Biological control of Sclerotinia head rot in confection sunflowers with honeybee-vectored *Clonostachys rosea*

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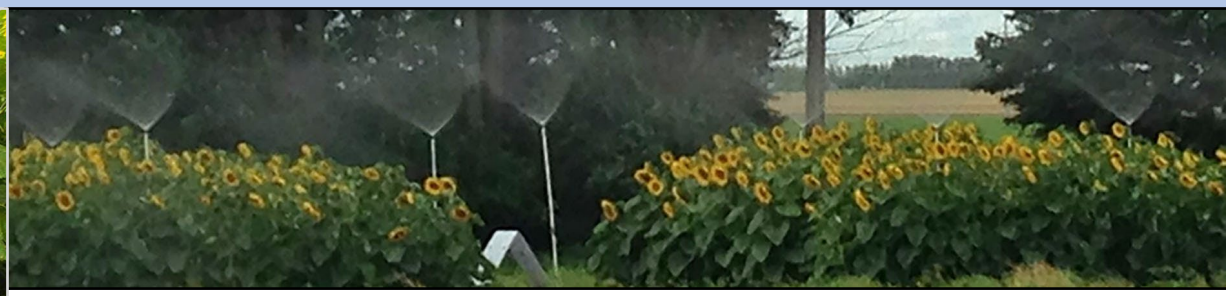
CASE
EVAN 150

Preliminary testing – Oilseed sunflowers, bumblebee-vectored *Clonostachys rosea*

Non-replicated studies. Sunflowers exposed to bees were spatially separated from identically managed sunflowers not exposed to bees.

Langdon, ND (2016, 2017)



Sunflowers were inoculated twice:

- Once at approx. R5.4-R5.6
- Once at approx. R5.5-R5.9

To each head, 15,000 ascospores were applied per head per inoculation (delivered with a hand-held spray bottle calibrated to deliver 5,000 spores per spray).

	Langdon **2016** NuSun '306'	Langdon **2017** NuSun '306'
Sclerotinia head rot incidence (% of plants)		
no bees	39	35
exposed to bees	26	16
Sunflower yield (pounds/acre)		
bagged heads	1880	1981
unbagged heads	2053	1761

Preliminary testing – Non-oil sunflowers, honeybee-vectored *Clonostachys rosea*

Replicated studies (4-5 reps). Bees were excluded from sunflower heads in the non-treated control by placing perforated pollination bags over heads. Heads were bagged from bloom initiation to R7.
Carrington, ND (2017, 2019)

INOCULATIONS:
- Sunflowers were inoculated twice in 2018 (at R5.5 and R5.8-R5.9) and once in 2019 (at R5.7-R5.9).
- To each head, 15,000 ascospores were applied per head per inoculation (delivered with hand-held spray bottle calibrated to deliver 5,000 spores / spray).

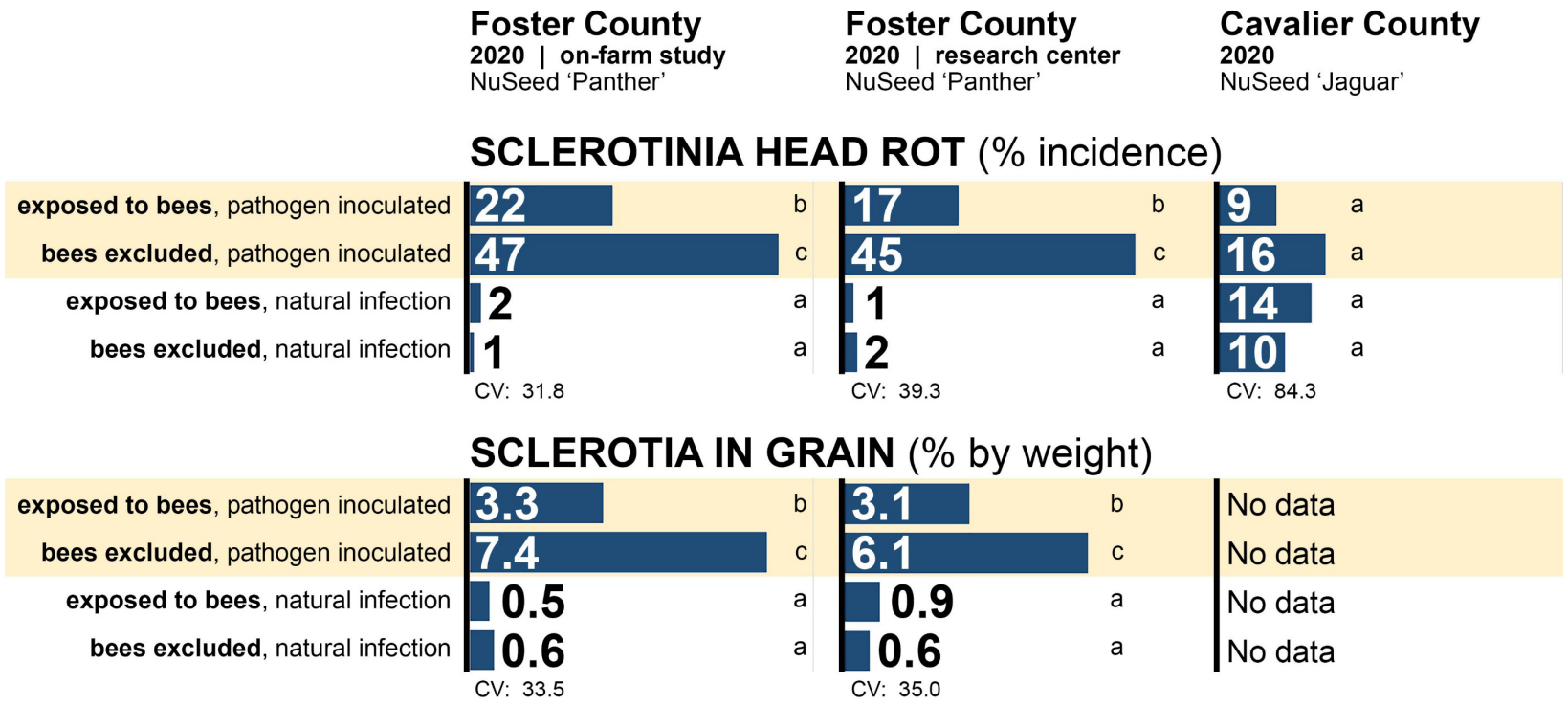
POLLINATION BAGS:
18 x 16 inch (length x width) pollination bags made of fine mesh fabric with 1 mm x 1 mm holes (Lawson Bags; Northfield, IL)

	Carrington **2018** NuSeed 'Jaguar'		Carrington **2019** NuSeed 'Jaguar'	
Sclerotinia head rot incidence (% of plants)				
bagged heads	70	b	93	a
unbagged heads	34	a	69	a
	CV: 16.0		CV: 9.4	
Sunflower yield (pounds/acre)				
bagged heads	635	b	NO DATA	
unbagged heads	1607	a		
	CV: 9.4			

Efficacy of honeybee-vectored *Clonostachys rosea* relative to distance from the bee hive

Replicated studies (3 reps). Sunflowers were established in a strip 60 to 110 feet wide by half-mile long. Bee hives were placed at one end and two-thirds the distance along the strip.

Year #1: Foster and Cavalier Counties, ND (2020)



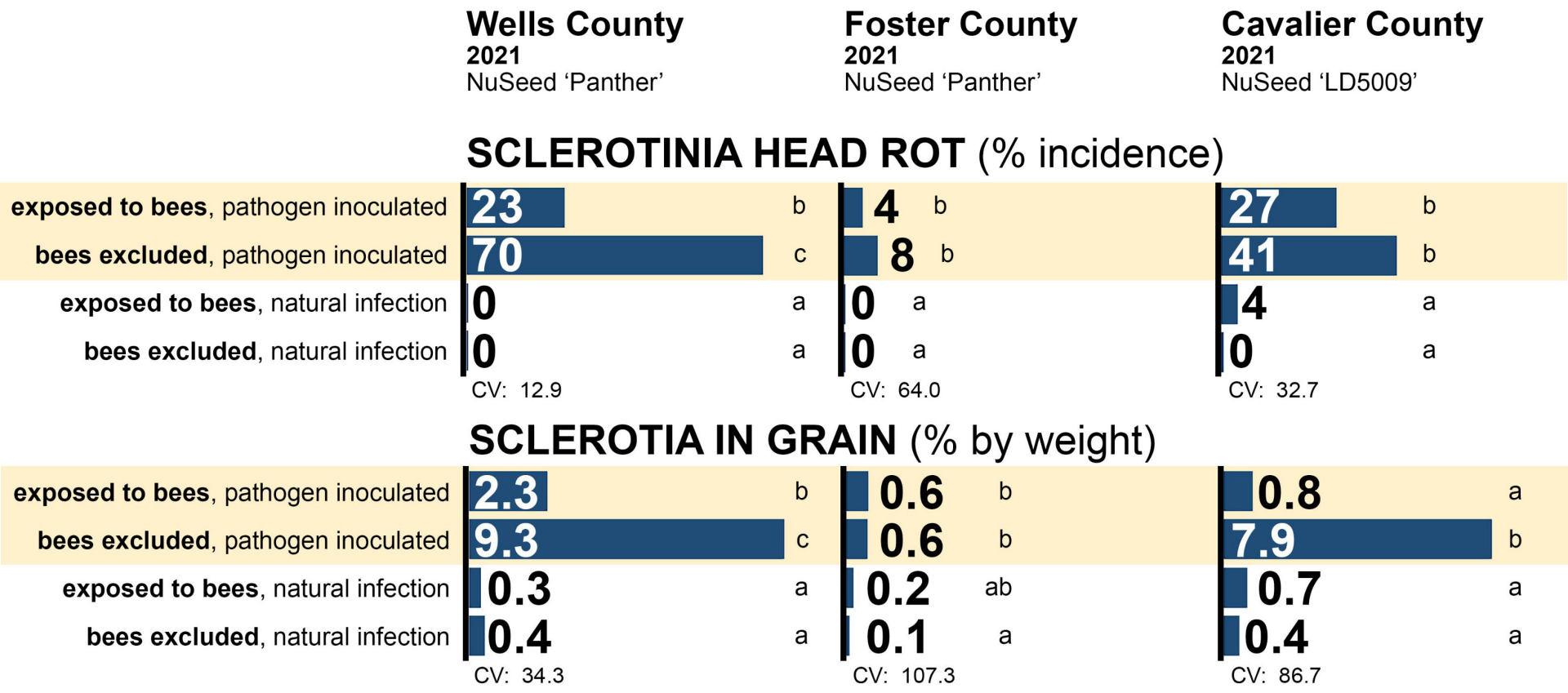
PLOT SIZE: Approx. 100 plants/plot across 3 or 4 rows. HIVES: 4 hives at each location, 100% of hives equipped with dispensers of the biological control agent at studies conducted in Foster County; 25% of hives equipped with dispensers at the study conducted in Cavalier County.

INOCULATIONS: Sunflowers were inoculated once at approx. R5.4-R5.8. To each head, 15,000 ascospores were applied per head.

POLLINATION BAGS: 16x18" (40.64 x 45.72 cm) HDPE plastic with 336-micron pore diameter; 24% of the surface open; Midco Global; Kirkwood, MO.

Efficacy of honeybee-vectored *Clonostachys rosea* relative to distance from the bee hive

Replicated studies (3 reps). Sunflowers were established in a strip 60 to 110 feet wide by half-mile long. Bee hives were placed at one end and two-thirds the distance along the strip. **Year #2: Foster, Wells and Cavalier Counties, ND (2021)**



PLOT SIZE: Approx. 100 plants/plot across 3 or 4 rows.

HIVES: 4 or 6 hives at each location, 50 to 100% of hives equipped with dispensers of the biological control.

INOCULATIONS: Sunflowers were inoculated once at approx. R5.4-R5.9. To each head, 15,000 ascospores were applied per head.

POLLINATION BAGS: *Rep 3 of Wells County study:* 18 x 16 inch (length x width), fine mesh fabric with 1 mm x 1 mm holes (Lawson Bags; Northfield, IL)
Remainder of studies: 16x18" (40.64 x 45.72 cm) HDPE plastic with 336-micron pore diameter; 24% of surface open (Midco Global; Kirkwood, MO)

What impact do pollination bags have on Sclerotinia head rot disease pressure?

Replicated study (6 reps; average 100 plants/plot).
Cavalier County, ND (2022)

	Sclerotinia Head Rot
	% incidence
Unbagged heads	**5.0** a*
Bag type #2 (used in 2020-2021)	**8.8** a
Bag type #3 (used in 2022)	**9.2** a
F:	1.8
P>F:	0.2154
CV:	55.2

What impact do pollination bags have on Sclerotinia head rot disease pressure?

Replicated study (7 reps; average 160 plants/plot).
Foster County, ND (2022)

	Sclerotinia Head Rot	Sclerotinia Head Rot
	% incidence	% DSI
Unbagged heads	**7** b*	**7** b*
Bag type #1 (used in 2018-2019)	**29** a	**28** a
Bag type #2 (used in 2020-2021)	**26** a	**25** a
Bag type #3 (used in 2022)	**35** a	**33** a
F:	18.57	17.77
P>F:	< 0.0001	< 0.0001
CV:	30.6	31.4

What impact do pollination bags have on Sclerotinia head rot disease pressure?

Replicated study (7 reps; average 160 plants/plot).
Foster County, ND (2022)

	Yield	Sclerotia contamination
	pounds/acre	% by weight
Unbagged heads	**3212** b*	**1.1** b*
Bag type #1 (used in 2018-2019)	**2557** a	**3.0** a
Bag type #2 (used in 2020-2021)	**2578** a	**2.6** a
Bag type #3 (used in 2022)	**2451** a	**3.8** a
F:	34.47	12.7
P>F:	< 0.0001	0.0001
CV:	5.3	21.5

Thank you!

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Preliminary testing, 2016-2019: BVT, Inc.

Field trials, 2020-2022:
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