



Optimizing the agronomic performance of chickpeas under disease pressure

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- Farm Business Management
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Carrington Research Extension Center

The Carrington Research Extension Center conducts research and educational programs to enhance the productivity, competitiveness, and diversity of agriculture in central North Dakota. The research effort focuses on traditional crop variety evaluation, crop production and management, alternative crop development, cropping systems, irrigation, integration of crop and livestock production, intensive cow/calf production, beef cattle feeding, feedlot management, bison nutrition, foundation seedstocks production, and fostering development of new agricultural enterprises. The central location of the Carrington Center is significant in that the research program is able to address research needs that represent a significant part of agriculture in North Dakota.

Upcoming Events

- [2013 Glyphosate Resistance Workshop](#)
Feb 27, 2013 08:00 AM - 05:00 PM — Carrington REC

Upcoming events...

News

- [2012 Corn Response to Tillage, Fertilizer, Row Spacing Video](#)
Jan 30, 2013
- [2012 Research Data Available](#)
Jan 30, 2013
- [Combined Feed Value and Protein and Energy Calculator](#)
Oct 29, 2012
- [2013 Soybean Performance Test Invitation](#)
Feb 15, 2012
- [2013 Corn Performance Test Invitation](#)
Feb 15, 2012
- [May 22, 2011](#)
Aug 18, 2011

More news...

Blaine G. Schatz

Diseases of seeds, seedlings and roots: Pythium



Pythium

Causal pathogens: *Pythium* spp.
(oomycete; “water mold”)

Conditions that favor infection:

- Soil moisture: **high**
- Soil temperatures: wide range of soil temperatures, but low to moderate soil temperatures are very high risk

Symptoms:

- **Seed decay** and **damping-off**, resulting in poor stand establishment.

Pythium

Susceptibility:

- Chickpeas >> lentils, field peas
 - Chickpeas are highly susceptible.
 - Lentils and field peas, while also susceptible, are less susceptible than chickpeas.

Seed treatments:

- Very effective.
- Pythium causes losses early in crop development when the concentration of active ingredient in affected tissues is high.

Pythium

Seed treatment:

- **metalaxyl** (Allegiance FL, Sebring 480, etc.)
- **mefenoxam** (Apron XL)
 - Chemical structure and efficacy are very similar
 - Low application rate often utilized
 - Use high application rate in high-risk situations
- **ethaboxam** (Intego Solo).
 - Registered on chickpeas and lentils, not field peas
 - On lentils, 0.3 fl oz/cwt application rate recommended
 - Best used with metalaxyl or mefenoxam

Diseases of seeds, seedlings and roots:
Rhizoctonia root rot



Photos: Weidong Chen, USDA-ARS

Rhizoctonia

Susceptibility:

- Chickpeas and lentils > field peas
 - Chickpeas and lentils: highly susceptible.
 - Field peas, while also susceptible, are less susceptible than chickpeas or lentils.

Rhizoctonia

Causal pathogen: *Rhizoctonia solani*
(fungal pathogen)

Conditions that favor infection:

- Soil moisture: moderate to high
- Soil temperatures: low

Symptoms:

- Poor stand establishment due to seed decay and damping-off
- Root rot: sunken reddish to dark brown lesions

Rhizoctonia

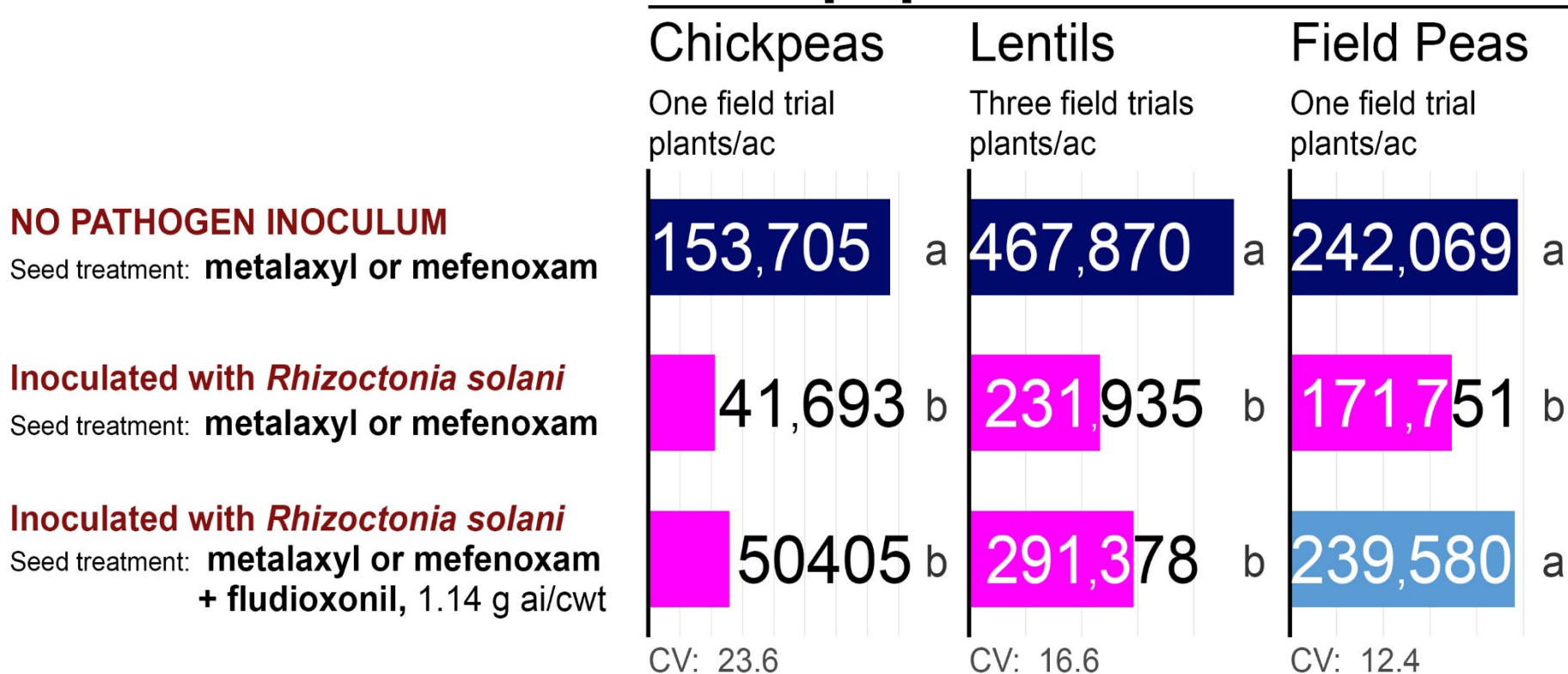
Seed treatments:

- Very effective.
- Rhizoctonia primarily causes losses early in crop development when the concentration of active ingredient in affected tissues is high.

Rhizoctonia: efficacy of seed treatments

Fludioxonil, 1.14 g ai/cwt: Maxim 4ST, Spirato 480ST, etc.

Plant population



Rhizoctonia: efficacy of seed treatments

Fludioxonil, 1.14 g ai/cwt: Maxim 4ST, Spirato 480ST, etc.

Yield

NO PATHOGEN INOCULUM

Seed treatment: **metalaxyl or mefenoxam**

Inoculated with *Rhizoctonia solani*

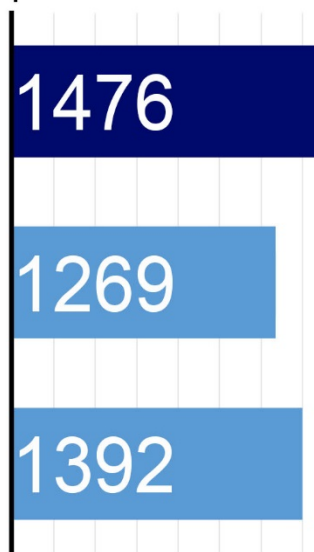
Seed treatment: **metalaxyl or mefenoxam**

Inoculated with *Rhizoctonia solani*

Seed treatment: **metalaxyl or mefenoxam + fludioxonil, 1.14 g ai/cwt**

Chickpeas

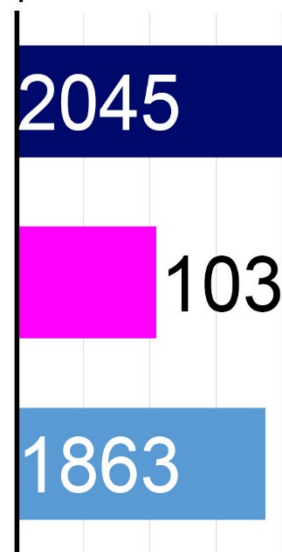
One field trial
pounds/ac



CV: 18.2

Lentils

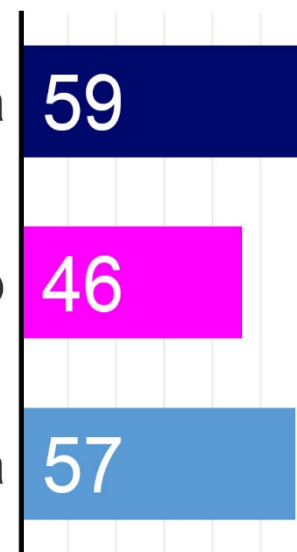
Two field trials
pounds/ac



CV: 3.5

Field Peas

One field trial
bushels/ac



CV: 7.9

Impact of seed treatment with Apron Maxx RTA (5 fl oz/cwt).

1.14 g fludioxonil + 1.69 g mefenoxam/cwt

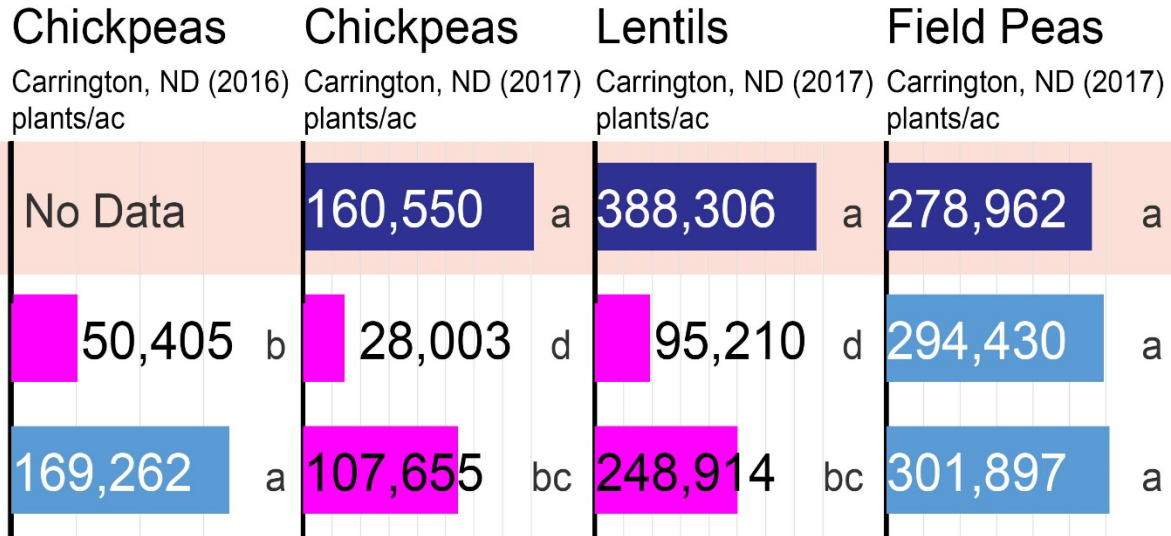
Strips of plots planted to treated and non-treated seed, 'CDC Frontier' chickpeas.

Carrington, ND (2017).



Rhizoctonia: efficacy of seed treatments

Plant Population



----- Inoculated with *Rhizoctonia solani*

Rhizoctonia: efficacy of seed treatments

Yield

	Chickpeas Carrington, ND (2016) pounds/ac	Chickpeas Carrington, ND (2017) pounds/ac	Lentils Carrington, ND (2017) pounds/ac	Field Peas Carrington, ND (2017) bushels/ac
NO PATHOGEN INOCULATION	No Data	3465 ^a	1826 ^a	45 ^{ab}
ApronMaxx RTA 5.0 fl oz/cwt mefenoxam + fludioxonil	1392 ^a	2484 ^b	1194 ^b	42 ^b
Vibrance Maxx 5.0 fl oz/cwt mefenoxam + fludioxonil + sedaxane	1761 ^a	3057 ^a	1940 ^a	46 ^{ab}

----- Inoculated with *Rhizoctonia solani* -----

Rhizoctonia: efficacy of seed treatments

Plant Population

	Chickpeas Carrington, ND (2016) plants/ac	Chickpeas Carrington, ND (2017) plants/ac	Lentils Carrington, ND (2017) plants/ac	Field Peas Carrington, ND (2017) plants/ac
NO PATHOGEN INOCULATION	No Data	160,550	388,306	278,962
ApronMaxx RTA 5.0 fl oz/cwt mefenoxam + fludioxonil	No Data	160,550	388,306	278,962
ApronMaxx RTA 5.0 fl oz/cwt mefenoxam + fludioxonil	50,405	28,003	95,210	294,430
Vibrance Maxx 5.0 fl oz/cwt mefenoxam + fludioxonil + sedaxane	169,262	107,655	248,914	301,897
Vibrance Maxx 5.0 fl oz + Mertect 0.47 fl oz/cwt mefenoxam + fludioxonil + sedaxane + thiabendazole	158,683	136,903	294,963	297,630

----- Inoculated with *Rhizoctonia solani* -----

Rhizoctonia: efficacy of seed treatments

Yield

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----- Inoculated with *Rhizoctonia solani* -----

Rhizoctonia: efficacy of seed treatments

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Chickpeas Carrington, ND (2016) plants/ac	Chickpeas Carrington, ND (2017) plants/ac	Lentils Carrington, ND (2017) plants/ac	Field Peas Carrington, ND (2017) plants/ac
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ApronMaxx RTA 5.0 fl oz/cwt
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50,405 ^b	28,003 ^d	95,210 ^d	294,430 ^a
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+ Mertect 0.47 fl oz/cwt**
mefenoxam + fludioxonil + sedaxane + thiabendazole

158,683 ^a	136,903 ^a	294,963 ^{bc}	297,630 ^a
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Obvius 5.9 fl oz/cwt
metalaxyl + pyraclostrobin + fluxapyroxad

182,952 ^a	135,036 ^{ab}	309,898 ^{ab}	306,698 ^a
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----- Inoculated with *Rhizoctonia solani* -----

Rhizoctonia: efficacy of seed treatments

Yield

Chickpeas Carrington, ND (2016) pounds/ac	Chickpeas Carrington, ND (2017) pounds/ac	Lentils Carrington, ND (2017) pounds/ac	Field Peas Carrington, ND (2017) bushels/ac
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3465

a

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ab

ApronMaxx RTA 5.0 fl oz/cwt
mefenoxam + fludioxonil

1392

a

2484

b

1194

b

42

b

Vibrance Maxx 5.0 fl oz/cwt
mefenoxam + fludioxonil + sedaxane

1761

a

3057

a

1940

a

46

ab

**Vibrance Maxx 5.0 fl oz
+ Mertect 0.47 fl oz/cwt**
mefenoxam + fludioxonil + sedaxane + thiabendazole

1833

a

3229

a

1994

a

51

a

Obvius 5.9 fl oz/cwt
metalaxyl + pyraclostrobin + fluxapyroxad

1630

a

3280

a

2068

a

50

ab

----- Inoculated with *Rhizoctonia solani* -----

Ascochyta blight of chickpeas

1. Sources of Ascochyta disease outbreaks

A subject of critical importance given increases in chickpea acreage, new chickpea producers



Review

Etiology – Ascochyta of lentils, field peas, and chickpeas

Different pathogens cause Ascochyta on chickpeas, field peas, and lentils.

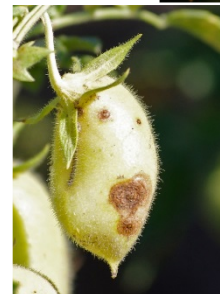
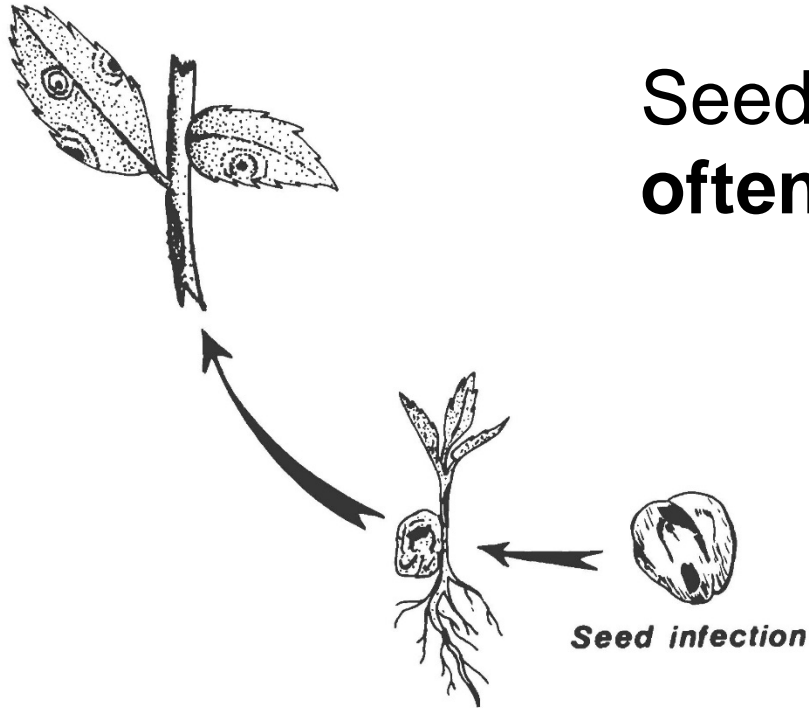
- the causal pathogens are different for each crop
- ... but the biology of each pathogen is similar



Initial introduction of *Ascochyta* blight

Transmission of disease from infected seed to seedlings.

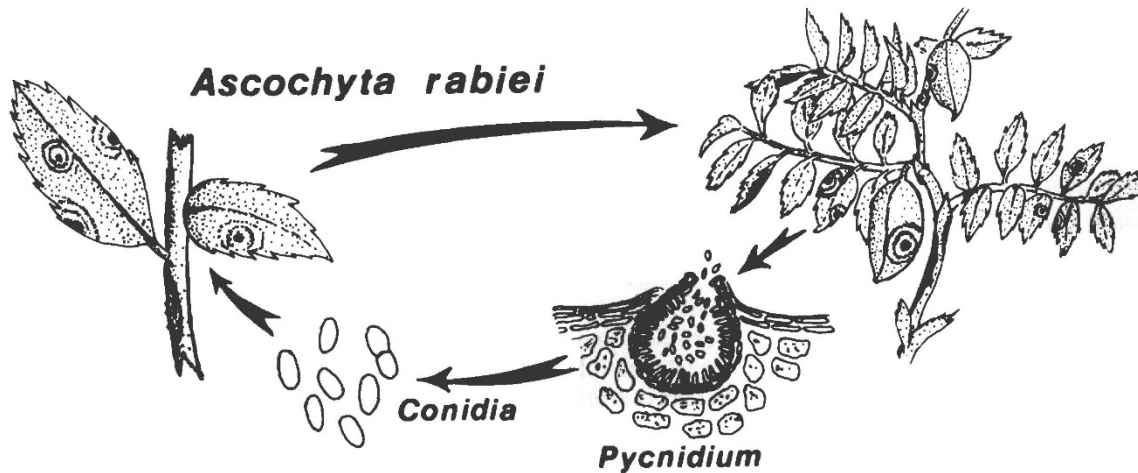
Seeds within diseased pods are often infected with *Ascochyta*



Local, in-season movement of *Ascochyta*

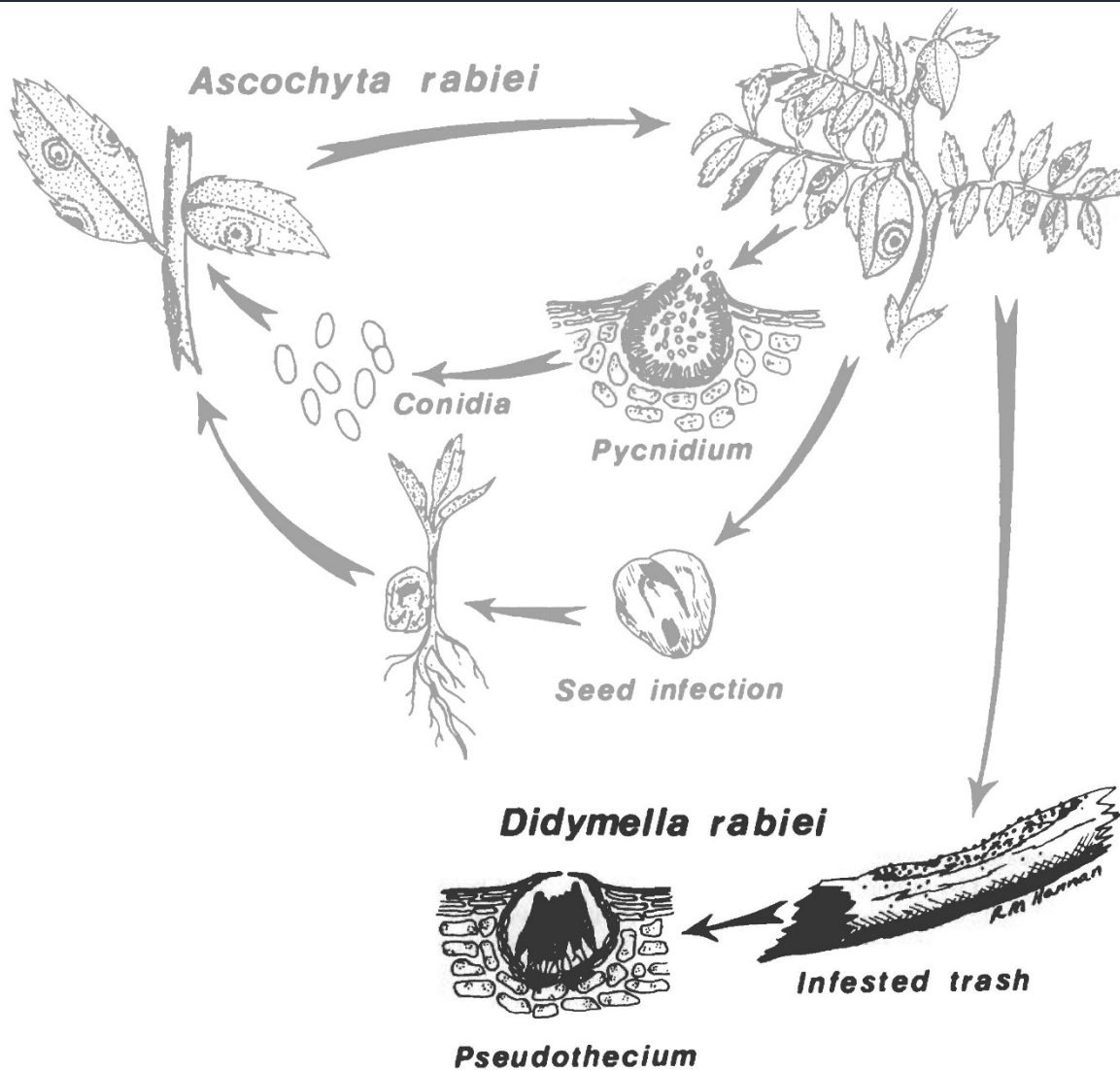
Spores produced on diseased tissue

Spores produced on disease lesions **move short distances** via **splash dispersal, wind-driven rain**



Long-distance movement of *Ascochyta*

Spores produced on overwintered crop residues



Sexually produced ascospores are produced on overwintered infested residues.

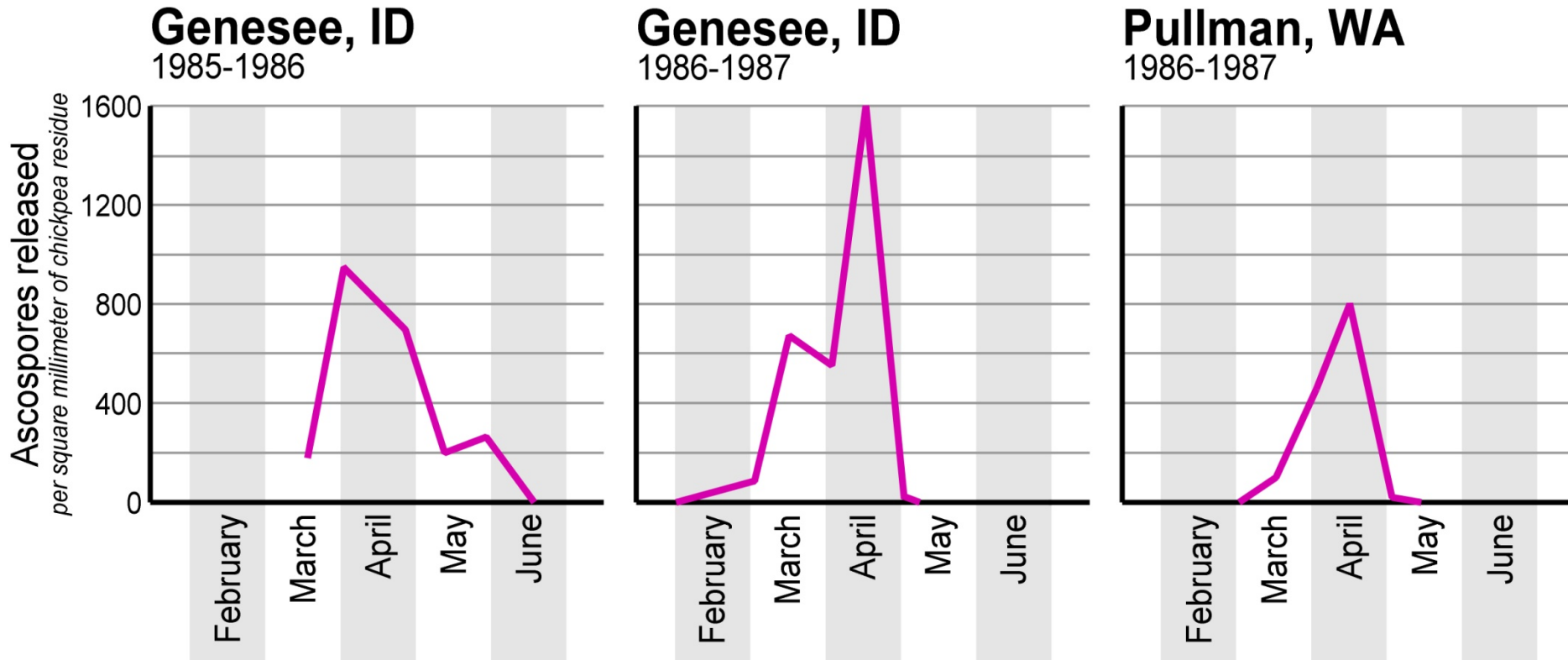
Can be **carried aloft by air currents**

Long-distance movement of *Ascochyta*

Spores produced on overwintered crop residues

The release of ascospores from overwintered residues can be significant:

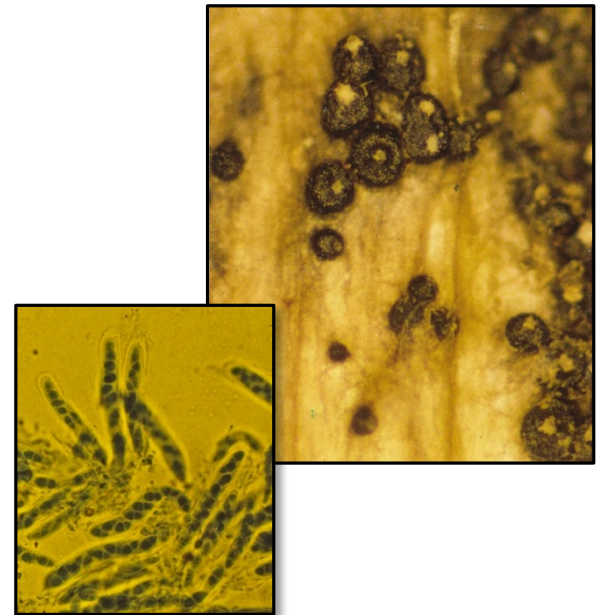
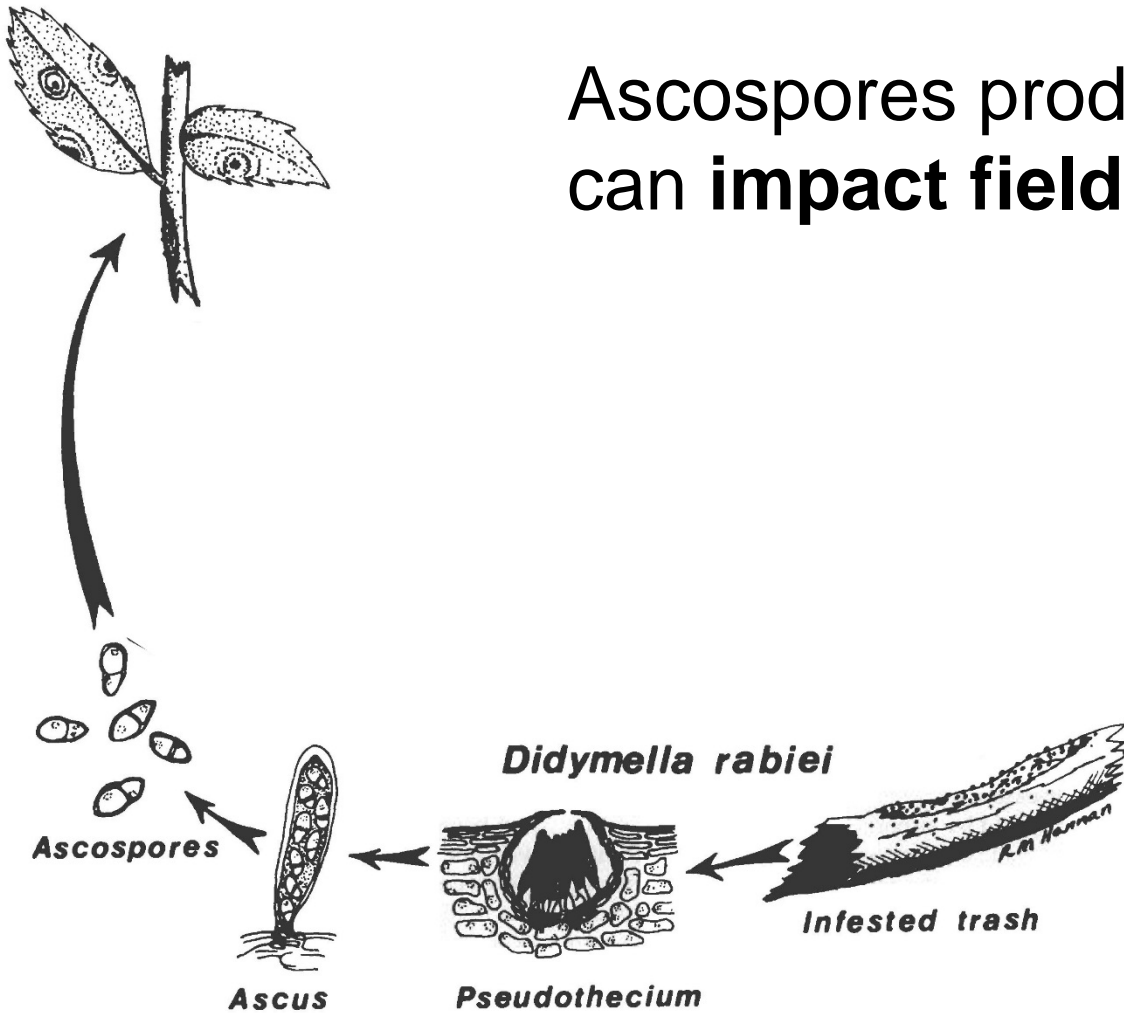
200-1,600 ascospores/mm² per day recorded in Pacific NW



Long-distance movement of Ascochyta

Spores produced on overwintered crop residues

Ascospores produced on residues can **impact fields miles away.**



Long-distance movement of *Ascochyta*

The experience from Washington and Idaho

Pre-1983: No *Ascochyta* blight known to occur in Washington or Idaho

1983: *Ascochyta* blight observed in chickpea variety trials in Pullman, WA

SOURCE:

Walter J. Kaiser

Plant pathologist (retired), USDA-ARS in Prosser, WA

Kaiser 1997. **Can. J. Plant Pathology** 19(2):214-224

Long-distance movement of *Ascochyta*

The experience from Washington and Idaho

1984: *Ascochyta* blight observed in 23 of 30 commercial chickpea production fields in northern Idaho

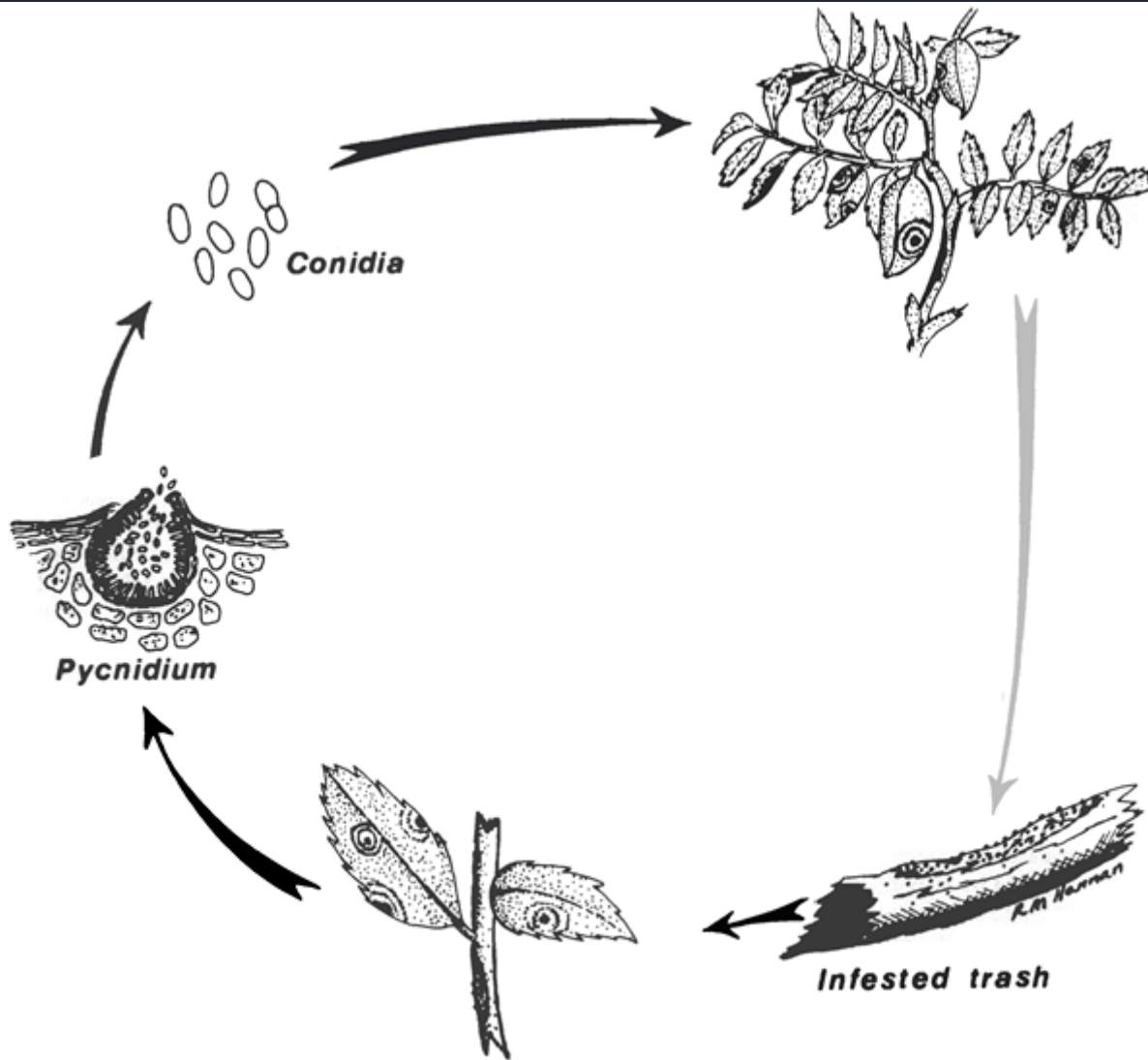
Pullman, WA



1987: Over 50% of the chickpea crop in Washington and Idaho severely impacted by *Ascochyta* blight

Persistence of Ascochyta in the soil

Disease transmission from residues directly to a new crop



When crop rotation intervals are short, Ascochyta can be directly transmitted, infested residues to new crops

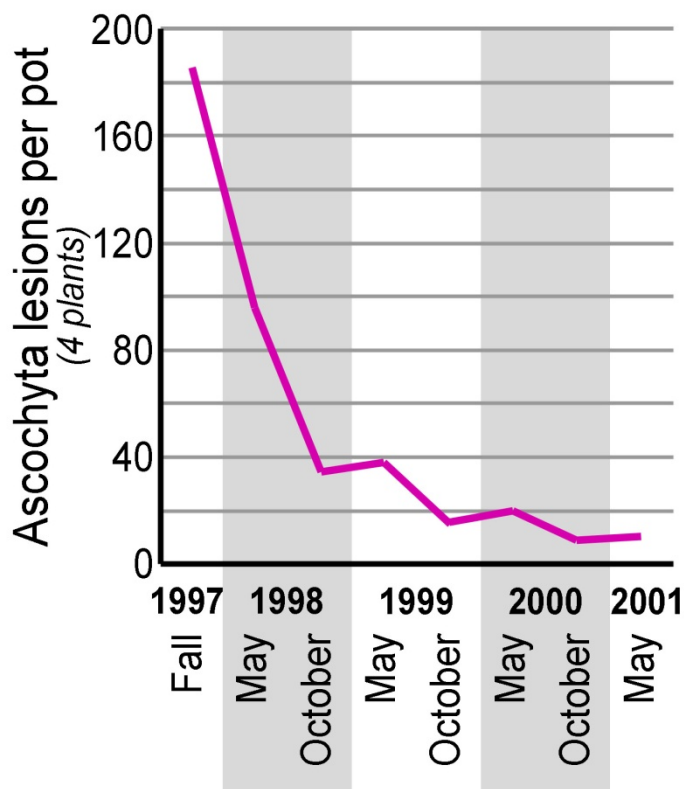
Transmission of Ascochyta blight from residues / infested soil

Disease transmission from Ascochyta-infected **chickpea residues** can occur for at least 4 years after harvest

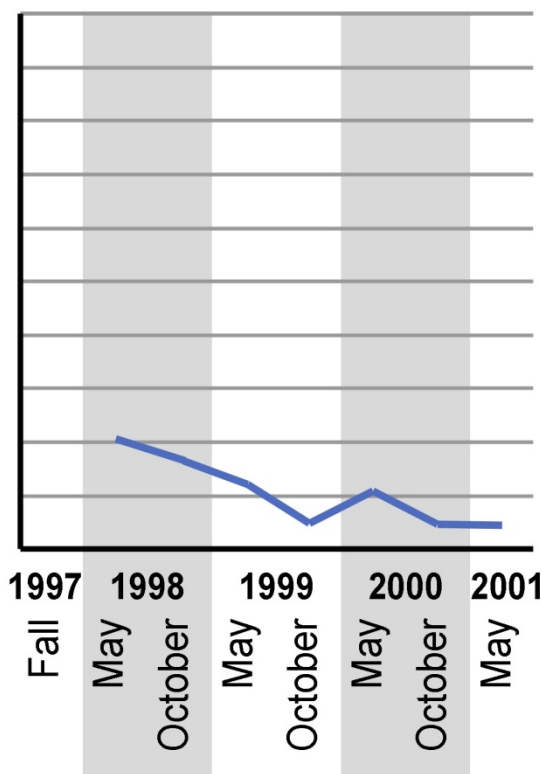
Ascochyta-infected chickpea leaf residues

Saskatoon, Saskatchewan - *heavy clay loam soil*

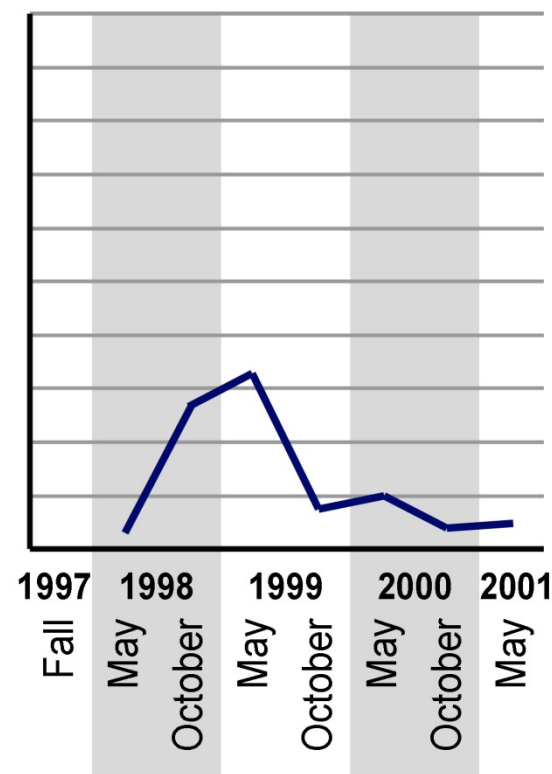
Residues on surface



Residues buried 2 in.



Residues buried 4 in.

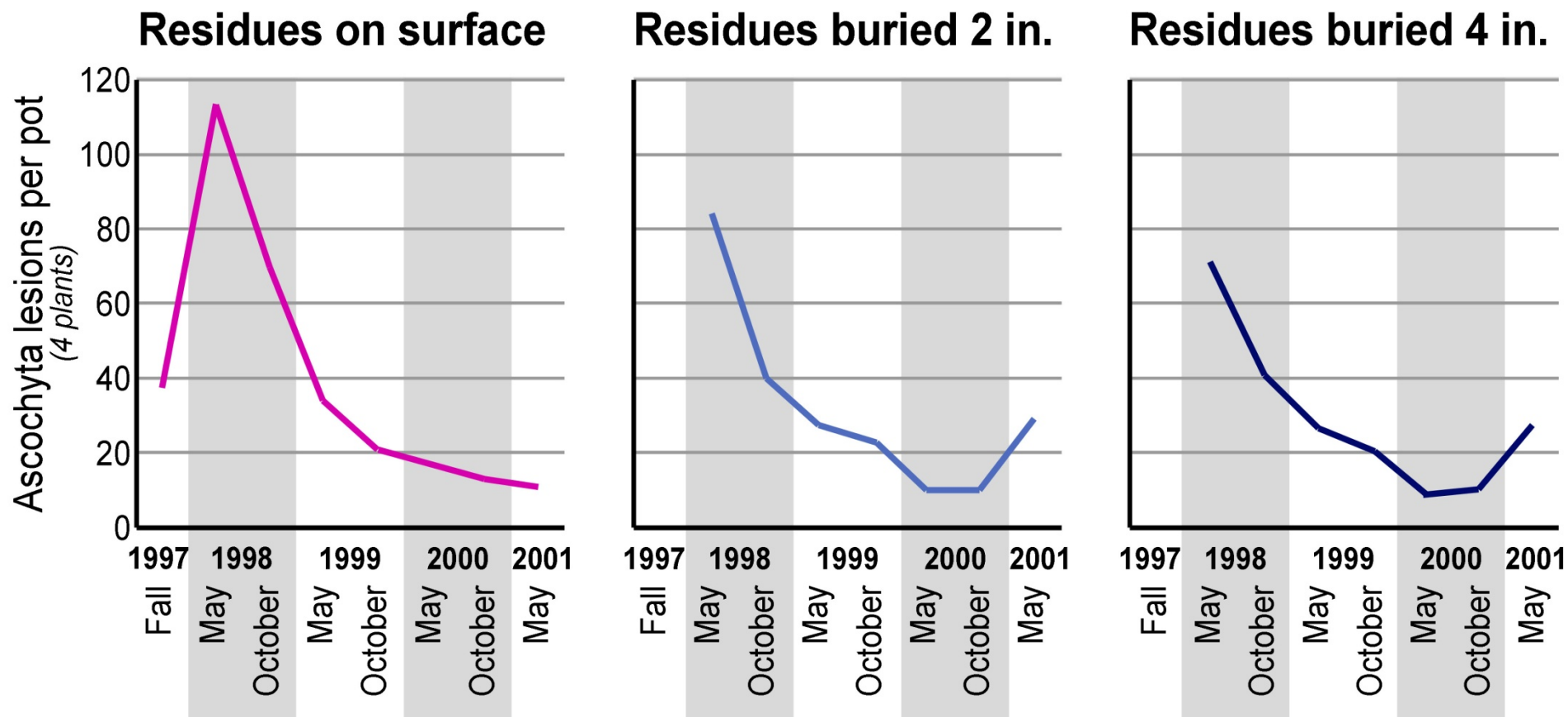


Transmission of Ascochyta blight from residues / infested soil

Disease transmission from Ascochyta-infected **chickpea residues** can occur for at least 4 years after harvest

Ascochyta-infected **chickpea stem residues**

Saskatoon, Saskatchewan - *heavy clay loam soil*



Ascochyta blight management

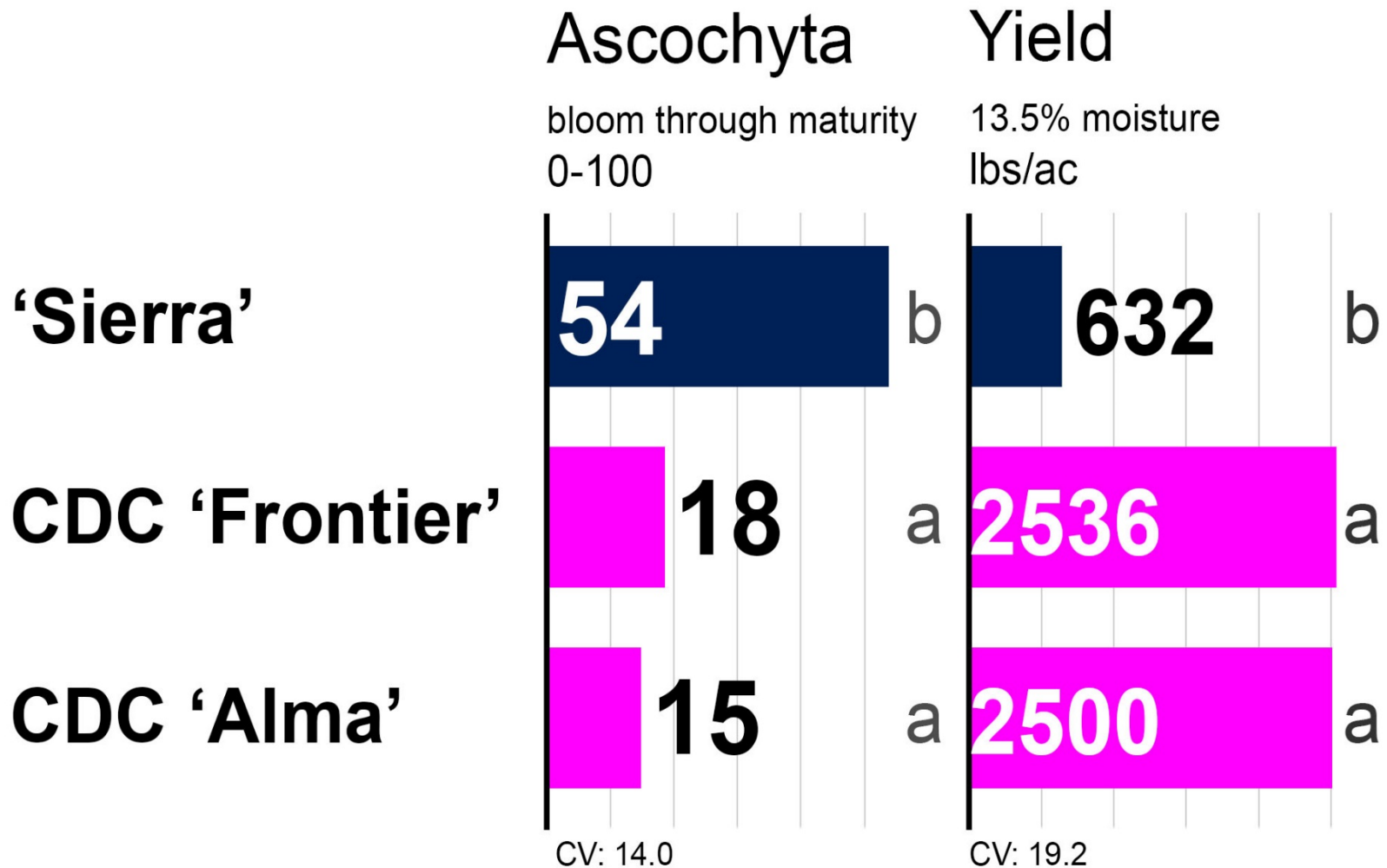
chickpeas

1. Select a variety partially resistant to Ascochyta
2. Clean seed
3. Long crop rotation intervals
4. More rigorous fungicide usage may be needed when Ascochyta outbreaks occurred in last 1-2 years within region



Ascochyta blight management

Differences in Ascochyta susceptibility across varieties



Field trial location: Sykeston, ND (13 miles northwest of Carrington) Year: 2015

Fungicides: All varieties received three applications of Proline (5.7 fl oz/ac) + NIS.

Fungicide efficacy – *Ascochyta* blight chickpeas

With the development of resistance to the QoI fungicides, **four primary fungicide modes of action are available for managing *Ascochyta* blight.**

DMI (FRAC 3): Proline

SDHI (FRAC 7): Endura, Vertisan, and premix fungicides

FRAC 29: Omega (chickpeas only)

MULTI-SITE ACTIVITY (FRAC M): principally chlorothalonil (Bravo Weatherstik, Echo 720, etc.)

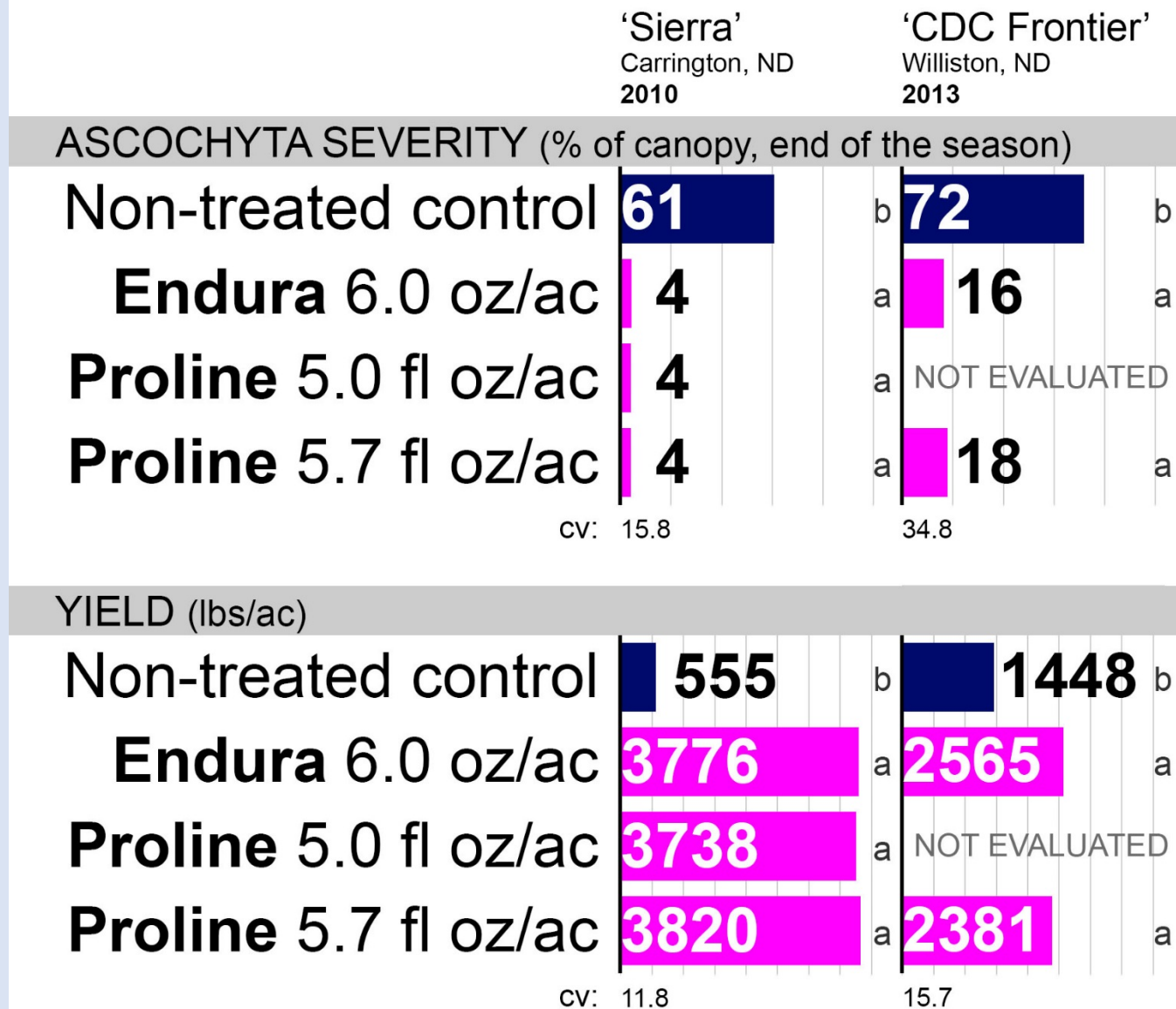
Fungicide efficacy – chickpea *Ascochyta*

SDHI fungicides (FRAC 7) - Endura

Under moderate disease pressure, Endura has been equally effective as Proline.

Endura 70WG:
boscalid
mode of action: SDHI

Proline 480SC:
prothioconazole
mode of action: DMI



Fungicide efficacy – chickpea *Ascochyta*

SDHI fungicides (FRAC 7) - Endura

Under severe disease pressure, Endura has been less effective than Proline.

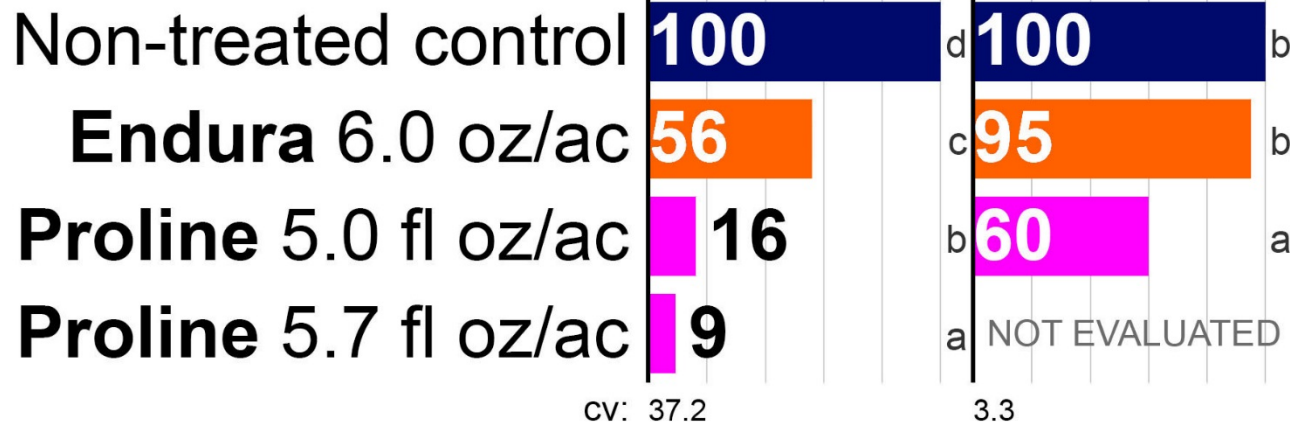
Endura 70WG:
boscalid
mode of action: SDHI

Proline 480SC:
prothioconazole
mode of action: DMI

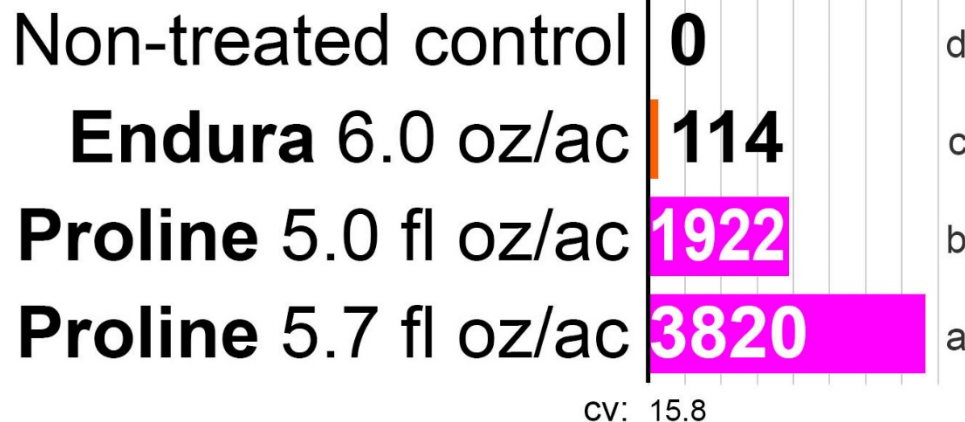
'Sierra'
Carrington, ND
2009

'CDC Xena'
Minot, ND
2011

ASCOCHYTA SEVERITY (% of canopy, end of the season)



YIELD (lbs/ac)



Fungicide efficacy – chickpea *Ascochyta*

SDHI fungicides (FRAC 7) - Priaxor

Due to QoI resistance,

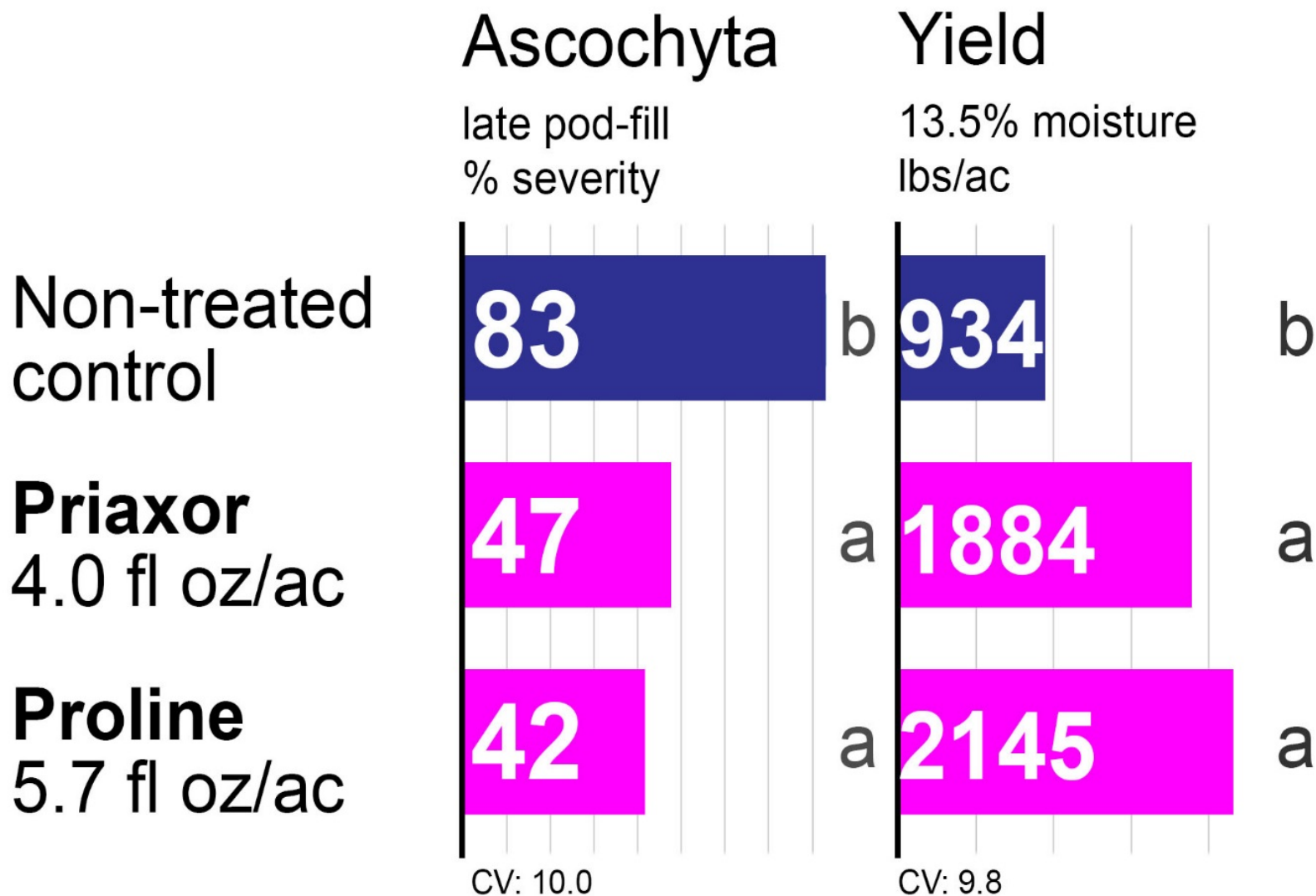
Priaxor is essentially a SDHI fungicide when applied to chickpeas to manage *Ascochyta* blight.

Active ingredients in Priaxor:

- pyraclostrobin (QoI)
- fluxapyroxad (SDHI)

Fungicide efficacy – chickpea *Ascochyta*

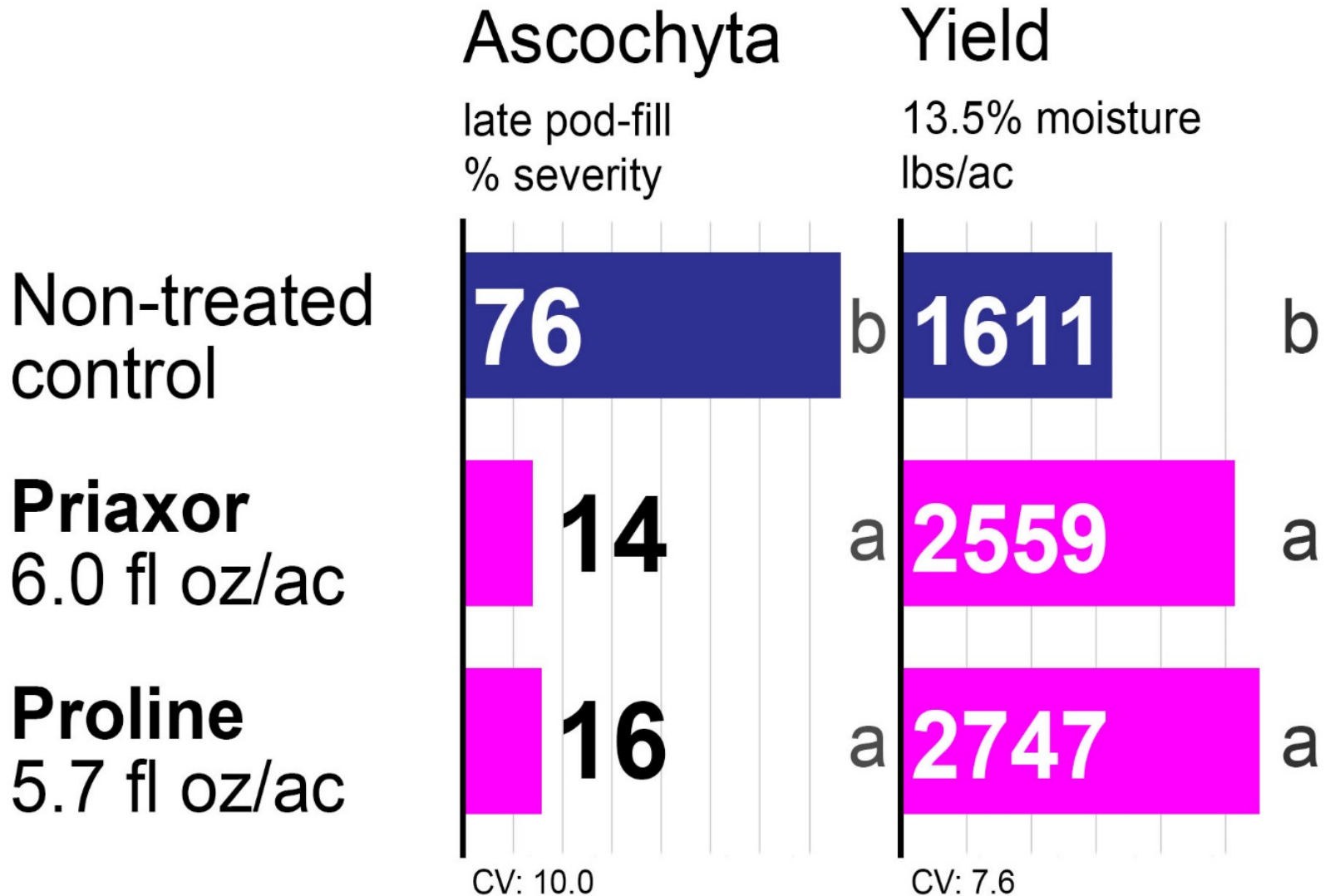
SDHI fungicides (FRAC 7) - Priaxor



Combined analysis across four field trials (Carrington and Williston, ND)

Fungicide efficacy – chickpea *Ascochyta*

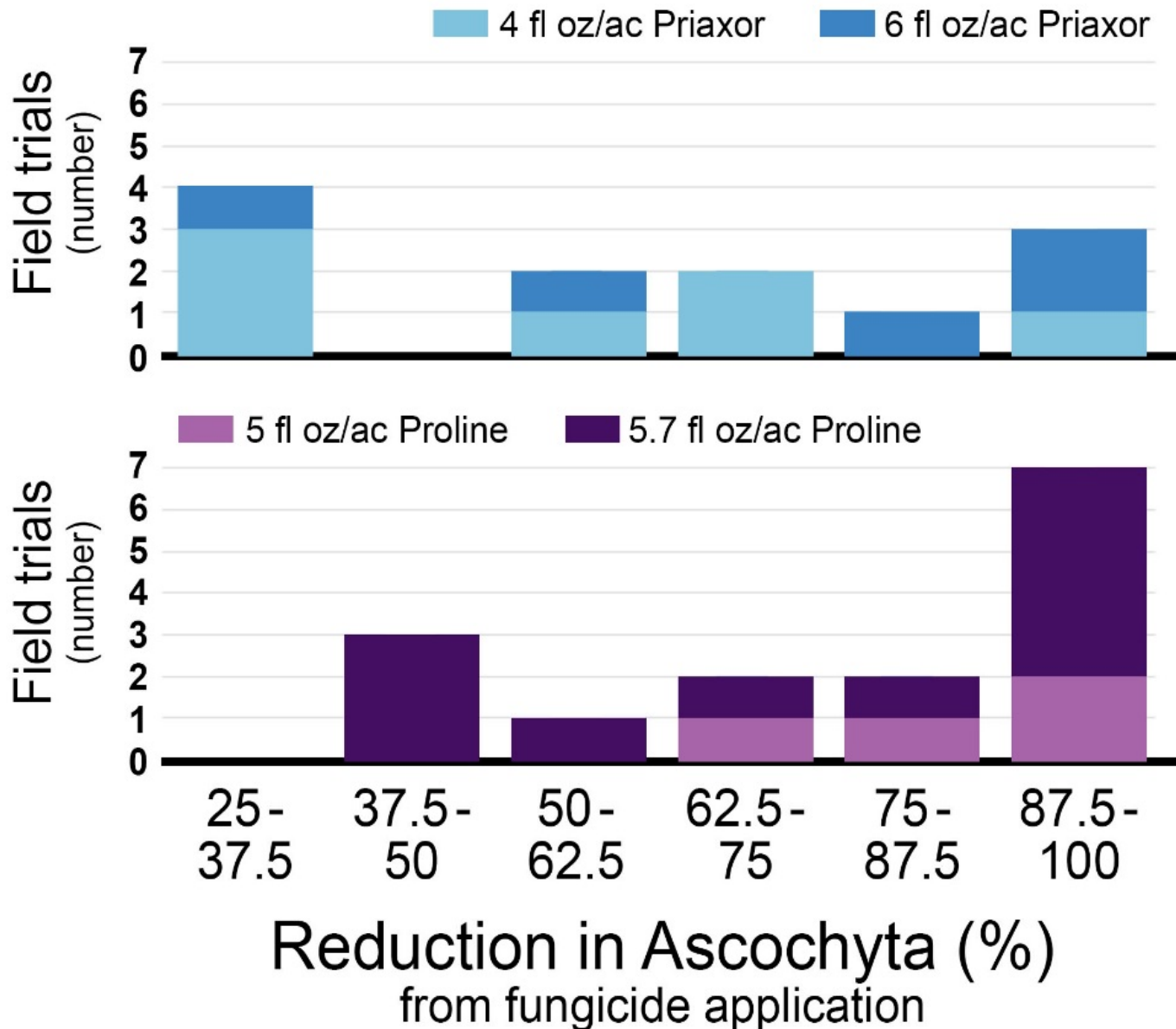
SDHI fungicides (FRAC 7) - Priaxor



Combined analysis across three field trials (Carrington and Williston, ND)

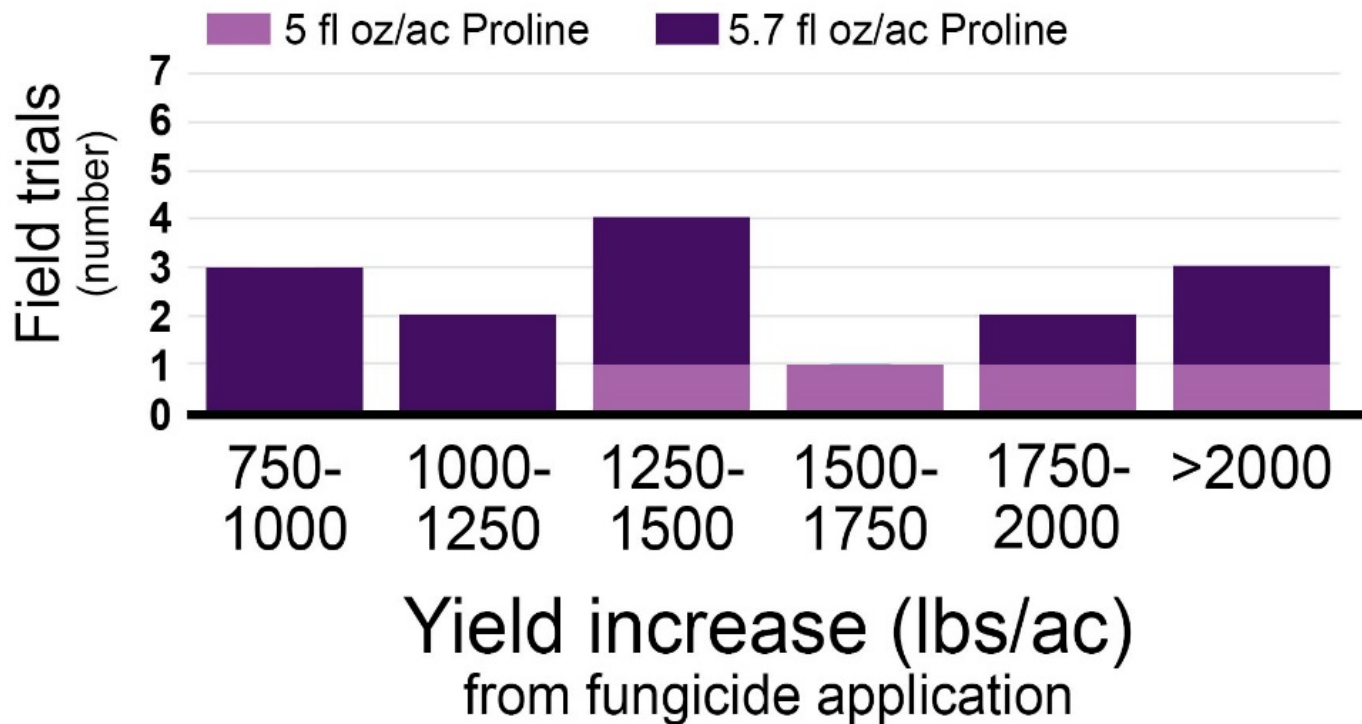
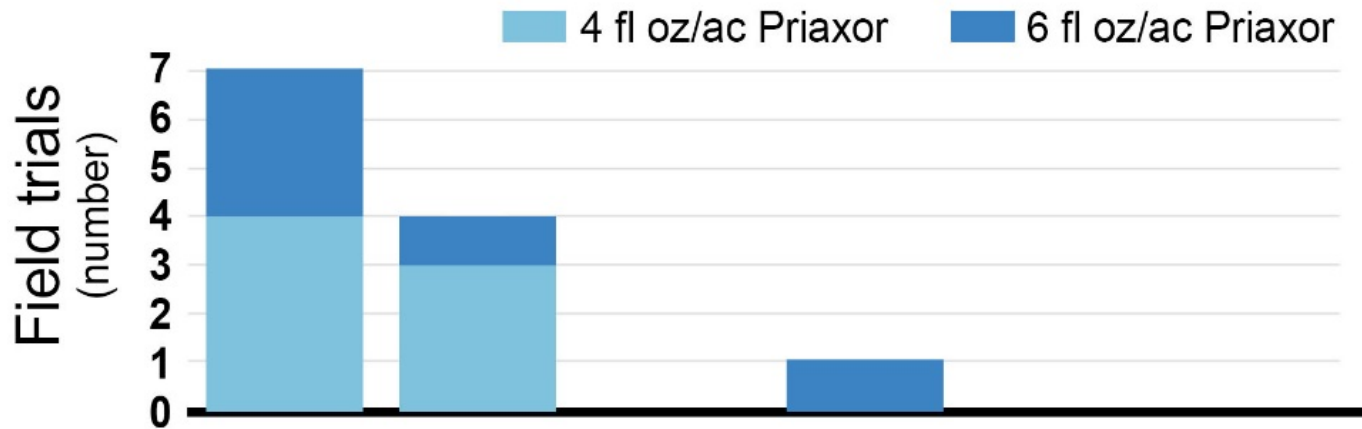
Fungicide efficacy – chickpea *Ascochyta*

SDHI fungicides (FRAC 7) - Priaxor



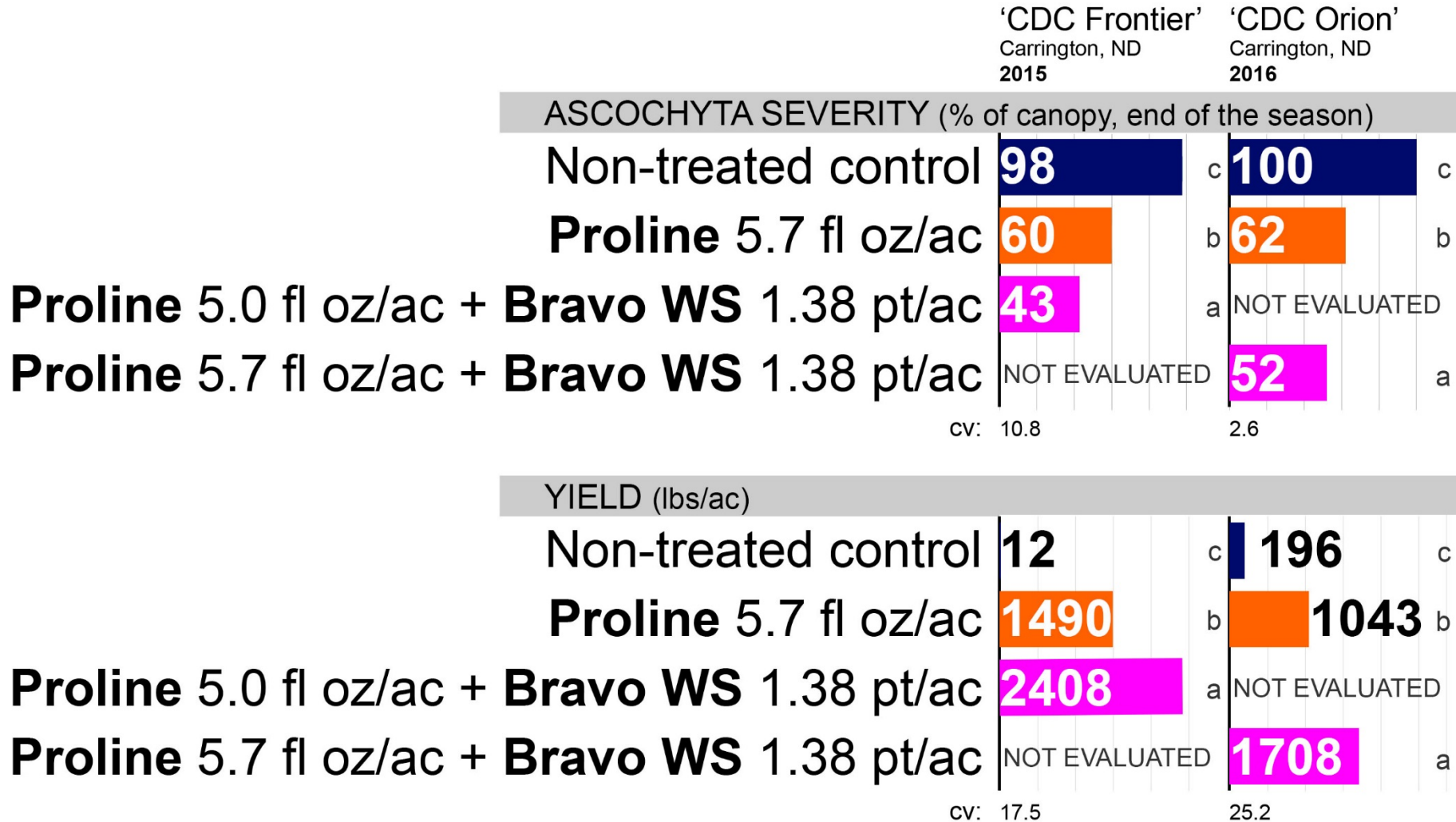
Fungicide efficacy – chickpea *Ascochyta*

SDHI fungicides (FRAC 7) - Priaxor



Fungicide efficacy – chickpea *Ascochyta*

FRAC M fungicide - chlorothalonil





Thank you!

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North Dakota Crop Protection Product Harmonization Board & Registration Board,
Northern Pulse Growers Association,
BASF, Arysta, Syngenta, Bayer, DuPont