Susceptibility to Sclerotinia head rot

relative to sunflower growth stage

Conclusions from inoculation timing studies:

(1) Susceptibility to head rot increases as bloom progresses

- Sunflowers are more susceptible to head rot at late bloom (R5.7-R5.9) than mid-bloom (R5.4-R5.6)
- Sunflowers are more susceptible to head rot at mid-bloom (R5.4-R5.6) than early bloom (R5.1-R5.3)
- Exceptions may occur when cool, wet weather occurs when sunflowers are predominantly at R5.1-R5.3 and hot dry weather occurs later in bloom

(2) Susceptibility to head rot drops sharply at R6

- Risk of head rot infection at R6 is low unless weather is extremely favorable for head rot (very cool and wet).

(3) Sunflowers do not appear to be susceptible to head rot at R7

- Water that pools on backs of cupped heads facilitates head rot development from disease initiated during 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 stage of bloom

- Inoculations must be conducted **over multiple dates** such that all heads across all entries are inoculated at the same growth stage
- Reduces bias from differences in susceptibility related to growth stage

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

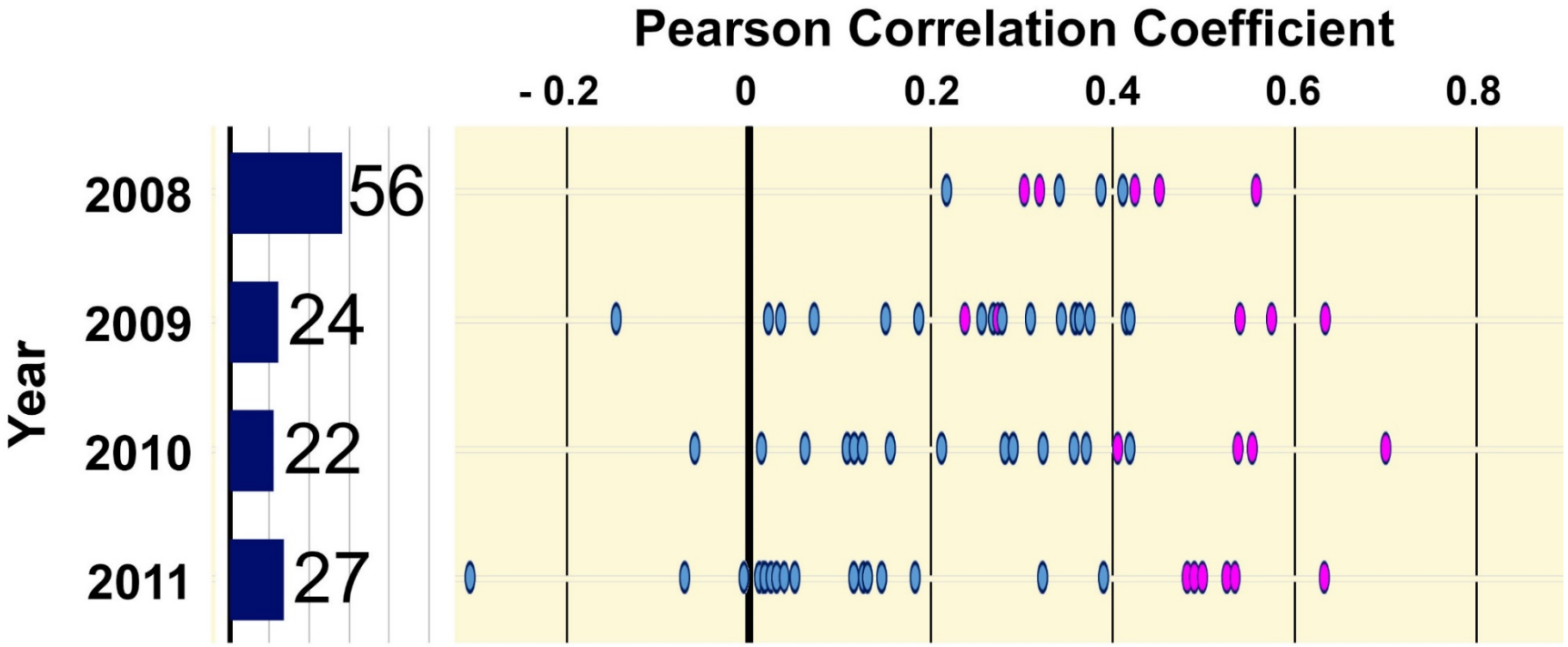
- Reduces bias from differences in susceptibility related to environmental conditions (hot & dry vs. cool & wet weather)

Sam Markell

Sclerotinia head rot screening nurseries conducted in North Dakota, Manitoba and Minnesota in 2008-2011:

In studies conducted in 2008-2011, sunflowers were inoculated on two dates (with inoculations conducted across all hybrids irrespective of growth stage) or every 2 to 3 days throughout bloom (with inoculations conducted to every sunflower in bloom irrespective of how many times it was previously inoculated).

- Due to growth stage-dependent differences in susceptibility, both of these strategies are likely to produce biased results.
- Results from different nurseries were poorly correlated. The hybrids that developed the least disease differed across screening nurseries.



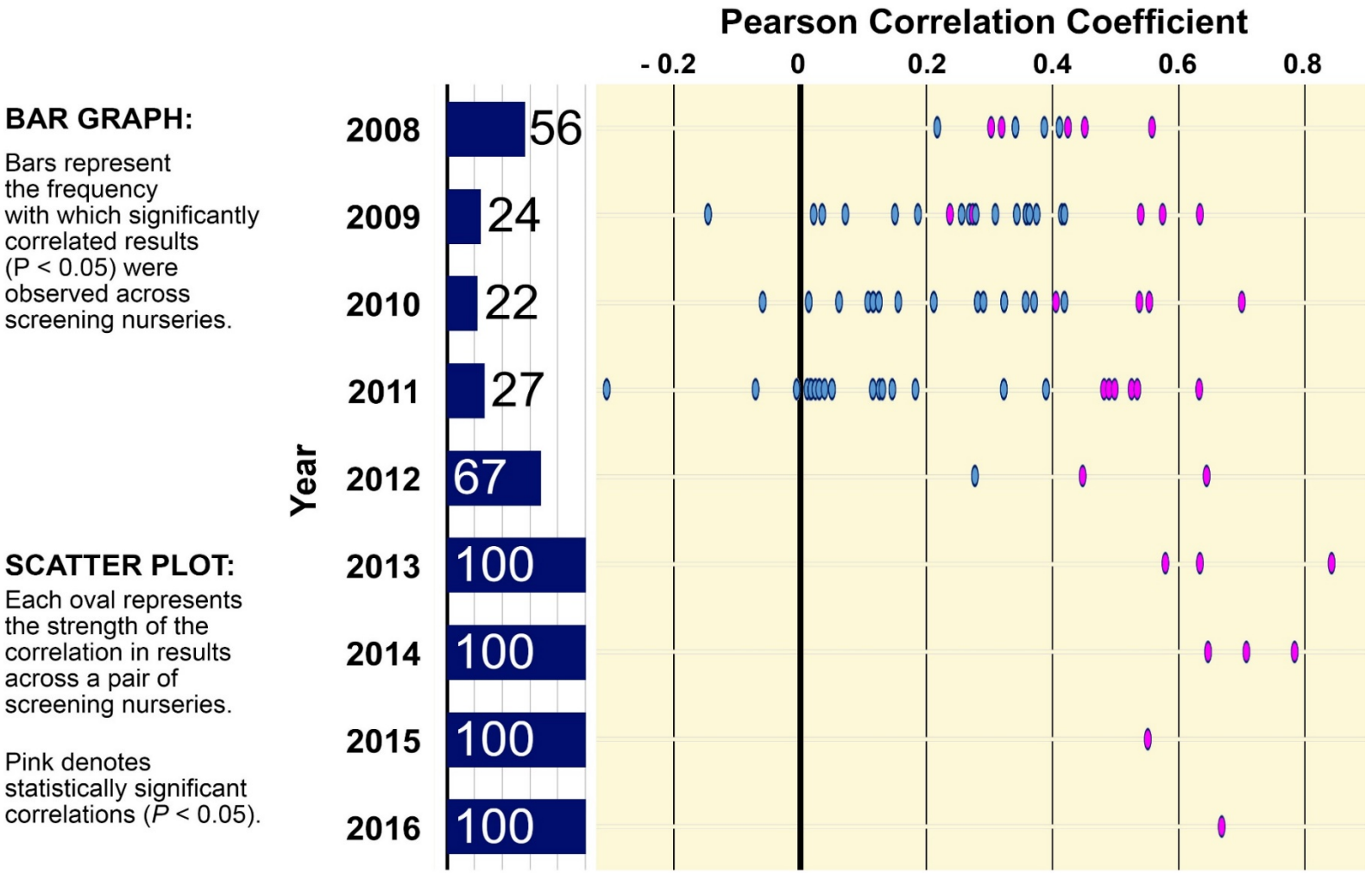
Bars ilustrate the frequency of observing significantly correlated results ($P<0.05$) **across screening nurseries.**

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

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

Sclerotinia head rot screening nurseries conducted in North Dakota in 2012-2016: The new inoculation procedures produced replicable results.

In all studies conducted in 2012-2016, inoculations were conducted on multiple dates such that all sunflower heads were inoculated twice, once at mid-bloom and once at late bloom: First inoculation at R5.4-R5.6; second inoculation at R5.6-R5.9



Conclusions –
Screening commercial sunflower hybrids and breeding lines for resistance

TO PRODUCE REPLICABLE, UNBIASED RESULTS:

Conditions favorable for head rot must be maintained throughout the bloom period across all hybrids – including early and late-maturity hybrids.

When sunflowers are inoculated with the causal pathogen, inoculations must be **conducted over multiple dates** such that all heads across all entries are inoculated at the same stage of bloom.

Susceptibility data generated in agronomic yield nurseries in which Sclerotinia head rot developed naturally will often be biased:

- Hybrids that were primarily in mid- to late bloom (R5.4-R5.9) when conditions favored head rot will develop the most disease.
- Hybrids that were primarily at the end of bloom (R6) or the first third of bloom (R5.1-R5.3) when conditions favored head rot will escape the disease and likely be erroneously be identified as less susceptible.

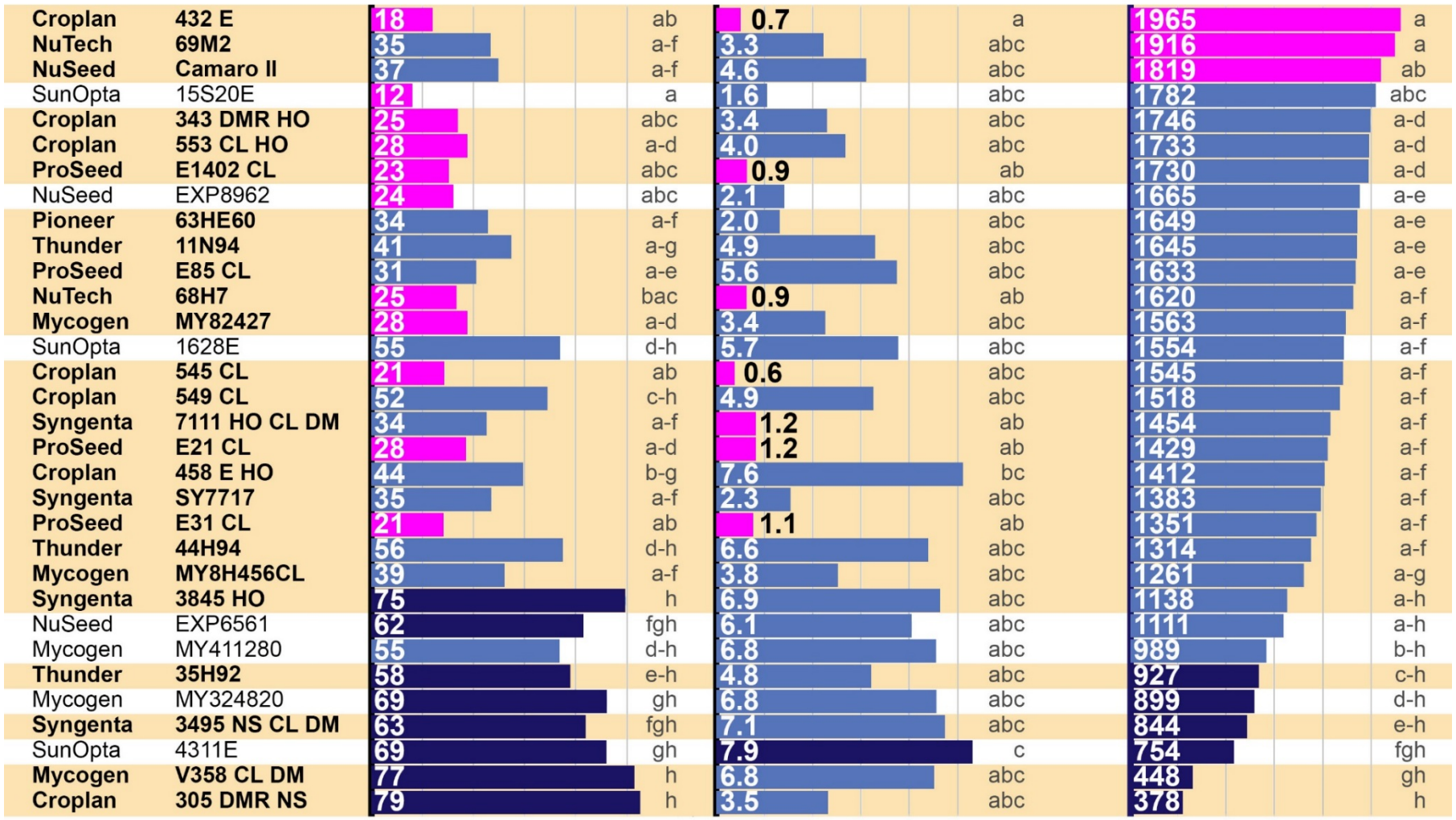
Can partially resistant hybrids be utilized to manage Sclerotinia head rot?

METHODS:

- Randomized complete block with four replicates
- Plots 5 ft (2 rows) wide x 25 to 60 feet long (depending on study)
- Inoculations conducted over multiple dates such that all sunflower heads were inoculated twice, once at mid-bloom and once at late bloom: First inoculation at R5.4-R5.6; second inoculation at R5.6-R5.9
  - In each inoculation, approx. 15,000 spores were delivered to the front of sunflower heads (each head received total 30,000 spores)
  - Spores were delivered with a hand-held spray bottle calibrated to deliver 5,000 spores per squirt.

Susceptibility of **oilseed** hybrids to Sclerotinia head rot

Carrington, ND (2015)

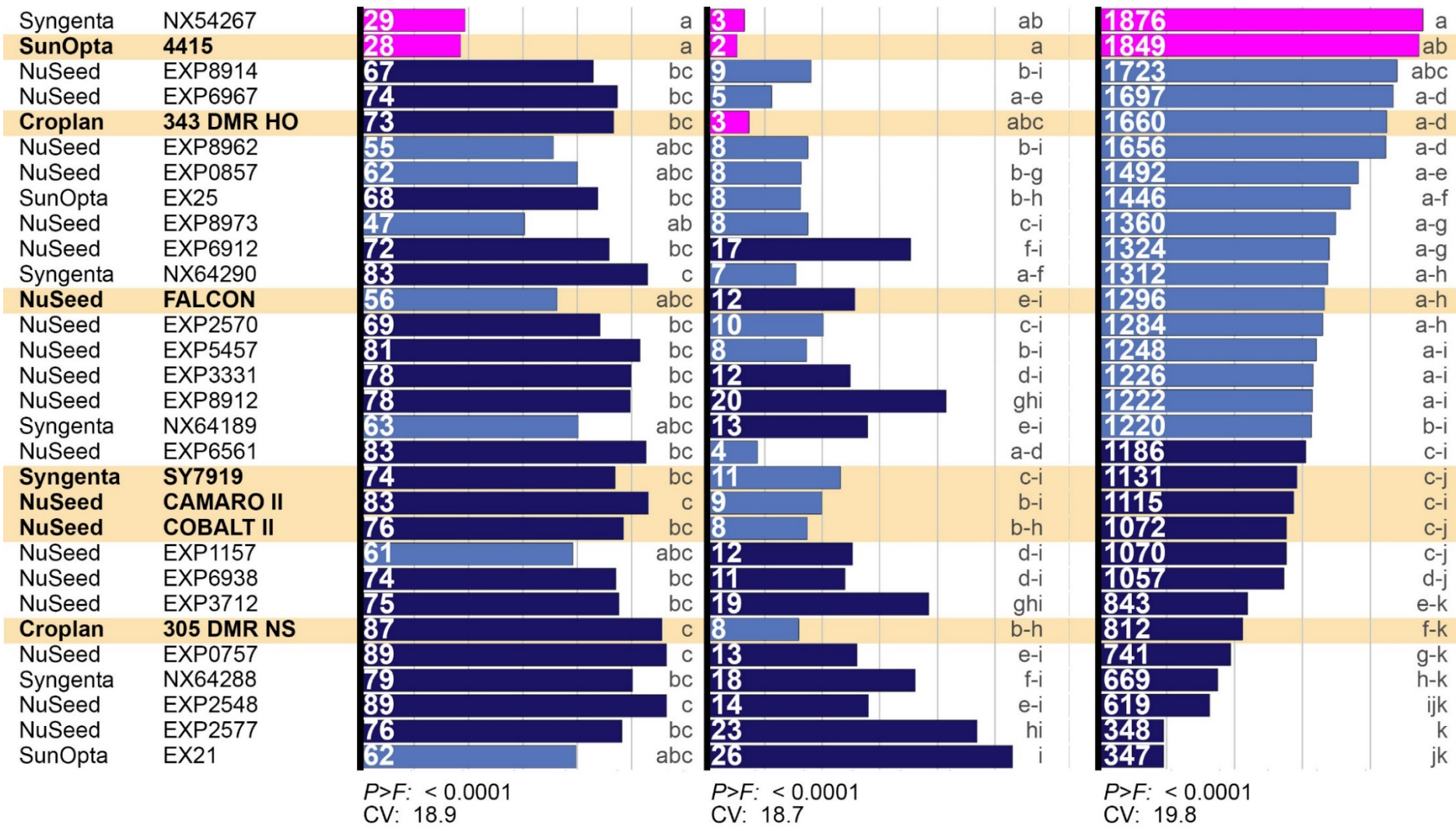


Yellow background = commercial hybrid

White background = experimental hybrid

Susceptibility of **oilseed** hybrids to Sclerotinia head rot

Carrington, ND (2016)



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Susceptibility of **oilseed** hybrids to Sclerotinia head rot

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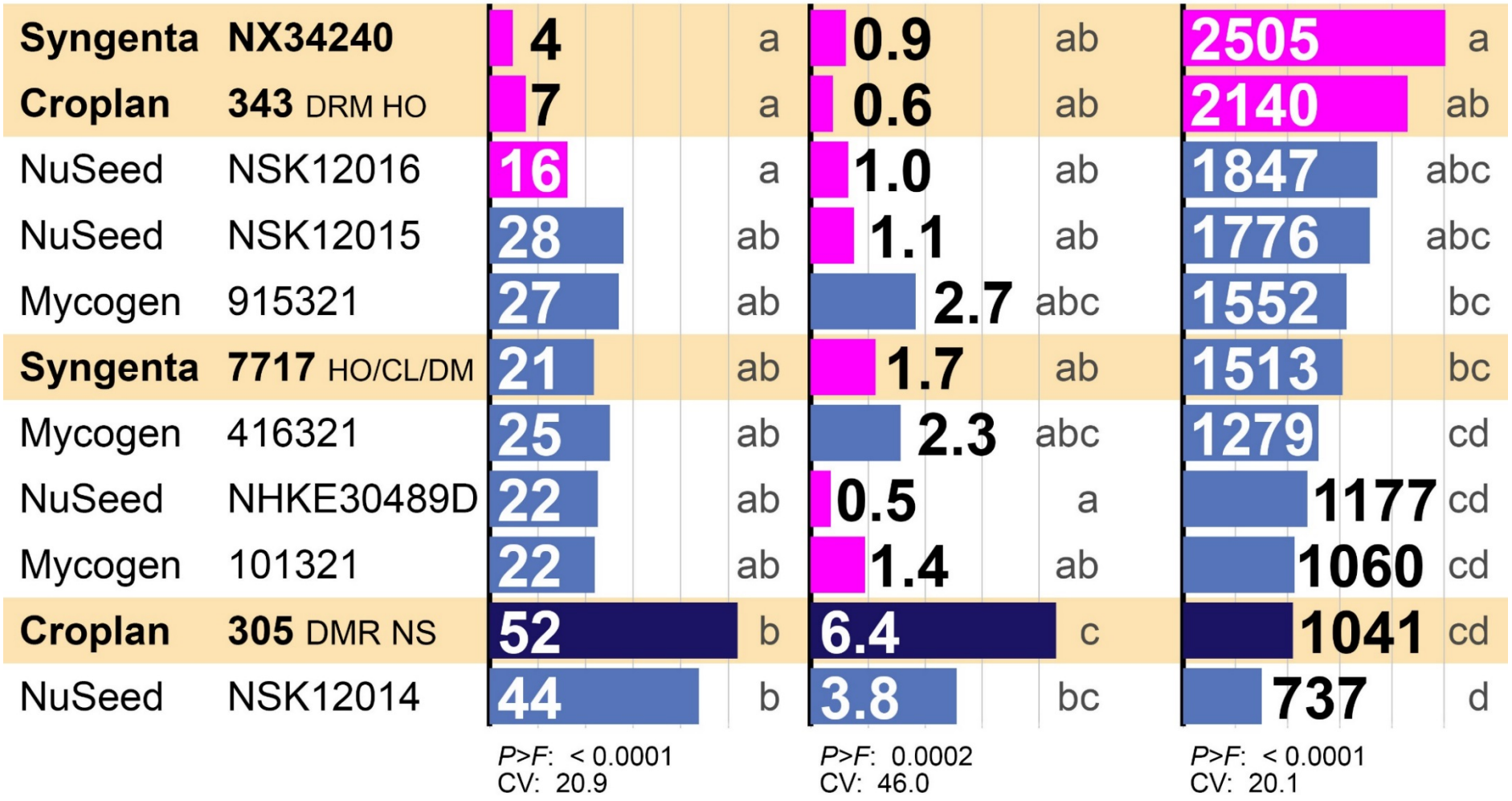


Yellow background = commercial hybrid

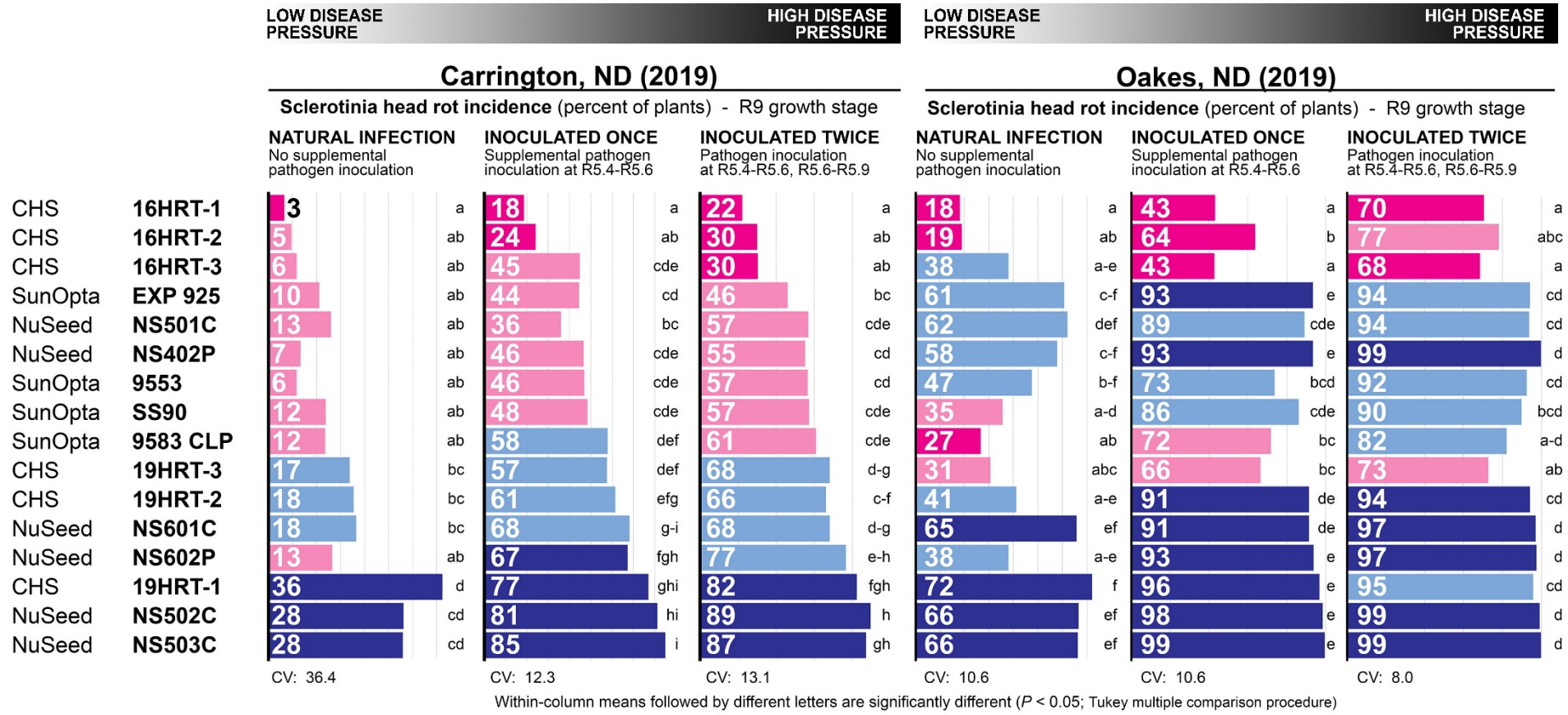
White background = experimental hybrid

Susceptibility of **confection (non-oil)** hybrids to Sclerotinia head rot

Carrington and Oakes, ND (2019)

Differences in susceptibility to head rot may also exist among confection hybrids, particularly new hybrids in development

- Most of the hybrids evaluated in this study were advanced experimental hybrids
- Yield data will be forthcoming (grain is currently being cleaned & processed)



Can partially resistant hybrids be utilized to manage Sclerotinia head rot?

CONCLUSIONS:

(1) **DIFFERENCES IN SUSCEPTIBILITY**

- Commercial oilseed hybrids differ sharply in susceptibility to head rot.
- Differences in susceptibility to head rot may also exist among confection hybrids, particularly new hybrids in development

(2) **STRENGTH OF PARTIAL RESISTANCE**

- No hybrids exhibit complete resistance.
- Under high disease pressure, partial resistance can be overwhelmed and result in unacceptable levels of disease.

(3) **IDENTIFYING PARTIALLY RESISTANT HYBRIDS**

- Susceptibility data generated in variety trials will not be reliable unless conditions favorable for head rot occurred throughout the entire bloom period across all hybrids