25.0

P>F: < 0.0001
CV: 59.7

P>F: < 0.0001
CV: 22.9

Yellow background = commercial hybrid

White background = experimental hybrid

Susceptibility of oilseed hybrids to Sclerotinia head rot

Carrington, ND (2016)

Sclerotinia Head Rot

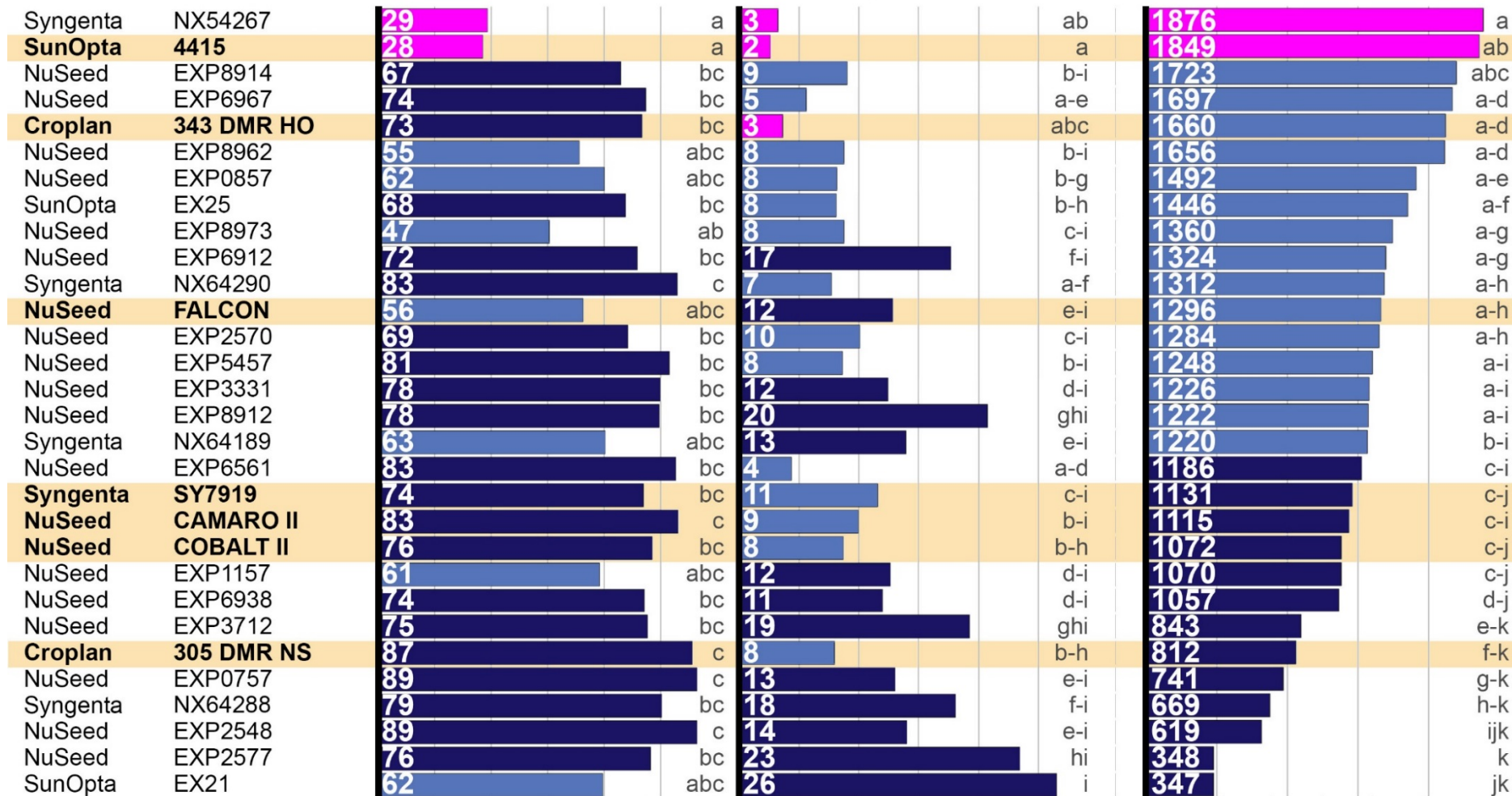
R9 growth stage
% incidence

Sclerotia in Grain

uncleaned grain
% by weight

Yield

10% moisture
pounds/acre



P>F: < 0.0001
CV: 18.9

P>F: < 0.0001
CV: 18.7

P>F: < 0.0001
CV: 19.8

Yellow background = commercial hybrid

White background = experimental hybrid

Susceptibility of oilseed hybrids to Sclerotinia head rot

Carrington, ND (2014)

Sclerotinia Head Rot

R9 growth stage
% incidence

Sclerotia in Grain

uncleaned grain
% by weight

Yield

10% moisture
pounds/acre

Hybrid	Sclerotinia Head Rot (% incidence)	Sclerotia in Grain (% by weight)	Yield (pounds/acre)
Syngenta NX34240	4 (a)	0.9 (ab)	2505 (a)
Croplan 343 DRM HO	7 (a)	0.6 (ab)	2140 (ab)
NuSeed NSK12016	16 (a)	1.0 (ab)	1847 (abc)
NuSeed NSK12015	28 (ab)	1.1 (ab)	1776 (abc)
Mycogen 915321	27 (ab)	2.7 (abc)	1552 (bc)
Syngenta 7717 HO/CL/DM	21 (ab)	1.7 (ab)	1513 (bc)
Mycogen 416321	25 (ab)	2.3 (abc)	1279 (cd)
NuSeed NHKE30489D	22 (ab)	0.5 (a)	1177 (cd)
Mycogen 101321	22 (ab)	1.4 (ab)	1060 (cd)
Croplan 305 DMR NS	52 (b)	6.4 (c)	1041 (cd)
NuSeed NSK12014	44 (b)	3.8 (bc)	737 (d)

$P > F: < 0.0001$
CV: 20.9

$P > F: 0.0002$
CV: 46.0

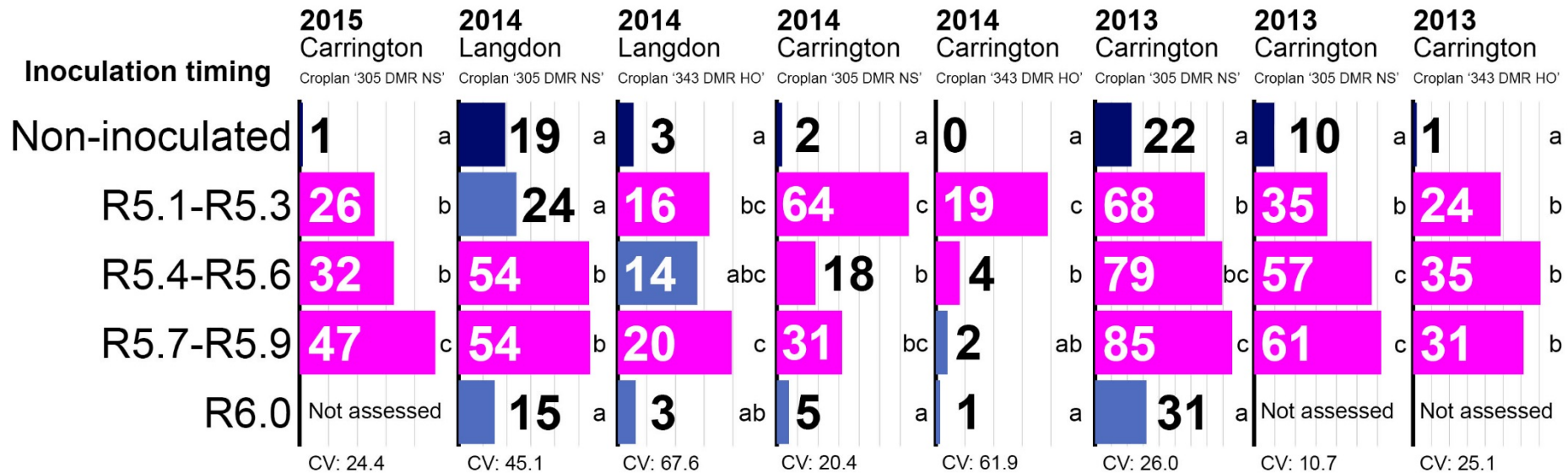
$P > F: < 0.0001$
CV: 20.1

Yellow background = commercial hybrid

White background = experimental hybrid

Susceptibility to Sclerotinia head rot relative to sunflower growth stage

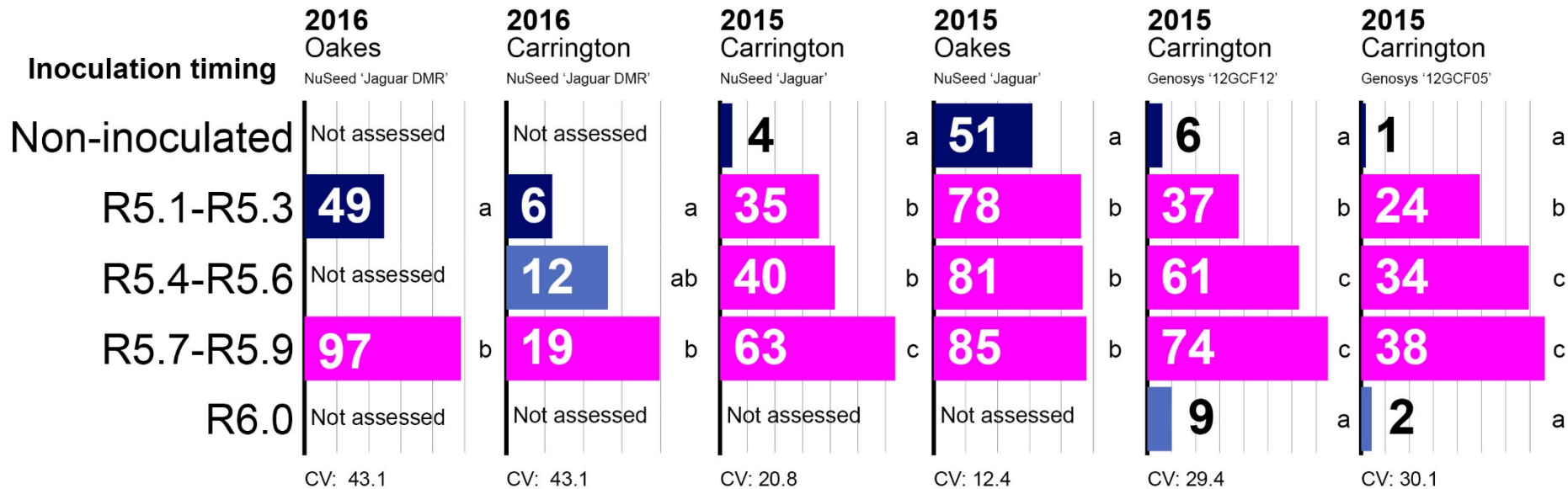
Oilseed sunflowers:



- 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

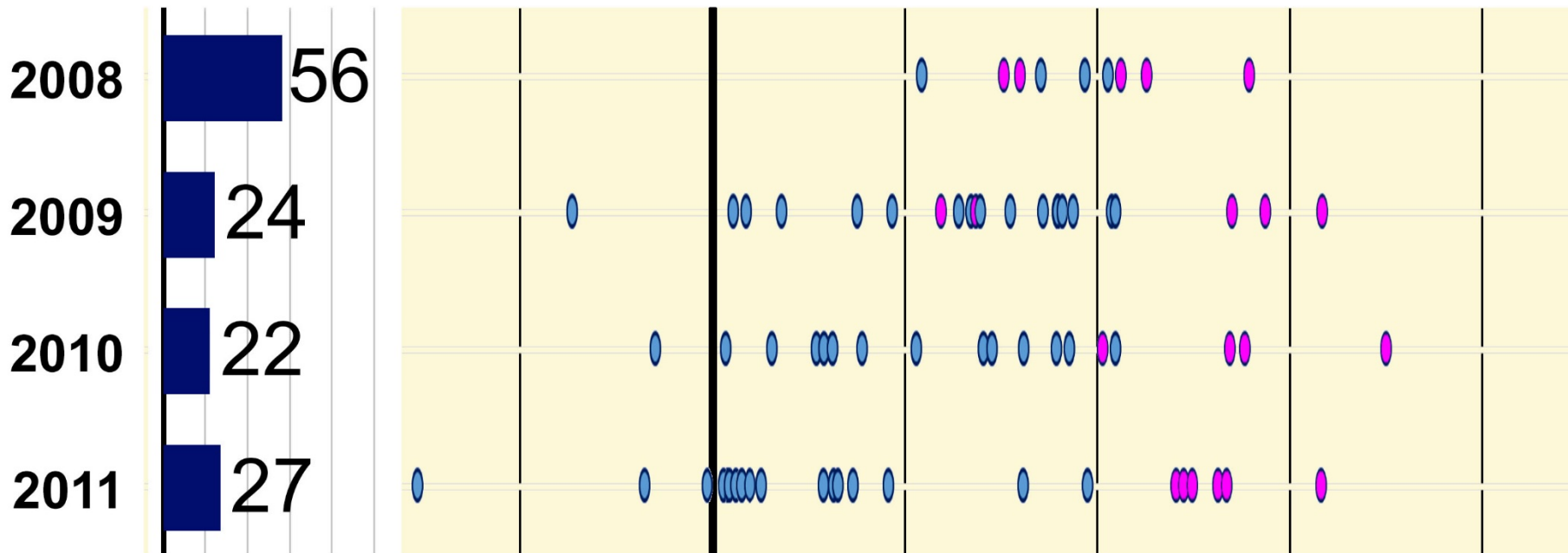
2008-2011:

Before modified inoculation methods were implemented.

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

Pearson Correlation Coefficient

- 0.2 0 0.2 0.4 0.6 0.8



Bars illustrate 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.

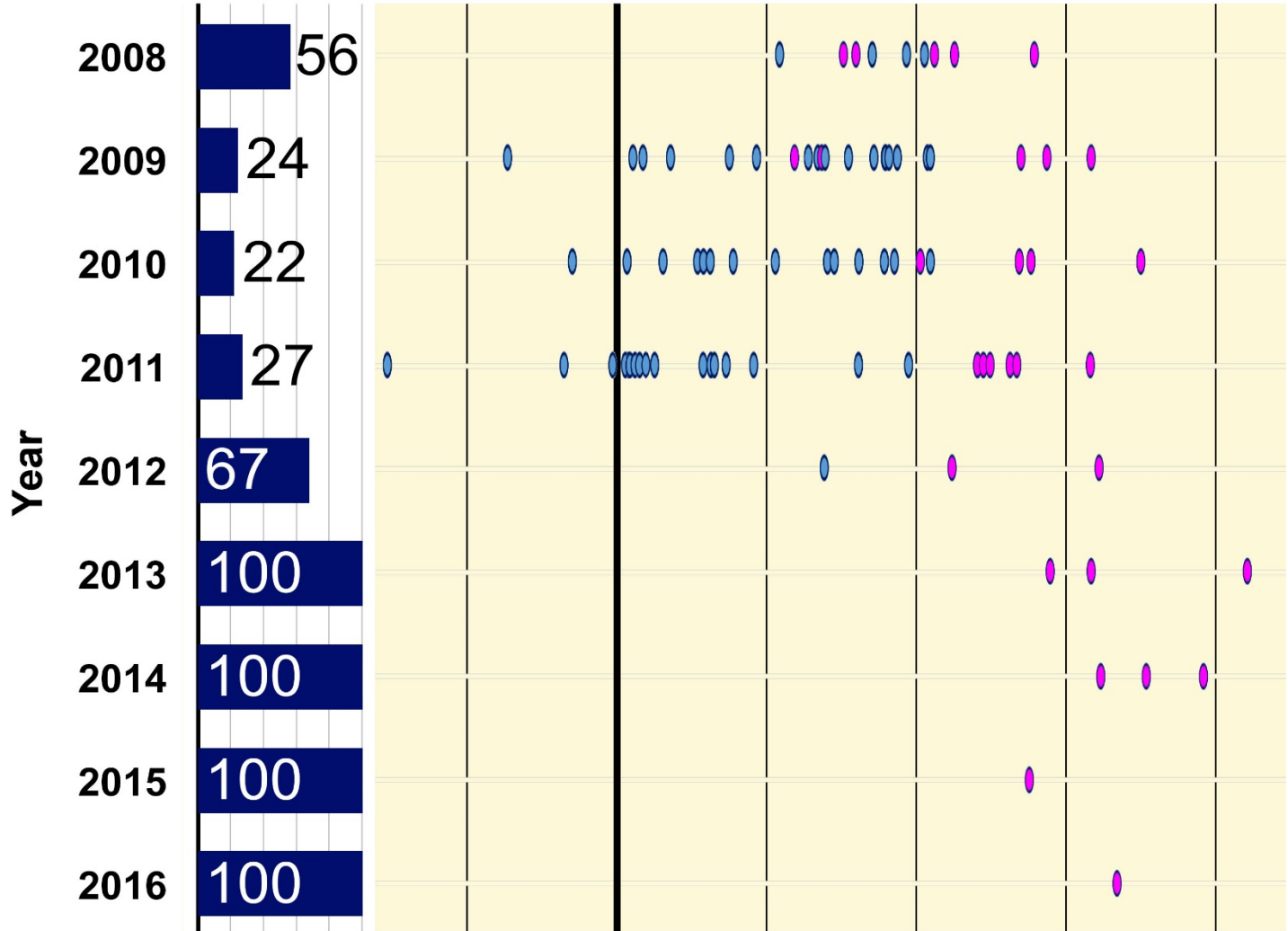
Pink denotes a statistically significant correlation ($P < 0.05$).

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.



Fungicide efficacy

Endura
9 oz/ac



Study locations (years):

Carrington (2012, 2013, 2015)

Oakes (2013)

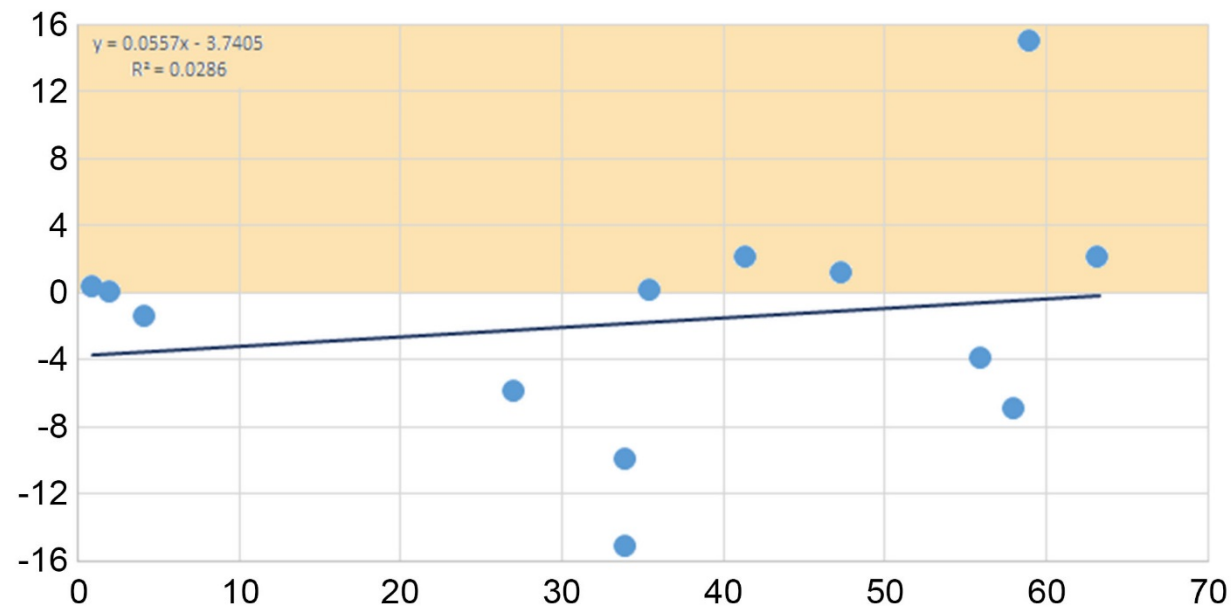
Langdon (2013)

Spray volume: 10, 15 or 20 gal/ac

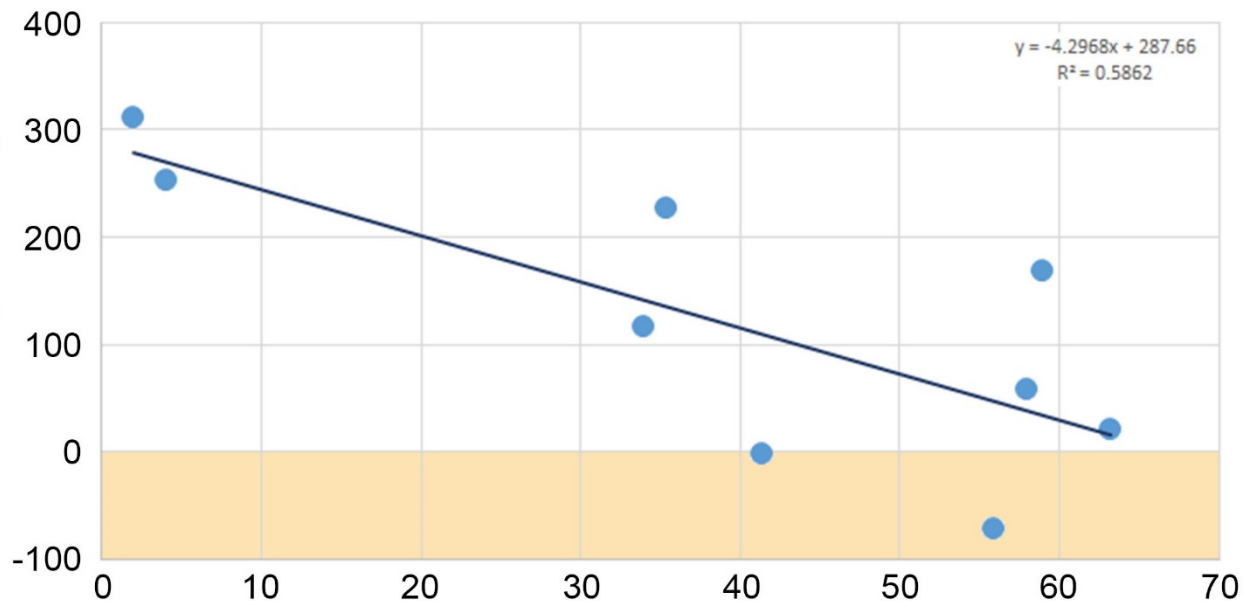
Spray nozzles, pressure: flat-fan nozzles, fine to medium droplet size. XR8001, 35 psi; R8002, 30 psi; XR8004, 55 psi; or TT11001, 40 psi

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

Change in Disease (%)
conferred by the fungicide



Change in Yield (lbs/ac)
conferred by the fungicide



Sclerotinia head rot disease pressure (%)
Sclerotinia head rot in the non-treated control

Fungicide efficacy

Proline

5.7 fl oz/ac



Study locations (years):

Carrington (2017, 2018)

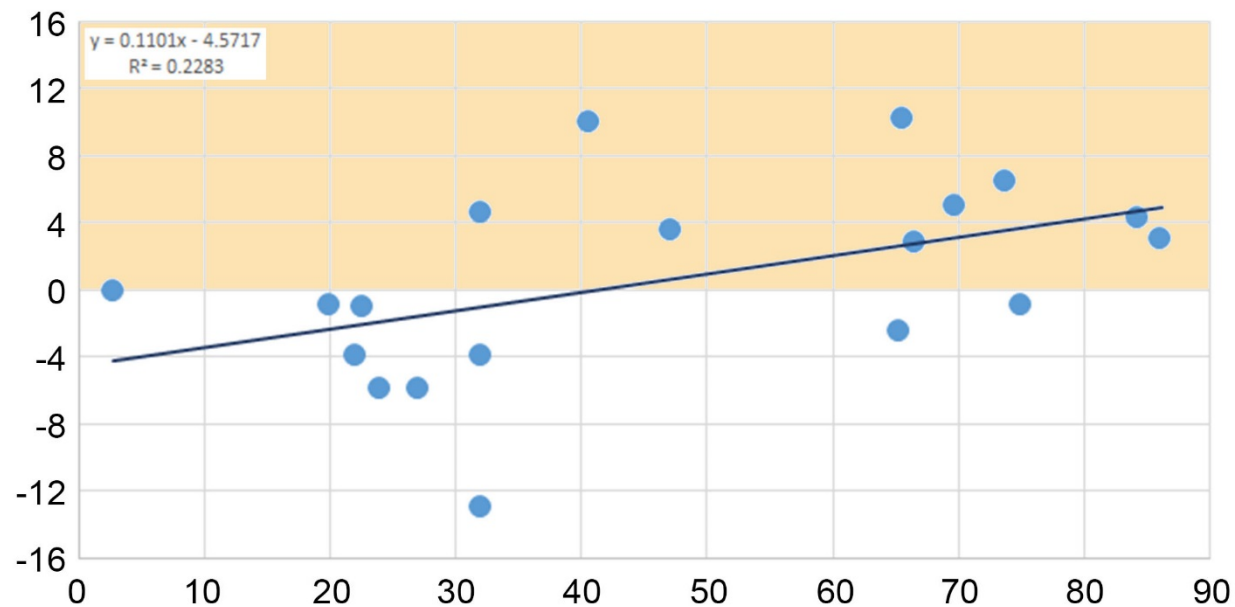
Oakes (2017, 2018)

Spray volume: 15 gal/ac

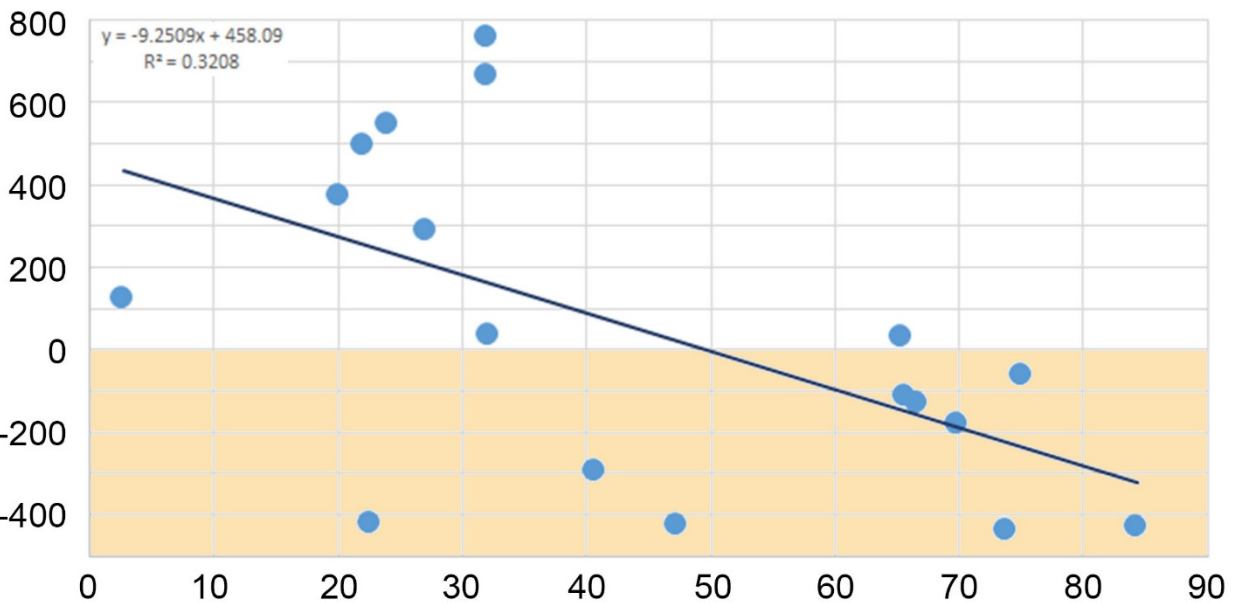
Spray nozzles, pressure: flat-fan nozzles, very fine to fine droplet size. XR11001, 60 psi or XR11002, 40 psi

Application method: tractor-mounted boom (all studies)

Change in Disease (%)
conferred by the fungicide



Change in Yield (lbs/ac)
conferred by the fungicide



Sclerotinia head rot disease pressure (%)
Sclerotinia head rot in the non-treated control

Fungicide efficacy

Endura
9 oz/ac



Study locations (years):

Carrington (2012, 2013, 2015)

Oakes (2013)

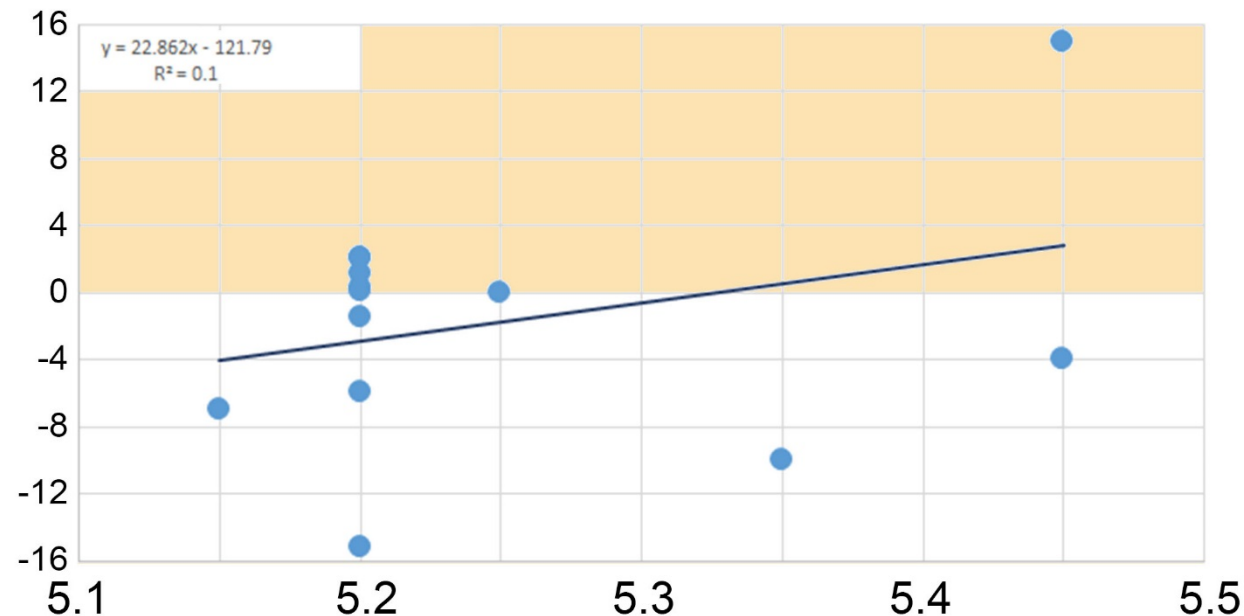
Langdon (2013)

Spray volume: 10, 15 or 20 gal/ac

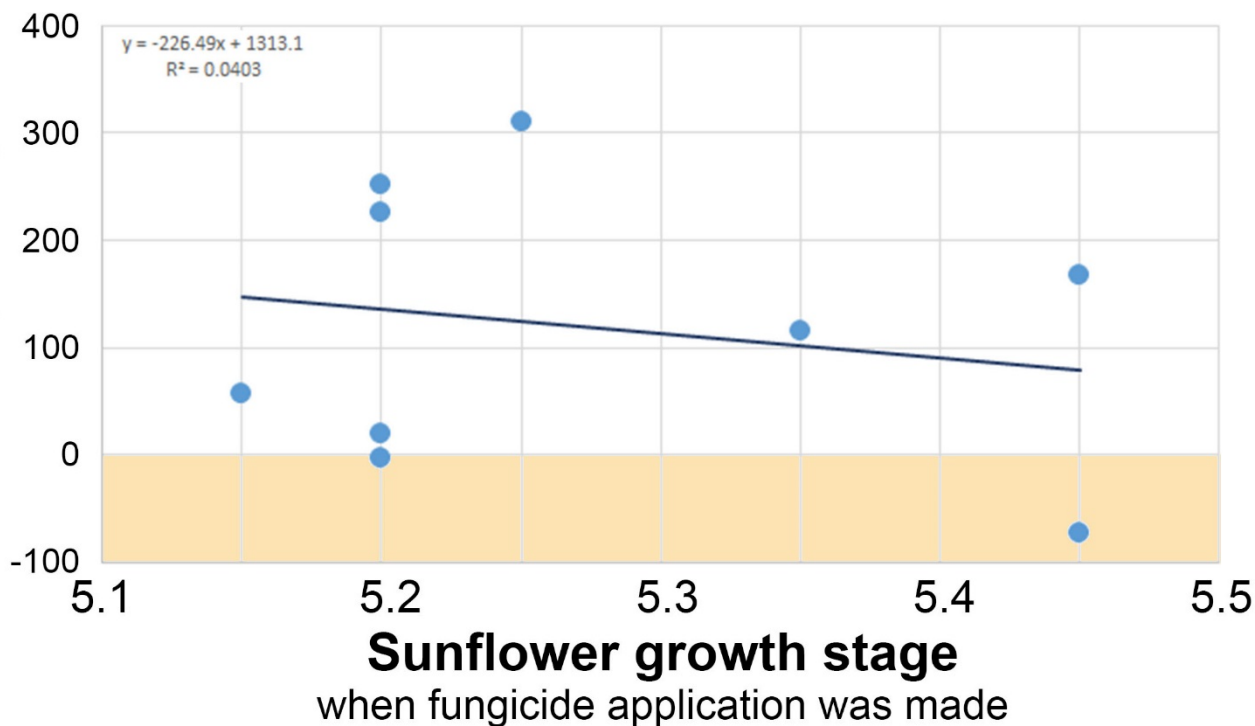
Spray nozzles, pressure: flat-fan nozzles, fine to medium droplet size. XR8001, 35 psi; R8002, 30 psi; XR8004, 55 psi; or TT11001, 40 psi

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Change in Yield (lbs/ac)
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Fungicide efficacy

Proline

5.7 fl oz/ac



Study locations (years):

Carrington (2017, 2018)

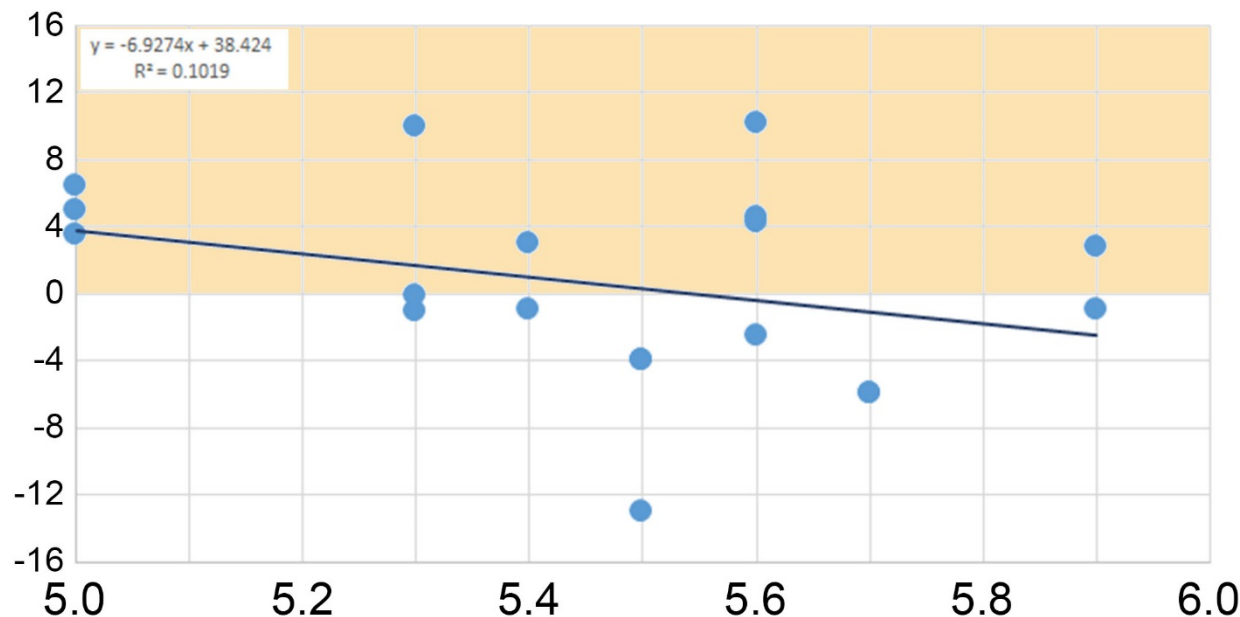
Oakes (2017, 2018)

Spray volume: 15 gal/ac

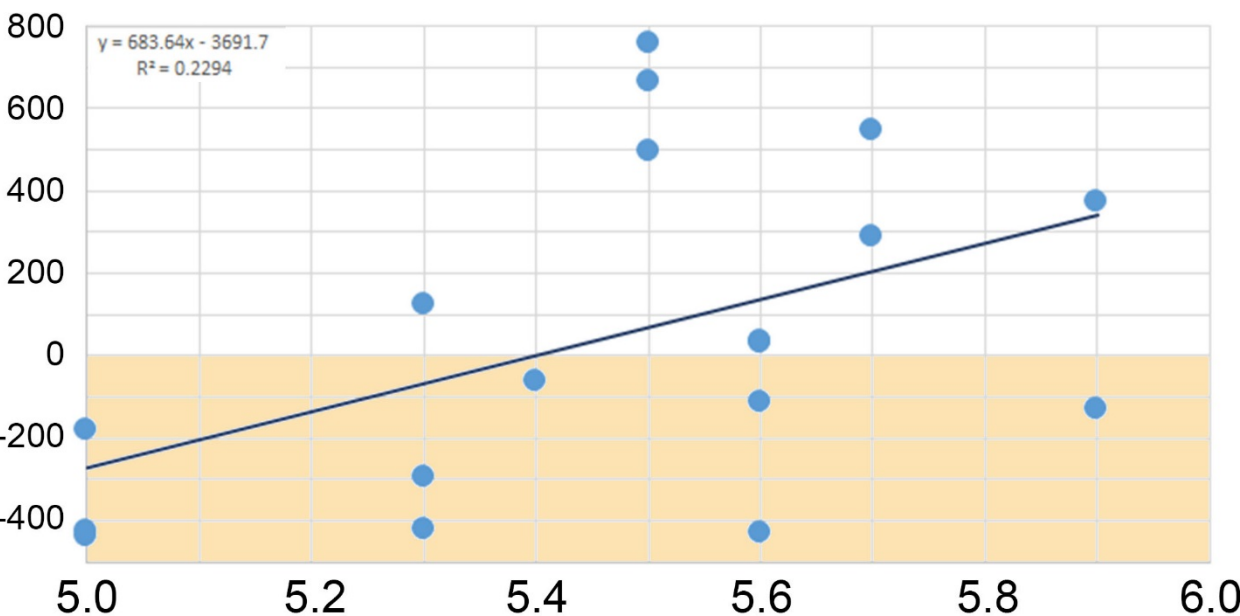
Spray nozzles, pressure: flat-fan nozzles, very fine to fine droplet size. XR11001, 60 psi or XR11002, 40 psi

Application method: tractor-mounted boom (all studies)

Change in Disease (%)
conferred by the fungicide



Change in Yield (lbs/ac)
conferred by the fungicide



Sunflower growth stage
when fungicide application was made

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



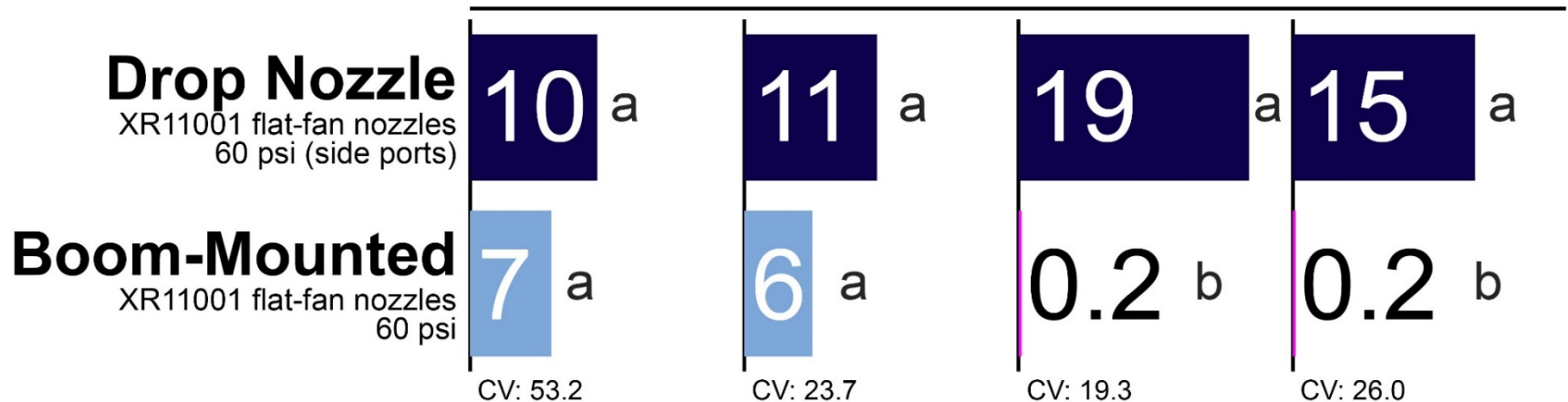
Fungicide application timing

Field trials conducted in 2018

Fungicide coverage relative to fungicide application method and sunflower growth stage

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

FUNGICIDE COVERAGE (%)



Fungicide efficacy – drop nozzles

Endura
9 oz/ac



Study locations (years):

Carrington (2015, 2017)

Oakes (2017)

Spray volume: 15 gal/ac

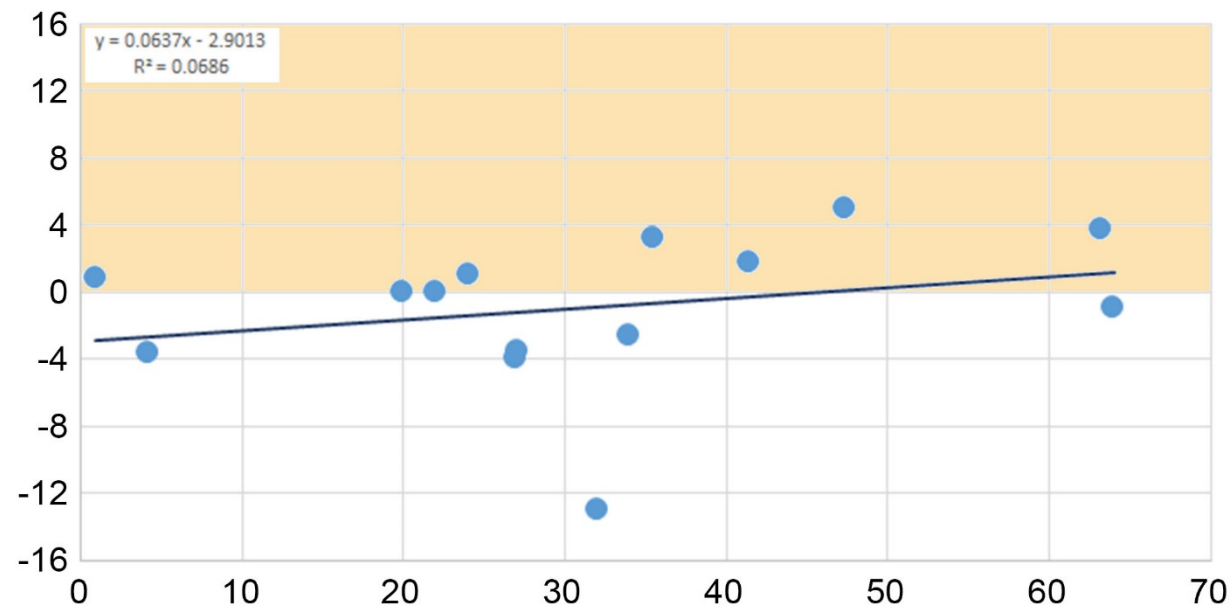
Spray nozzles, pressure: flat-fan nozzles on side ports, fine droplet size.

XR11001, 40 psi

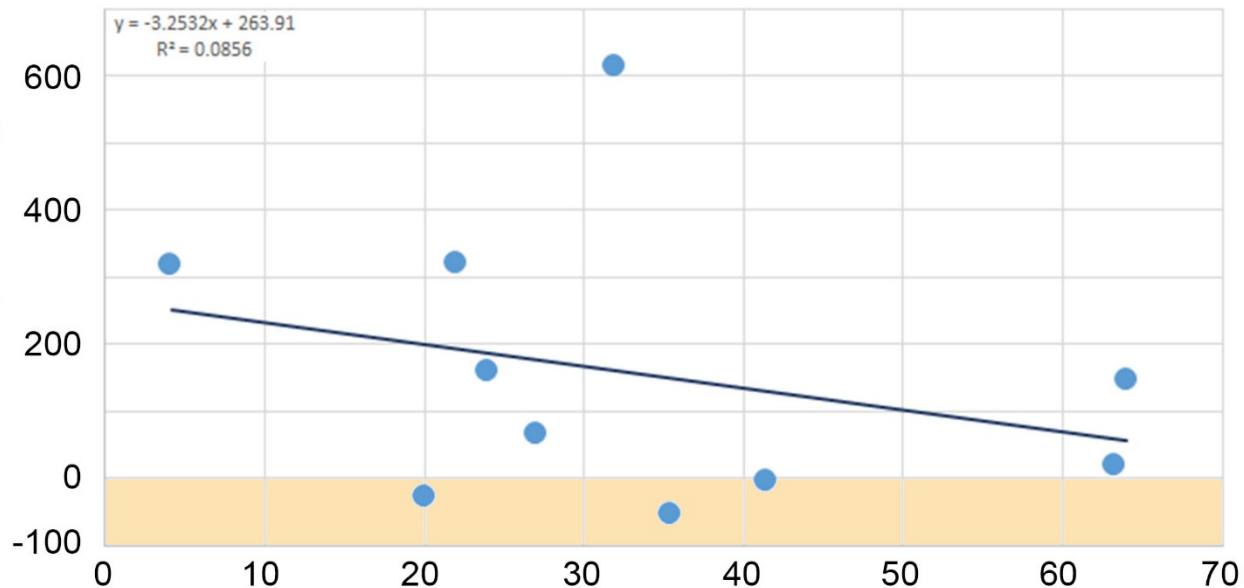
XR11002, 40 psi

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

Change in Disease (%)
conferred by the fungicide



Change in Yield (lbs/ac)
conferred by the fungicide



Sclerotinia head rot disease pressure (%)
Sclerotinia head rot in the non-treated control

Fungicide efficacy – drop nozzles

Proline
5.7 fl oz/ac



Study locations (years):

Carrington (2017, 2018)

Oakes (2017, 2018)

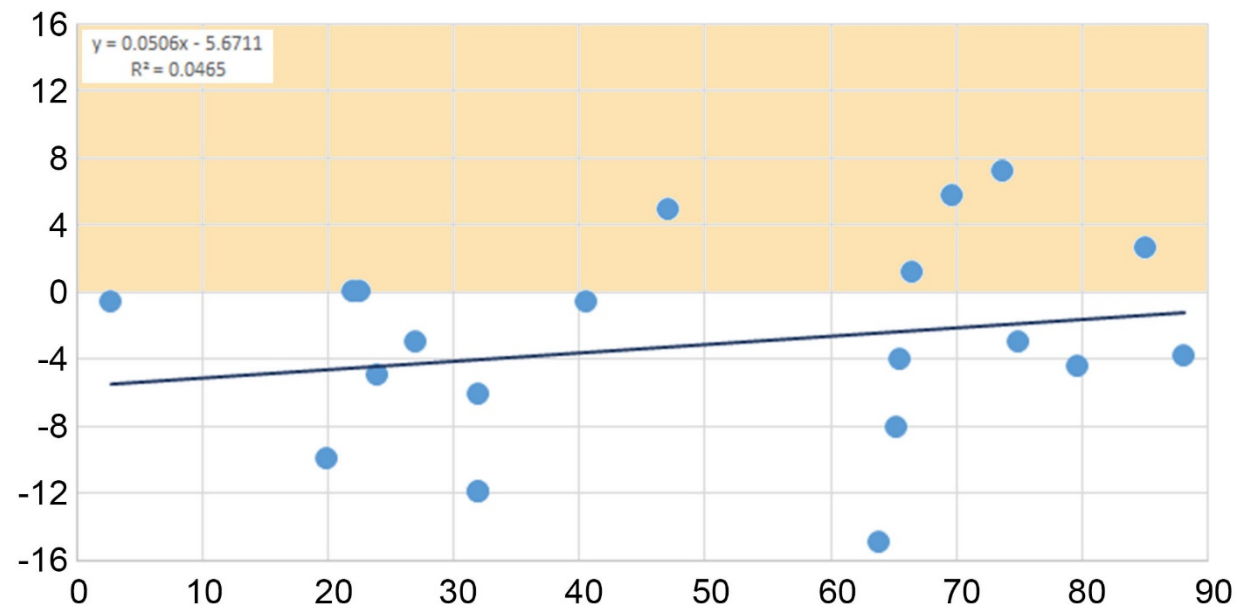
Spray volume: 15 gal/ac

Spray nozzles, pressure: flat-fan nozzles on side ports, fine or very fine droplet size.

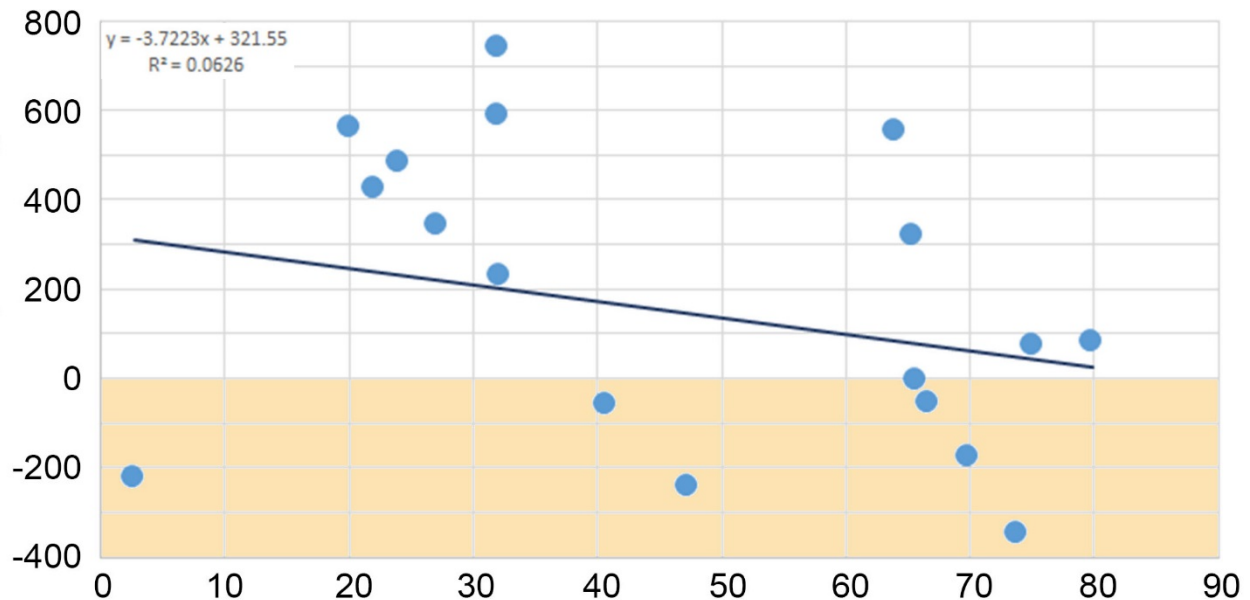
XR11001, 60 psi or XR11002, 40 psi

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

Change in Disease (%)
conferred by the fungicide



Change in Yield (lbs/ac)
conferred by the fungicide



Sclerotinia head rot disease pressure (%)
Sclerotinia head rot in the non-treated control

Thank you!



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- The National Sunflower Association
- USDA National Sclerotinia Initiative
- North Dakota Crop Protection Product Harmonization Board and Registration Board



SPECIALTY CROP
BLOCK GRANT PROGRAM

