Optimizing the agronomic performance of chickpeas under disease pressure

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Click on the “plant pathology” link

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

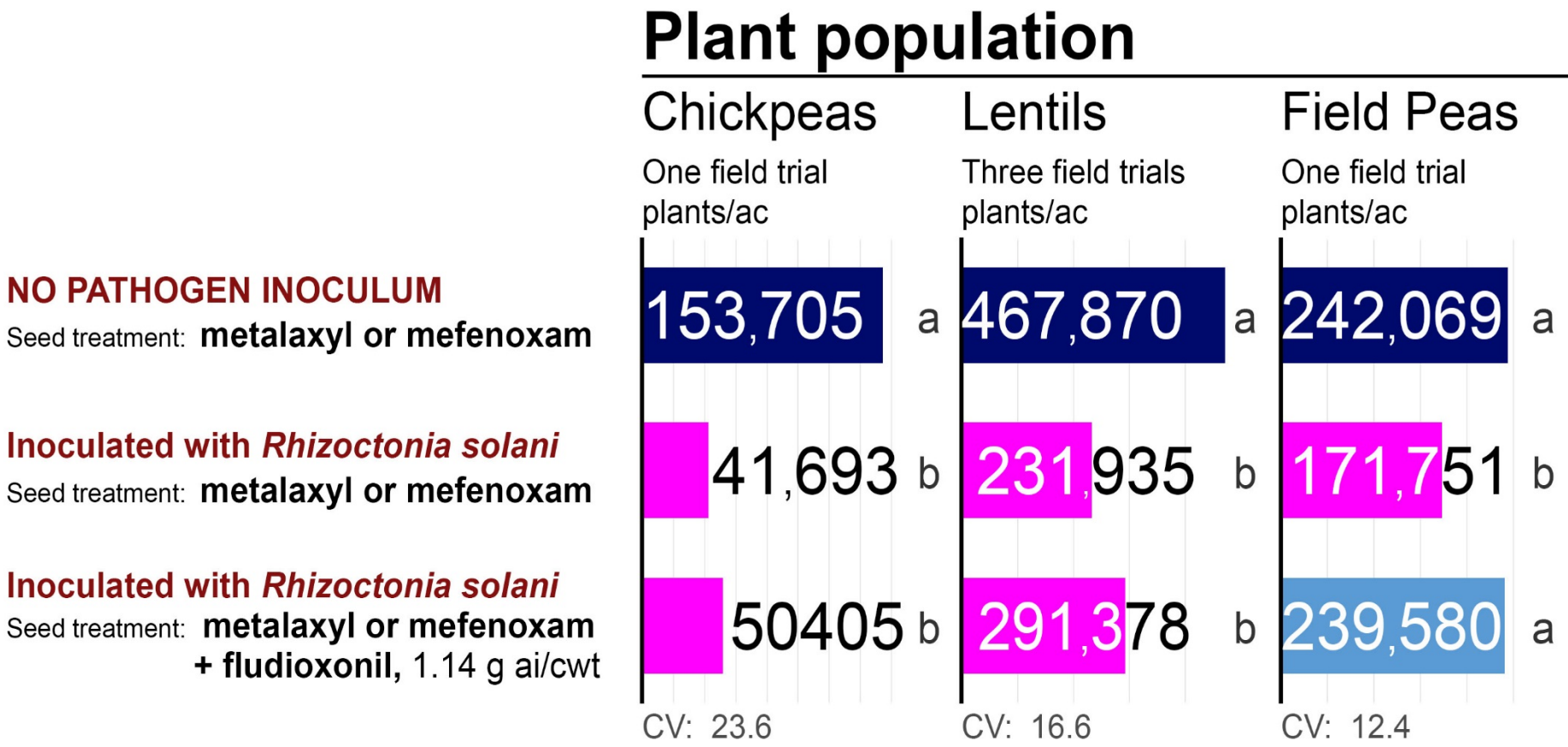
Rhizoctonia

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.



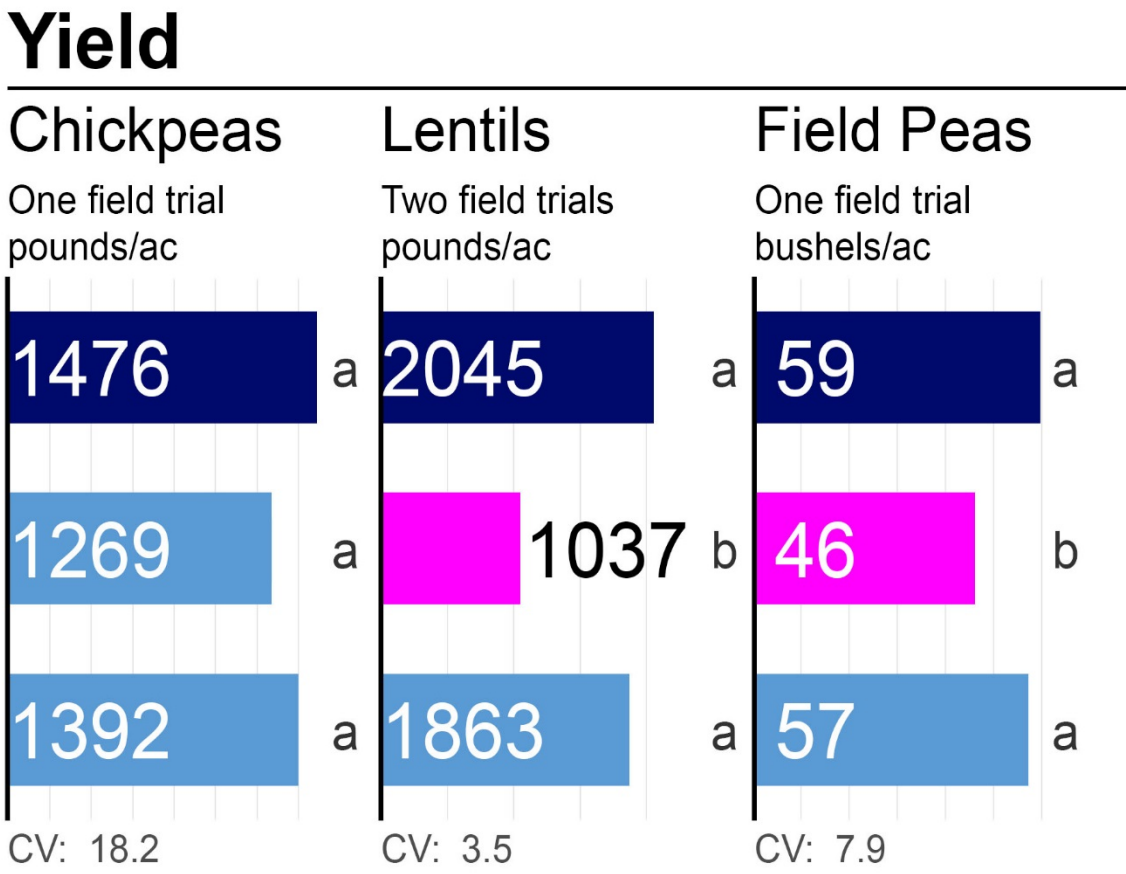
Rhizoctonia: efficacy of seed treatments

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

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

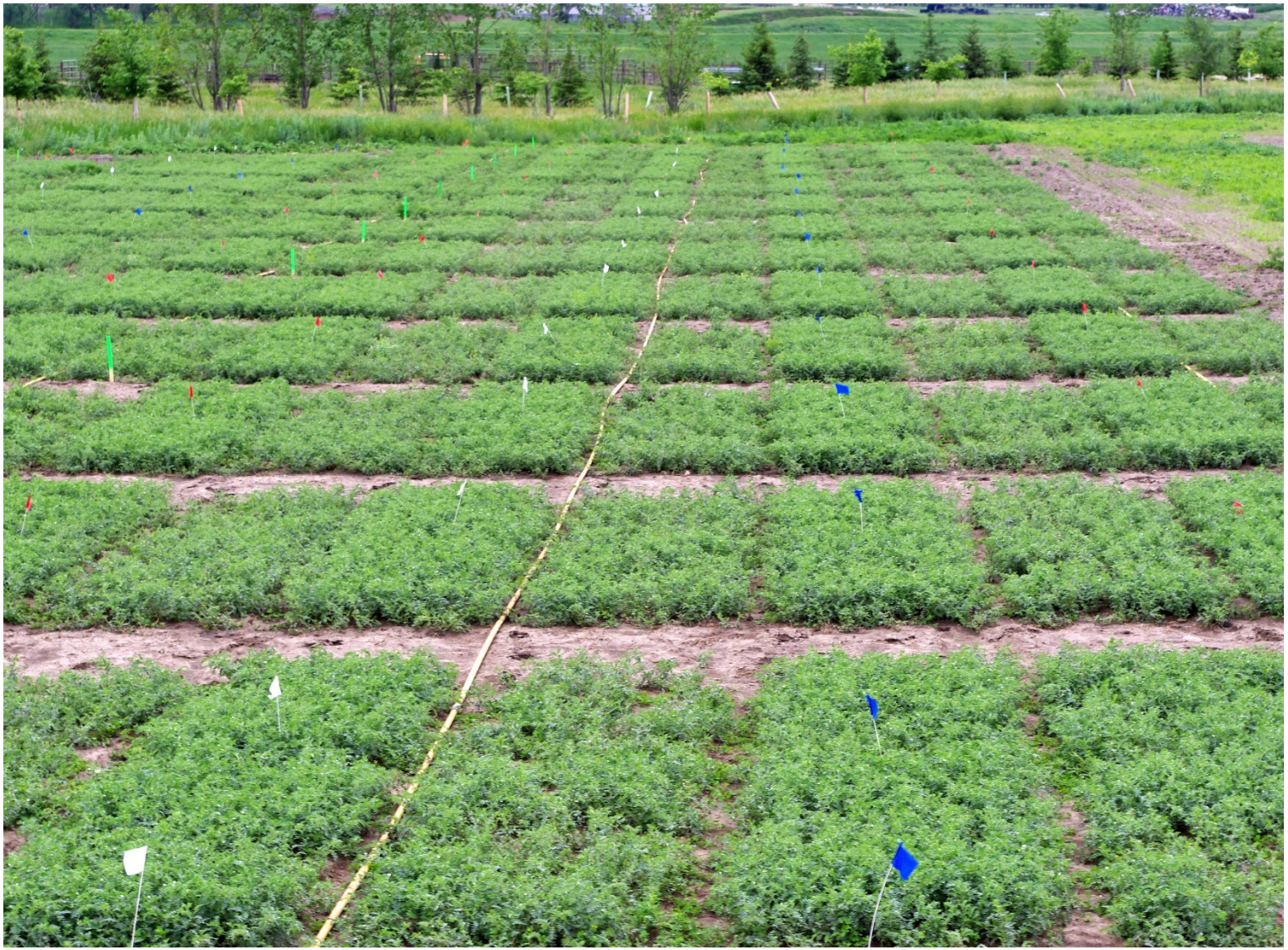


Impact of seed treatment with Apron Maxx RTA (5 fl oz/cwt).

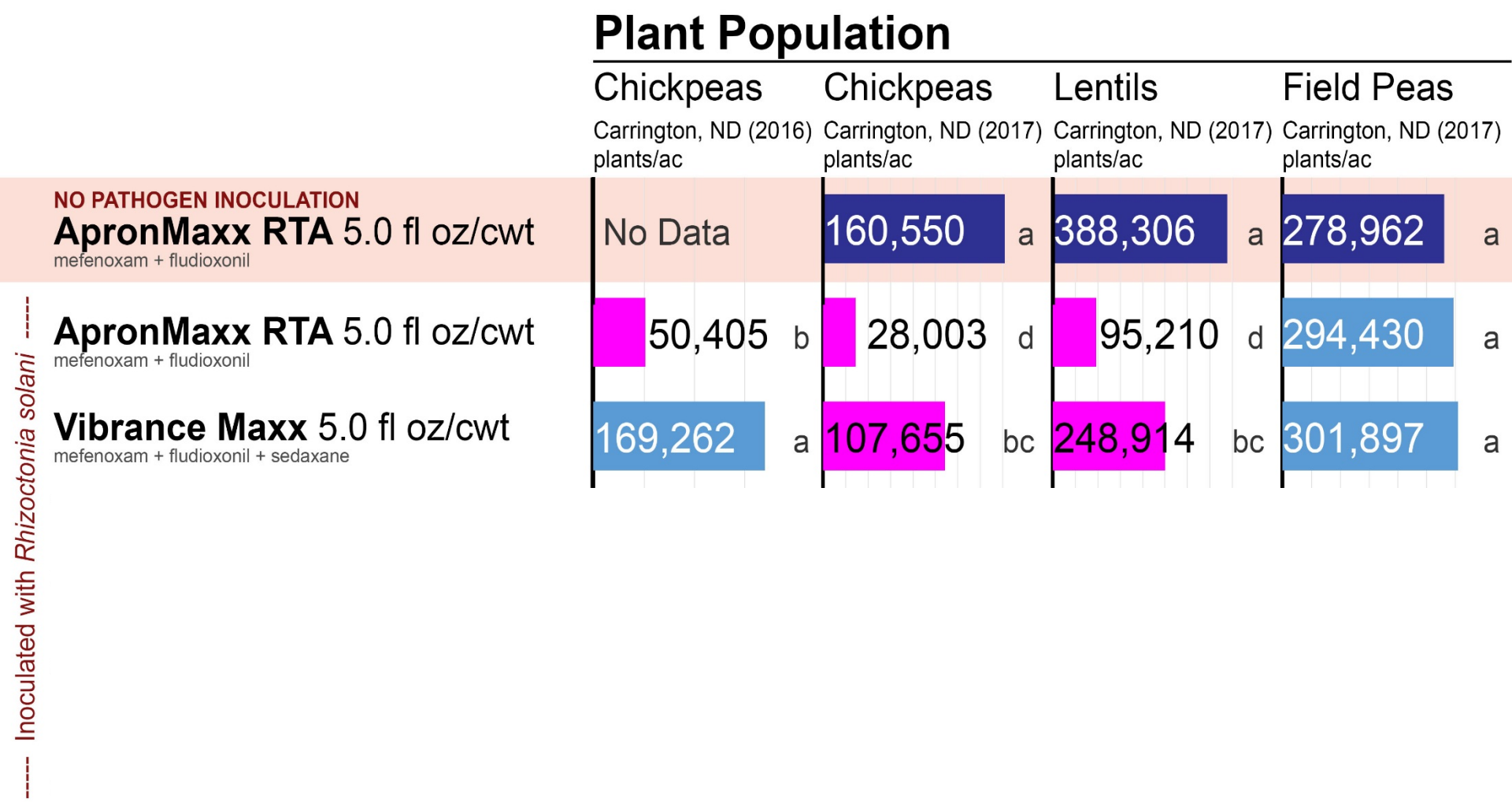
1.14 g fludioxonil + 1.69 g mefenoxam/cwt

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

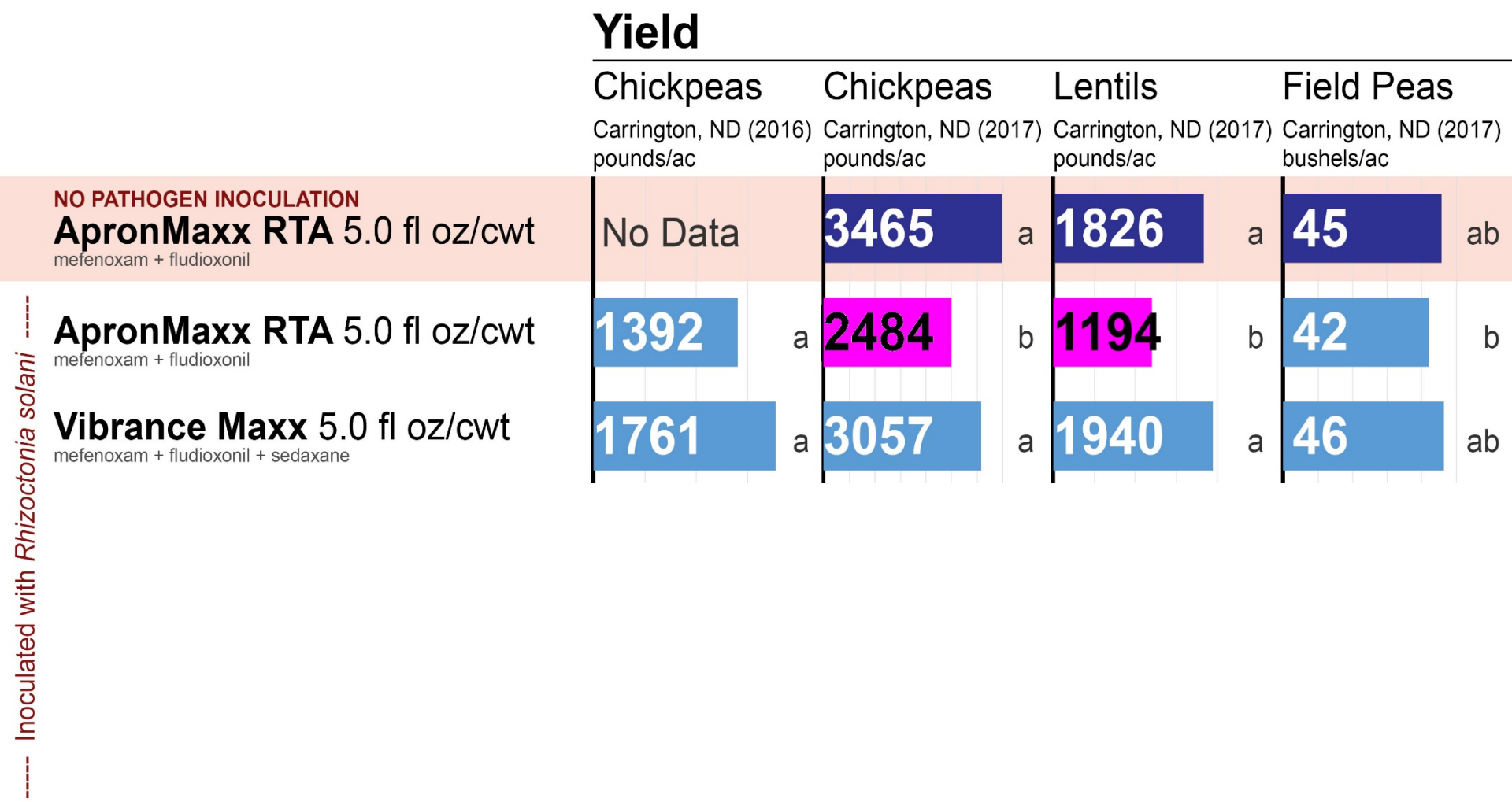
Carrington, ND (2017).



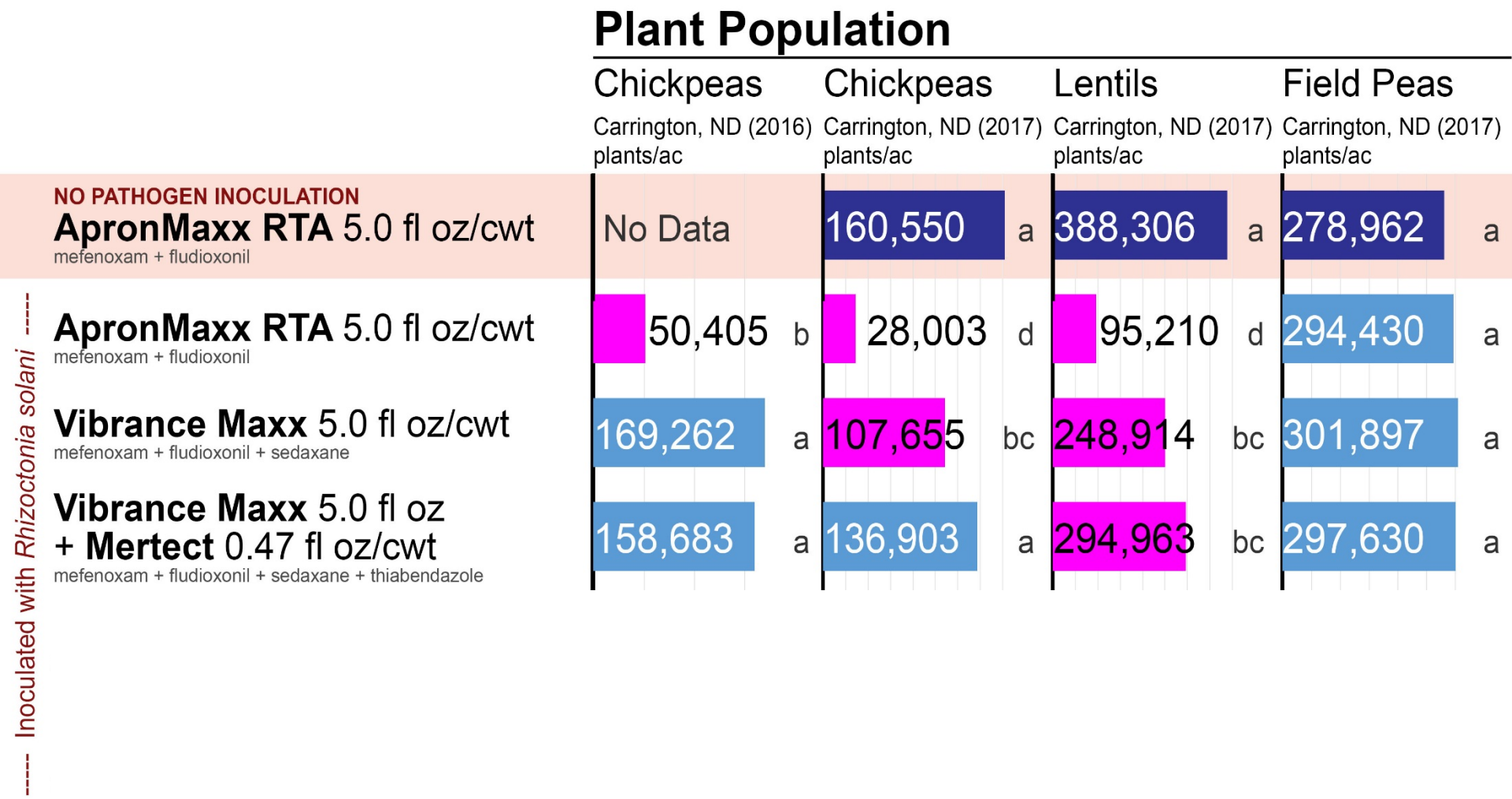
Rhizoctonia: efficacy of seed treatments



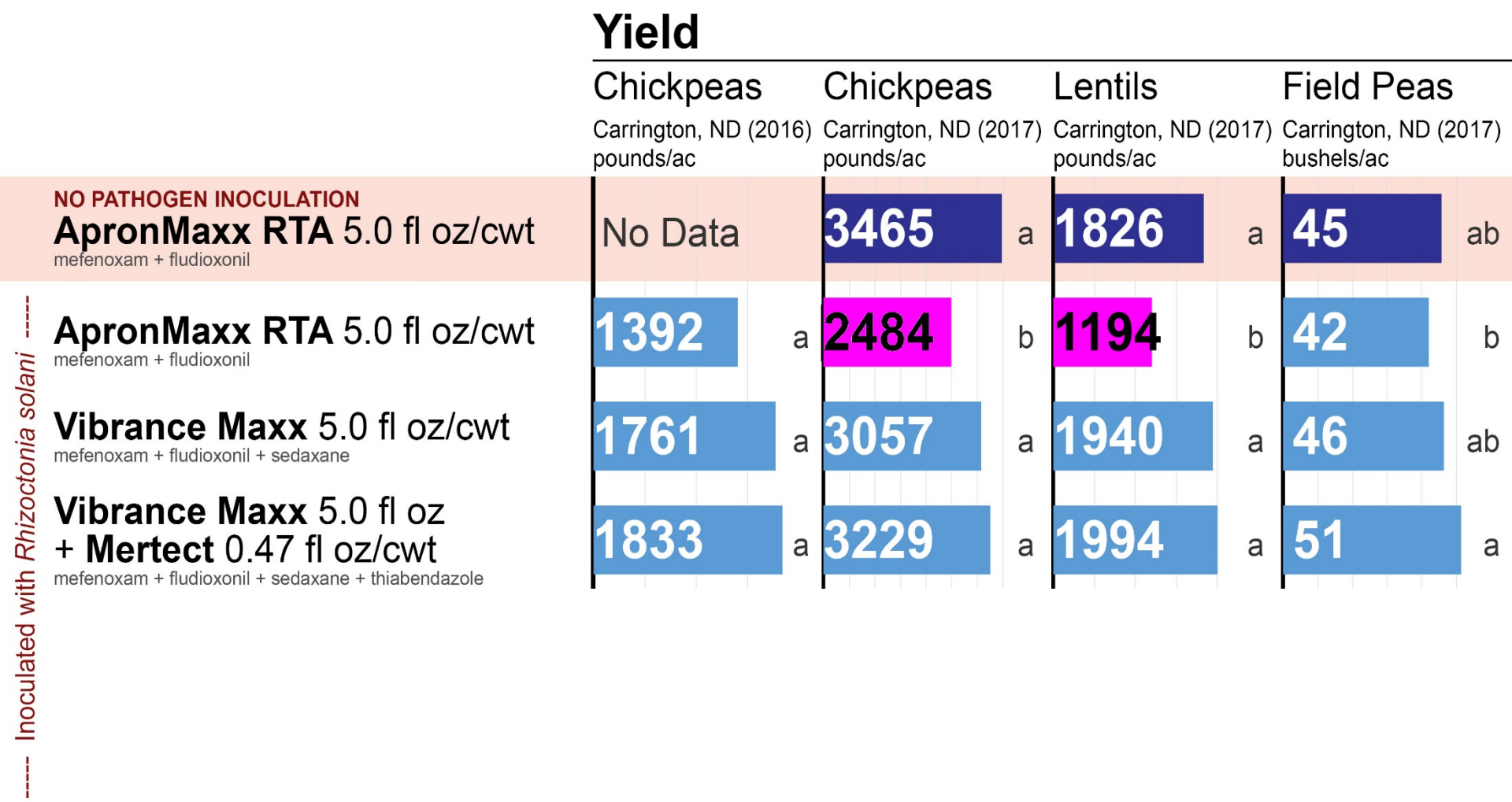
Rhizoctonia: efficacy of seed treatments



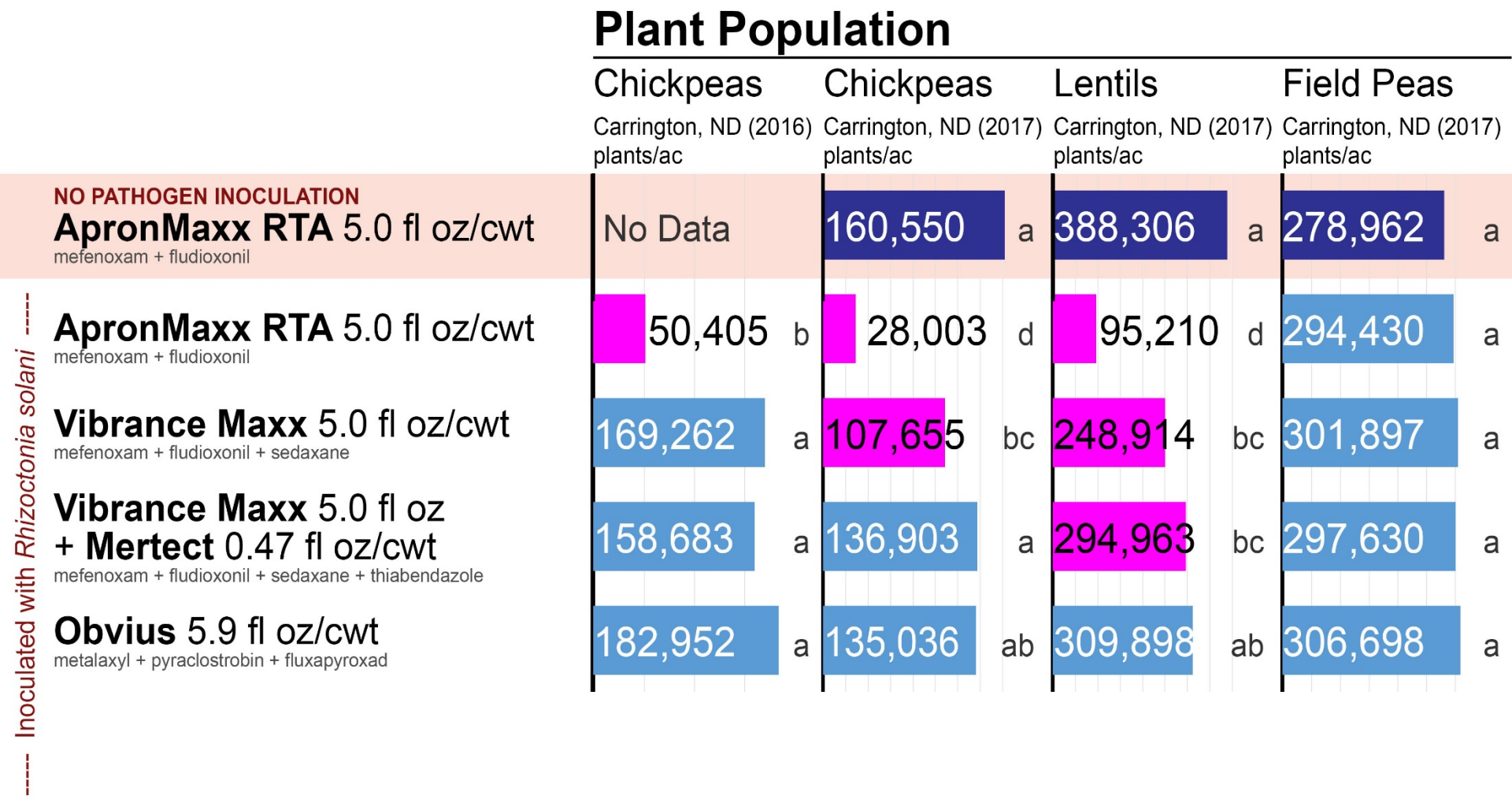
Rhizoctonia: efficacy of seed treatments



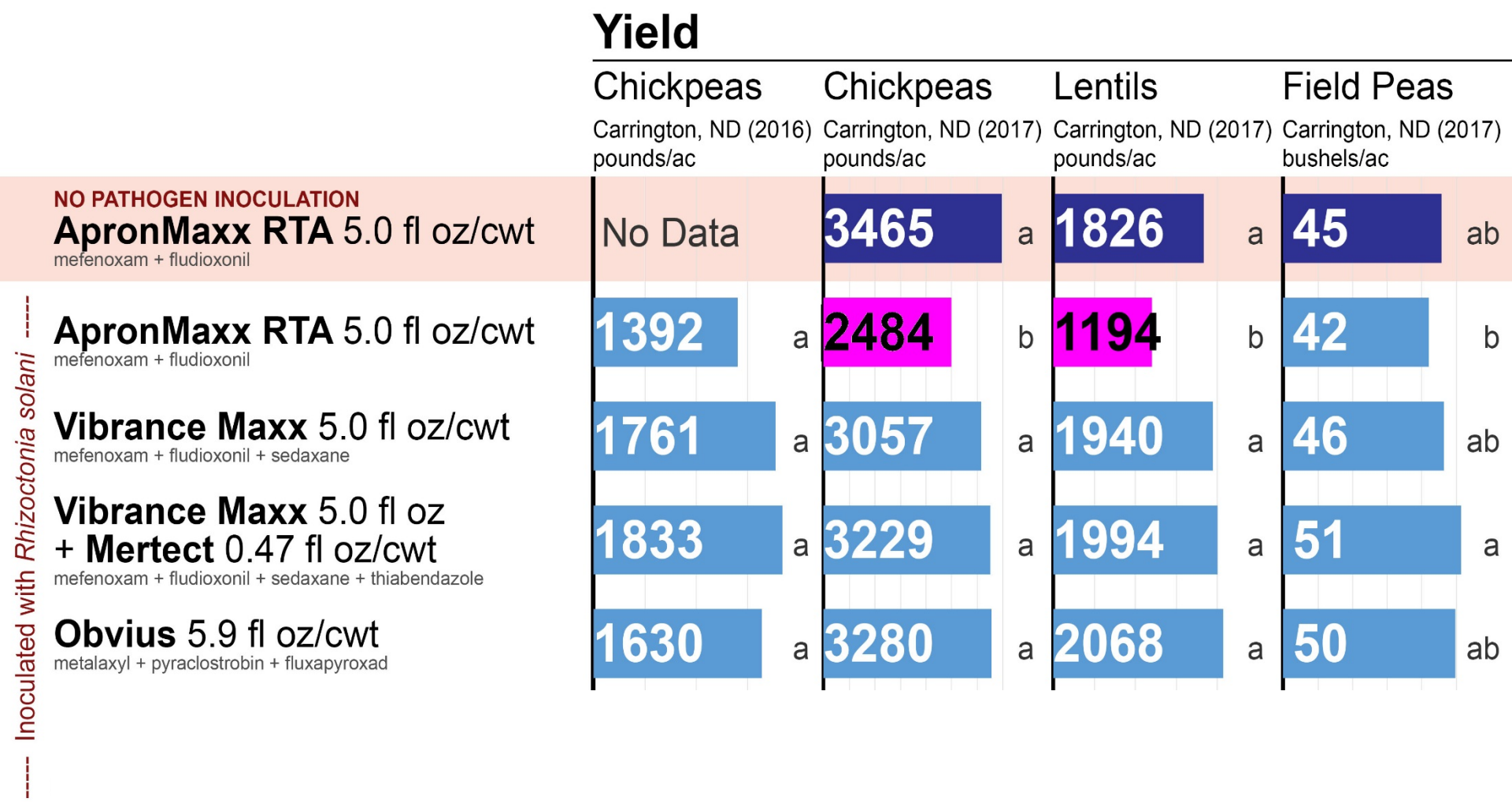
Rhizoctonia: efficacy of seed treatments



Rhizoctonia: efficacy of seed treatments



Rhizoctonia: efficacy of seed treatments



Ascochyta blight
of chickpeas

1. Sources of Ascochyta disease outbreaks

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



Review

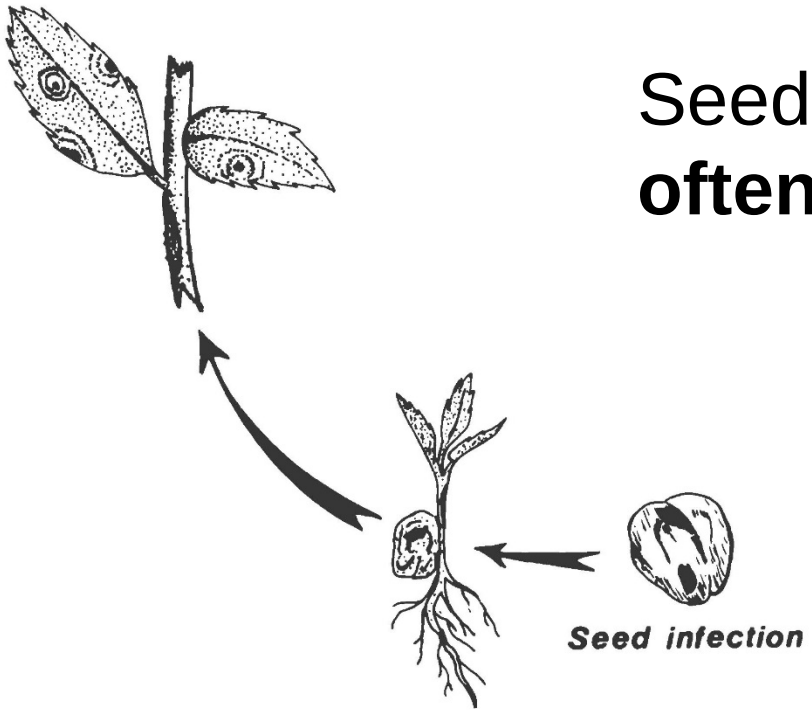
Etiology – Ascochyta of lentils, field peas, and chickpeas

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.



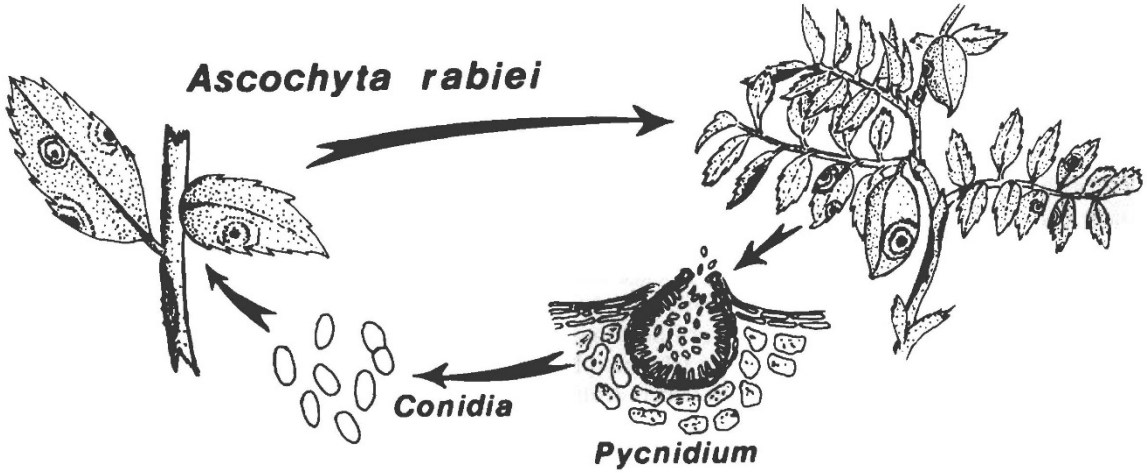
Seeds within diseased pods are **often infected with Ascochyta**

Illustration adapted from Kaiser 1997 Can. J. Plant Pathology 19(2):214-224

Local, in-season movement of Ascochyta

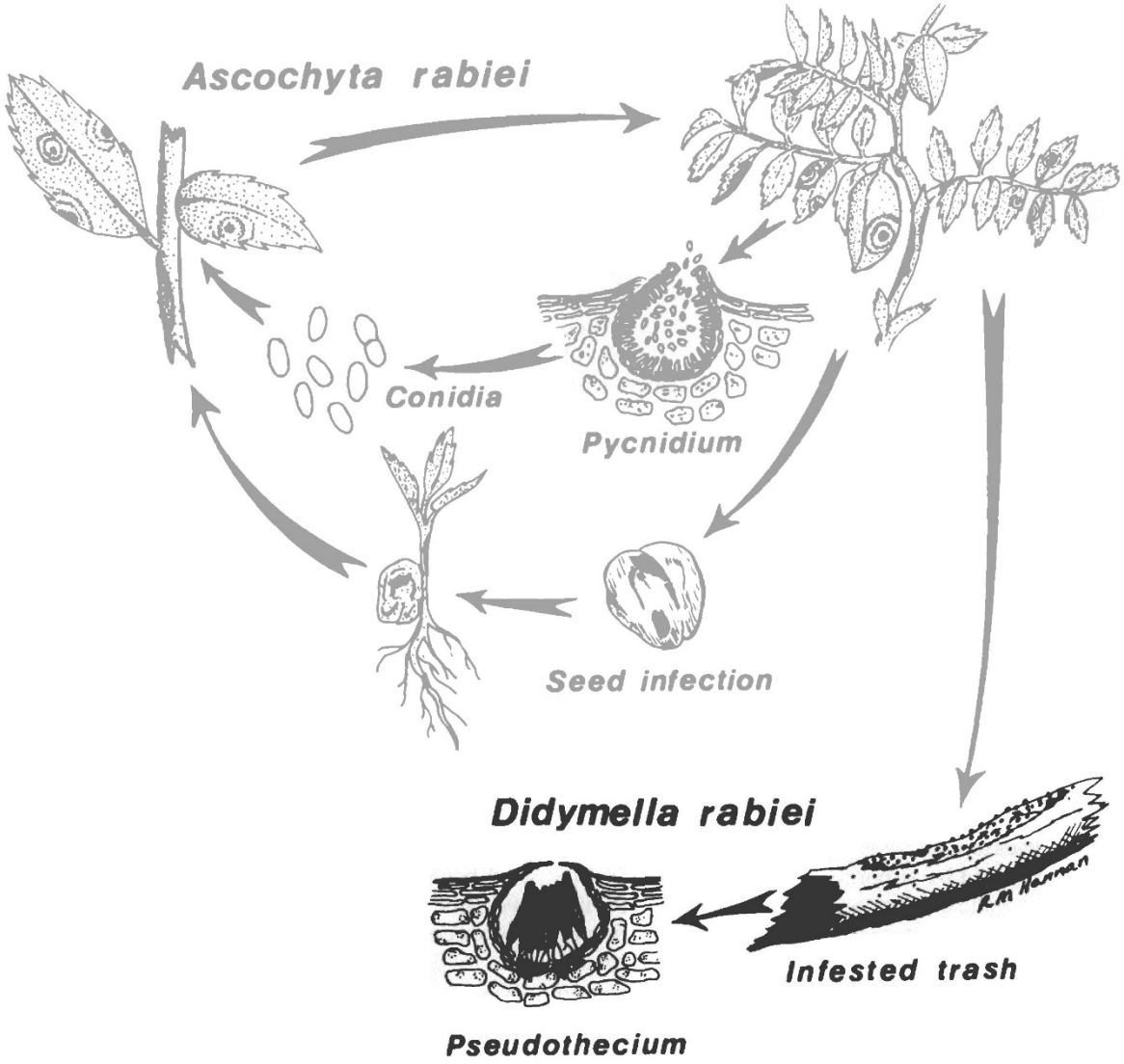
Spores produced on diseased tissue

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**

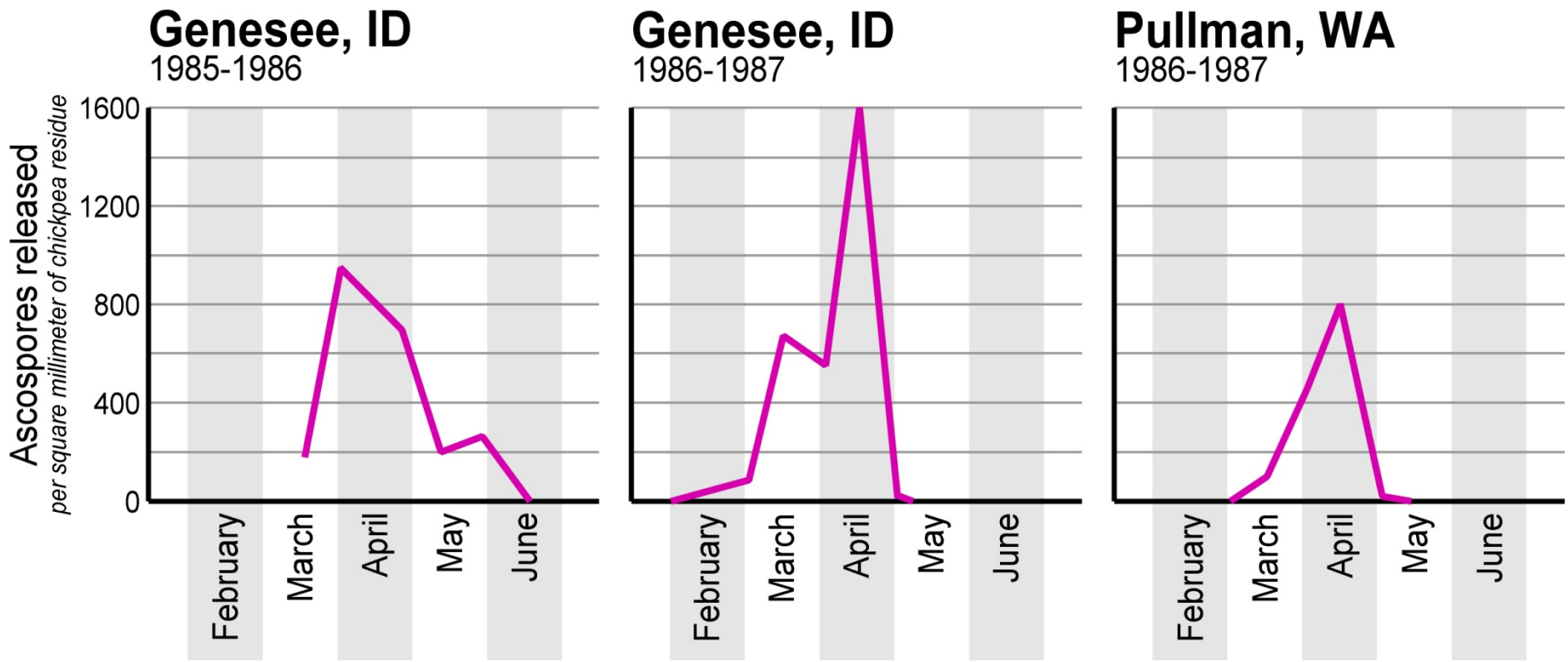
Illustration: Kaiser 1997 Can. J. Plant Pathology 19(2):214-224

Long-distance movement of Ascochyta

Spores produced on overwintered crop residues

The release of ascospores from overwintered residues can be significant:

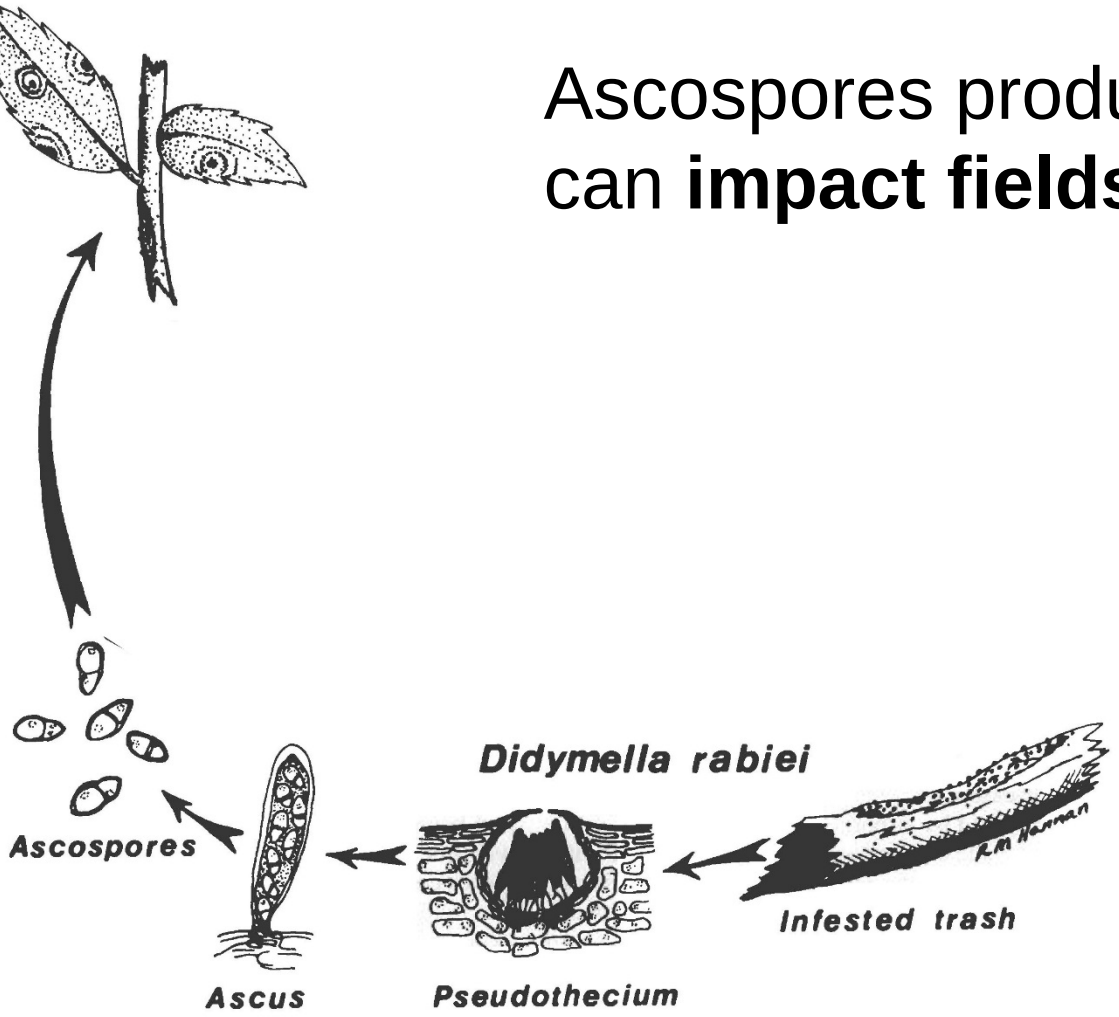
200-1,600 ascospores/mm^2 per day recorded in Pacific NW



Trapero-Casas and Kaiser 1992. **Phytopathology** 82:1261-1266.

Long-distance movement of Ascochyta

Spores produced on overwintered crop residues



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

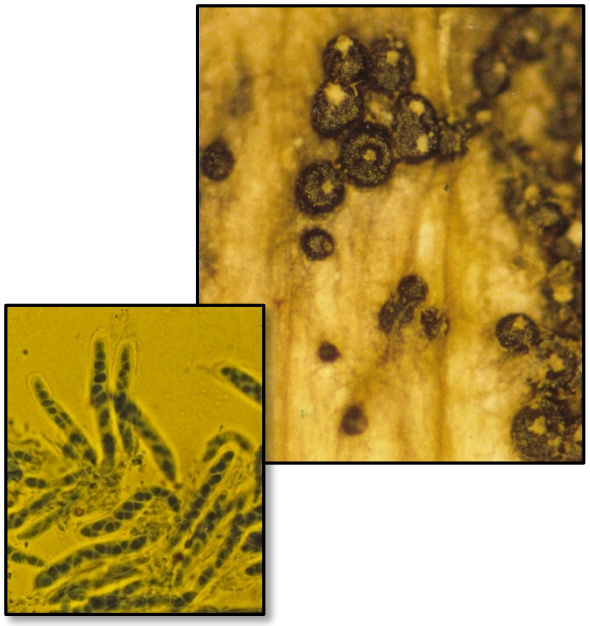


Illustration and images: Kaiser 1997 Can. J. Plant Pathology 19(2):214-224

Long-distance movement of Ascochyta

The experience from Washington and Idaho

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

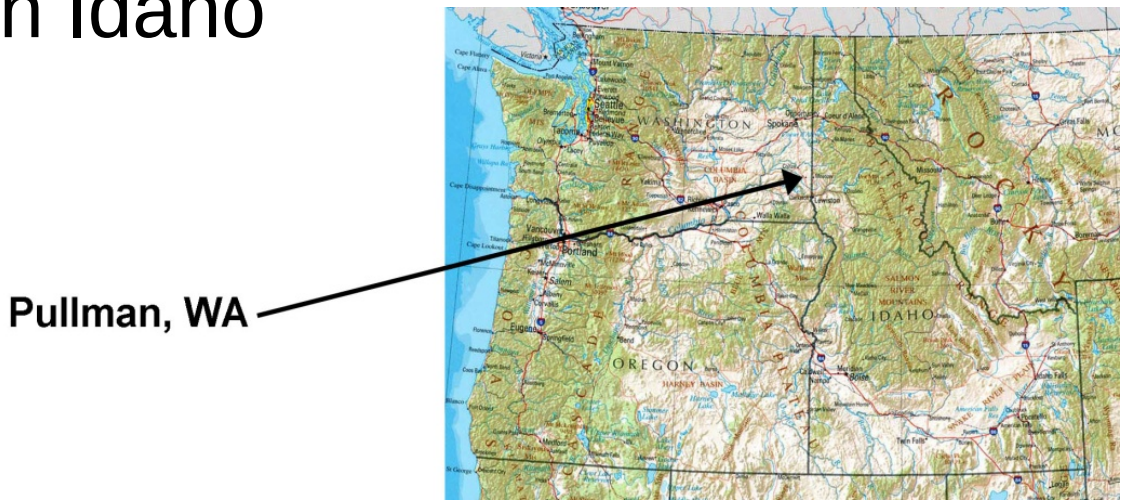
1983: Ascochyta blight observed in chickpea variety trials in Pullman, WA

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

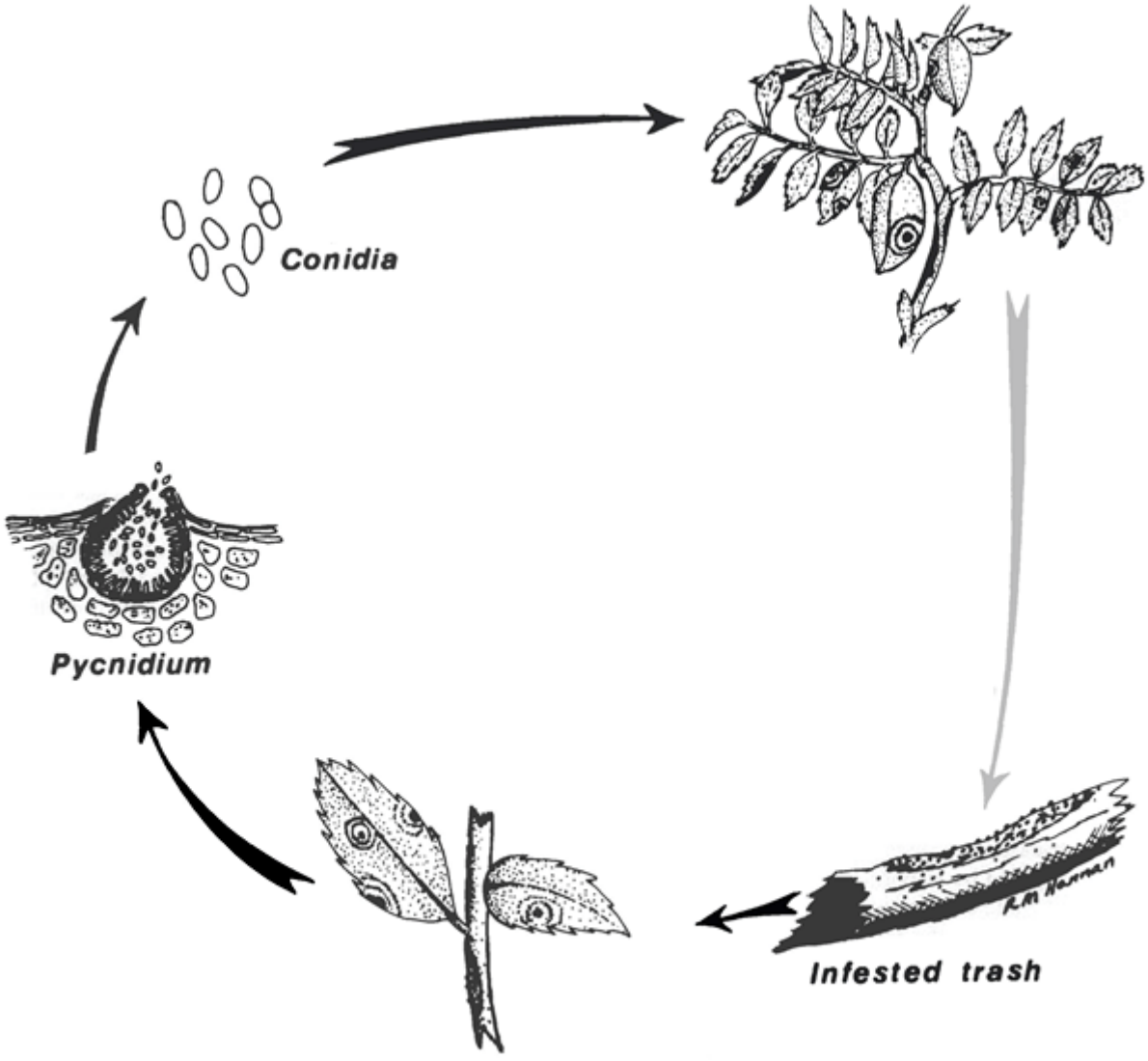
1984: Ascochyta blight observed in 23 of 30 commercial chickpea production fields in northern Idaho



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

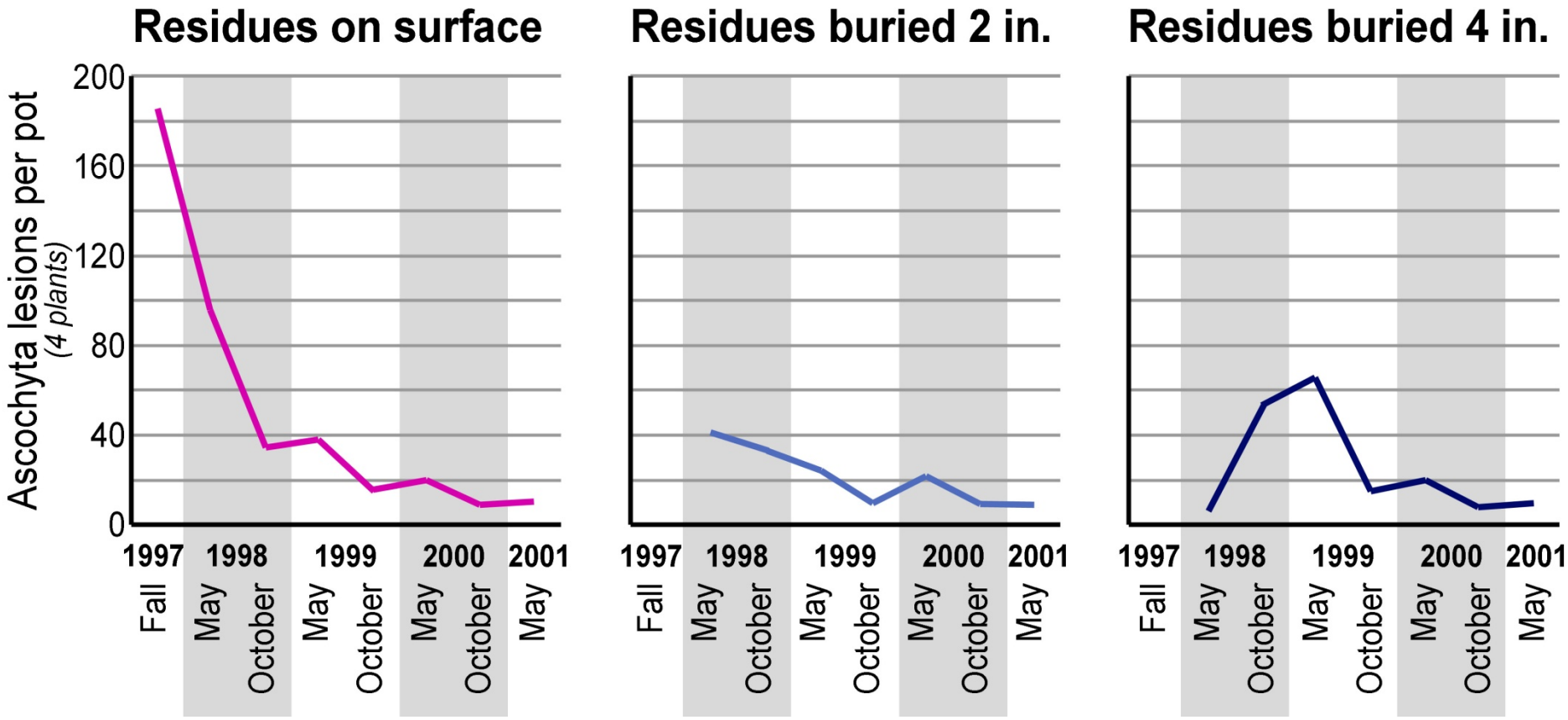
Illustration adapted from Kaiser 1997 Can. J. Plant Pathology 19(2):214-224

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*



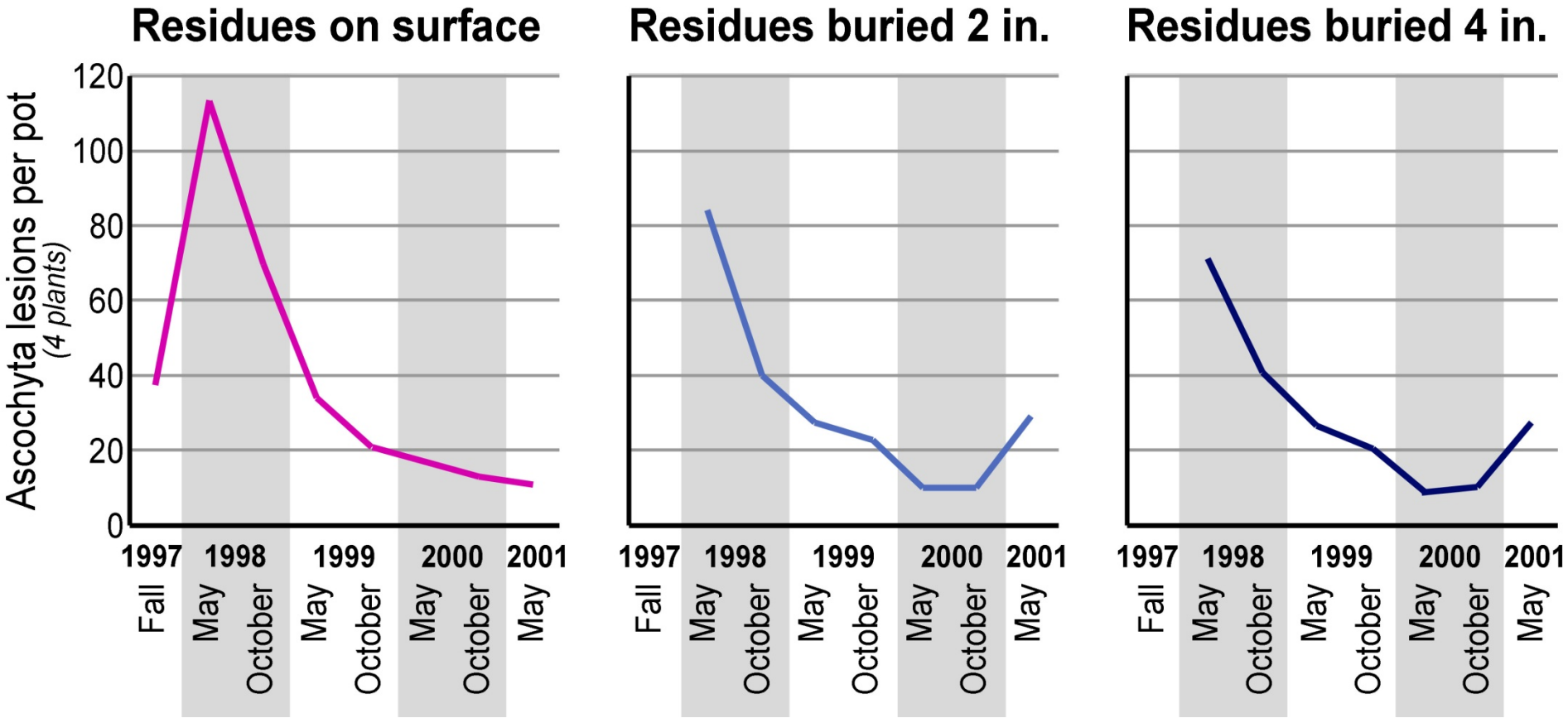
Gossen & Miller 2004. **Canadian Journal of Plant Pathology** 26:142-147.

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*



Gossen & Miller 2004. **Canadian Journal of Plant Pathology** 26:142-147.

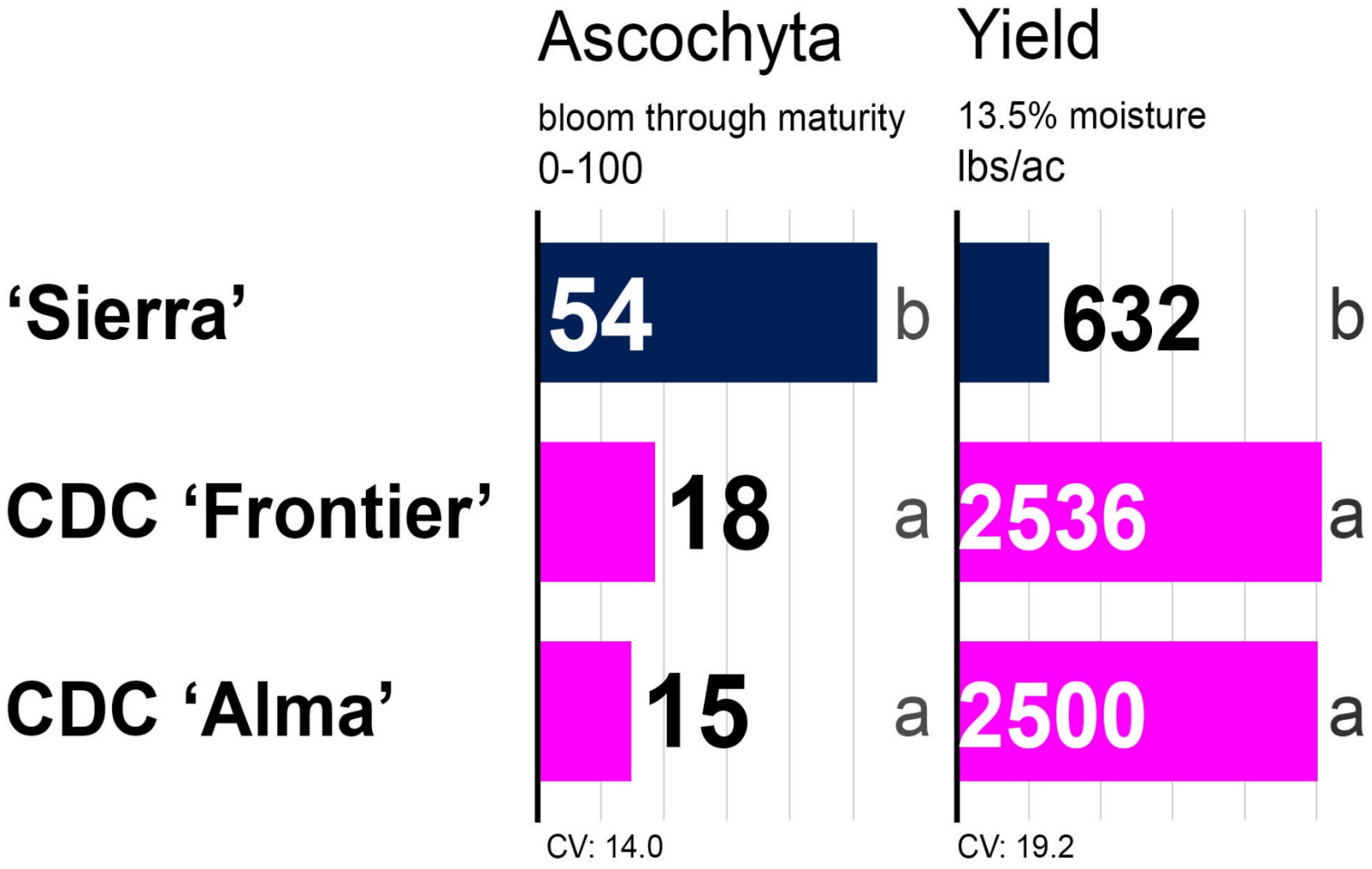
Ascochyta blight management

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.)

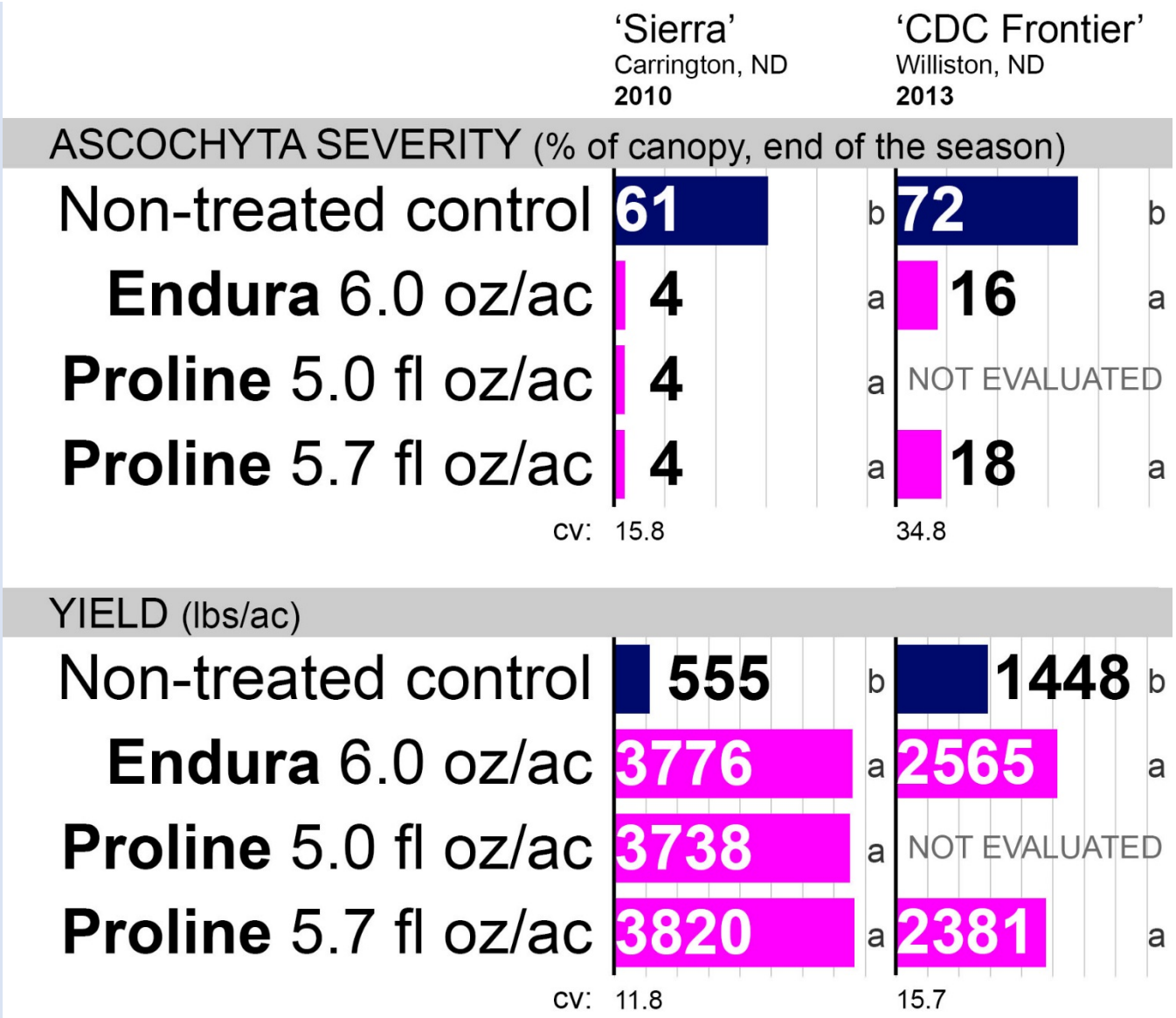
Fungicide efficacy – chickpea Ascochyta

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



DATA: M. Wunsch, T. Tjelde, B. Schatz; **NDSU Carrington and Williston Research Extension Centers**

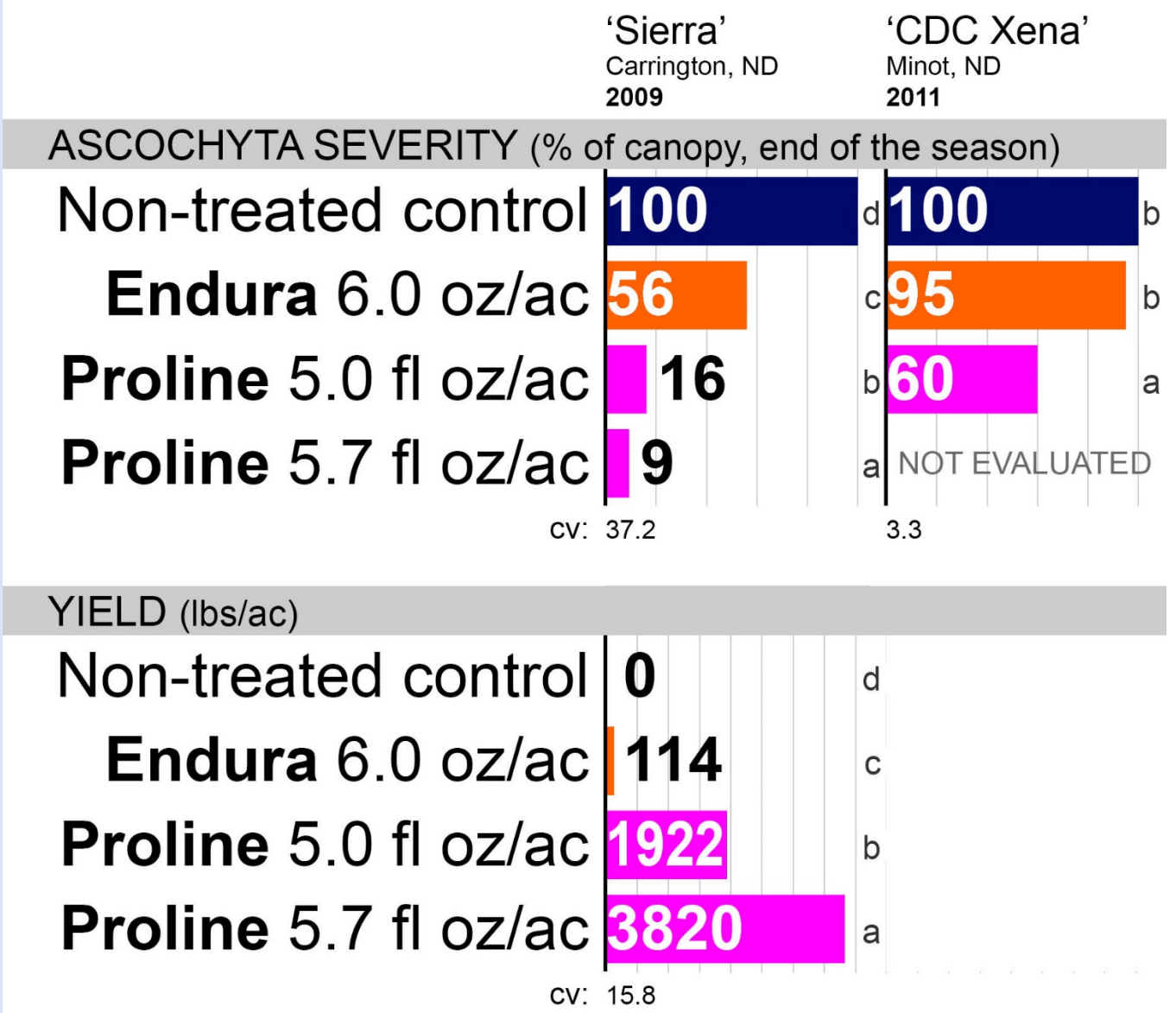
Fungicide efficacy – chickpea Ascochyta

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



DATA: B. Schatz, E. Aberle, M. Wunsch, J. Pederson; **NDSU Carrington and North Central Research Extension Centers**

Fungicide efficacy – chickpea Ascochyta

SDHI fungicides (FRAC 7) - Priaxor

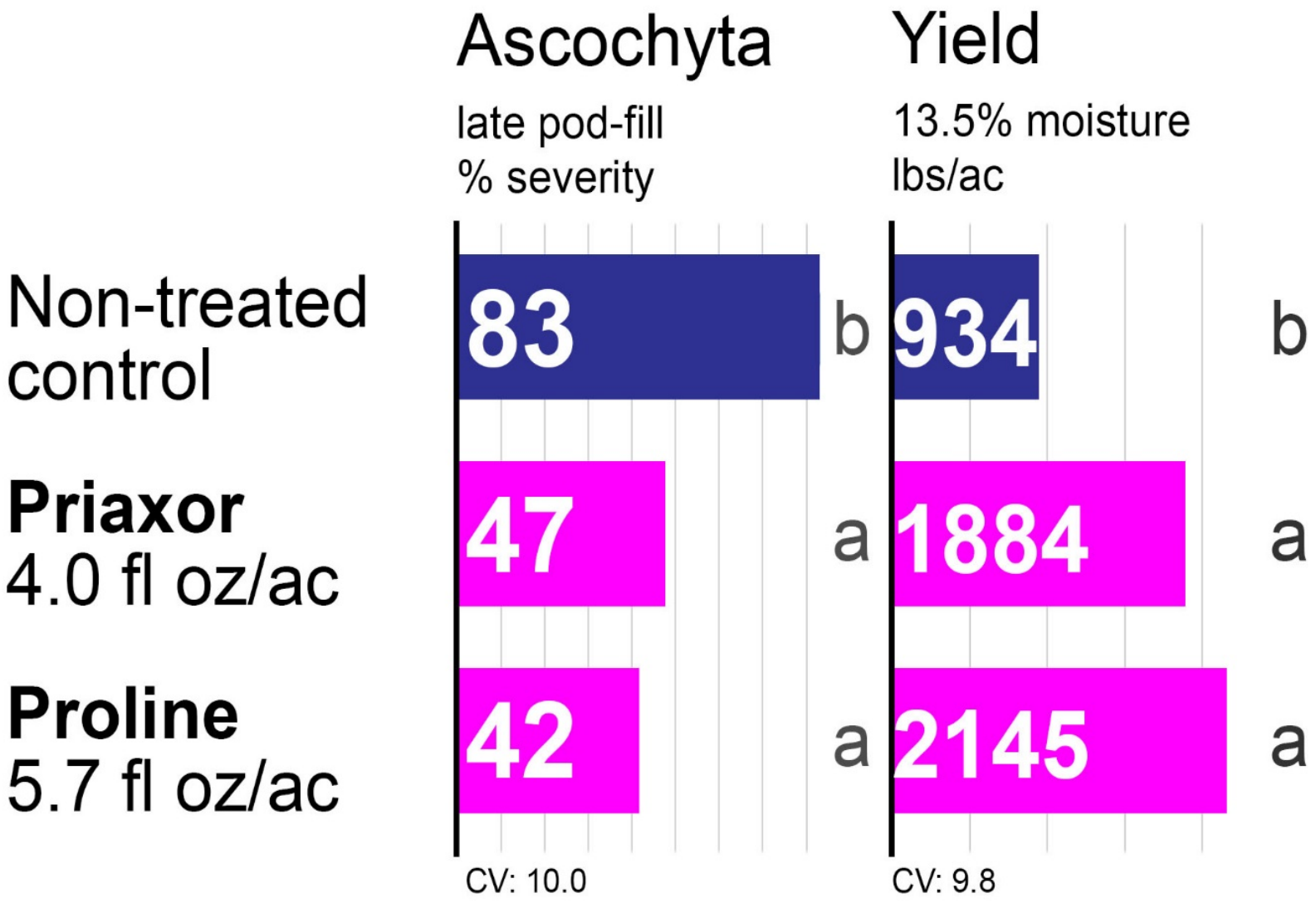
Due to QoI resistance,
Priaxor is essentially a SDHI fungicide when applied to chickpeas to manage Ascochyta blight.

Active ingredients in Priaxor:

- pyraclostrobin (QoI)
- fluxapyroxad (SDHI)

Fungicide efficacy – chickpea Ascochyta

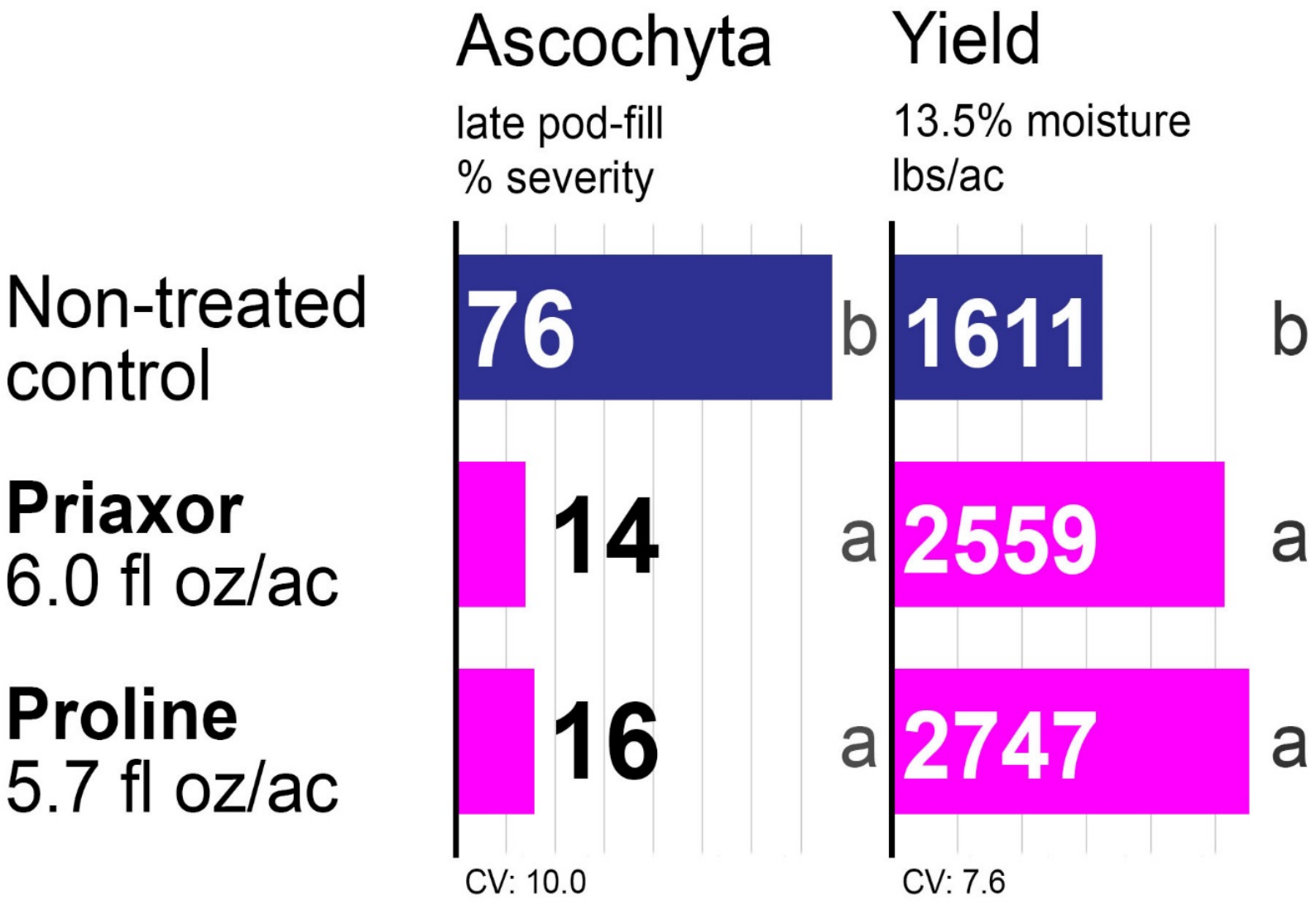
SDHI fungicides (FRAC 7) - Priaxor



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

Fungicide efficacy – chickpea Ascochyta

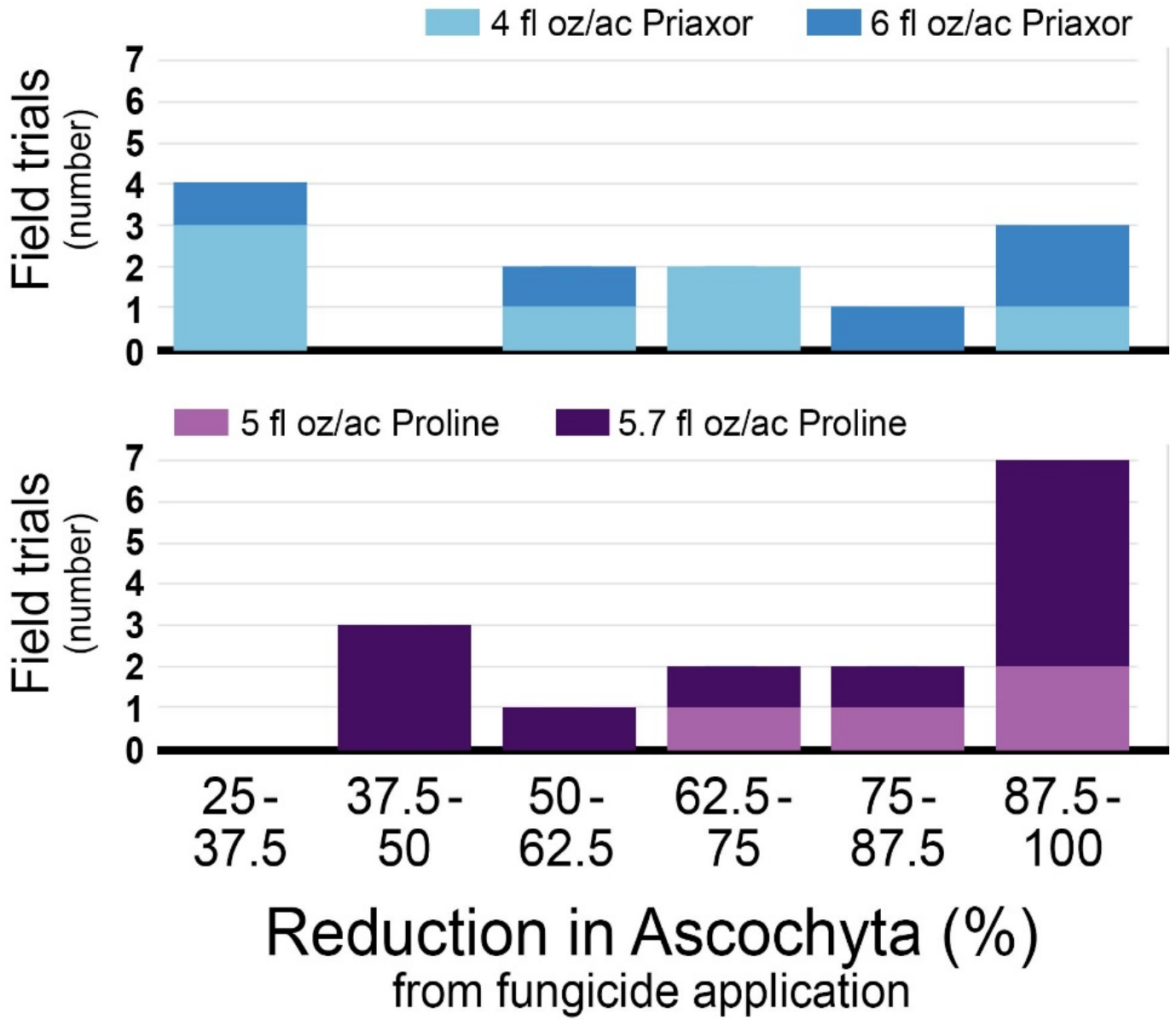
SDHI fungicides (FRAC 7) - Priaxor



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

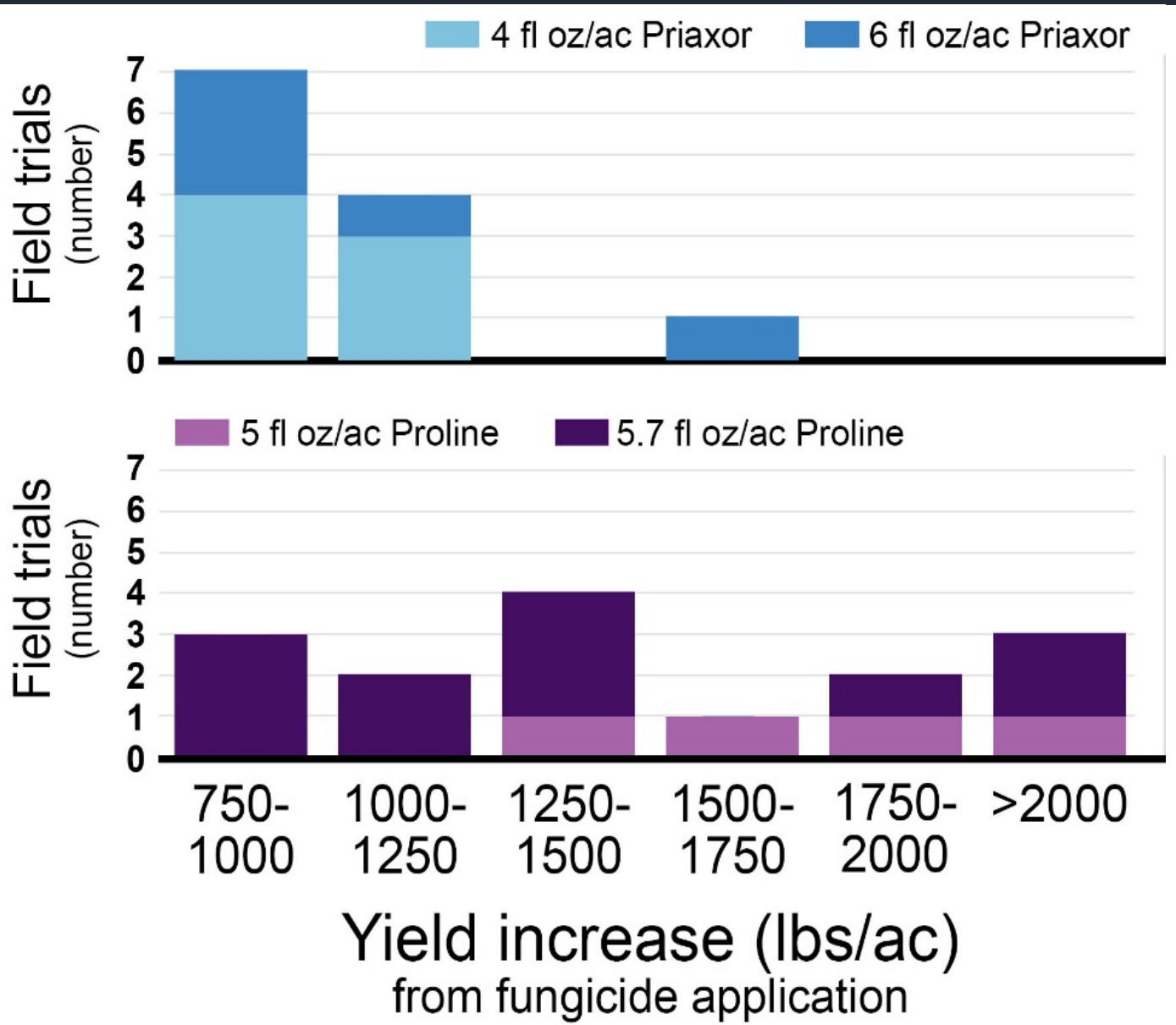
Fungicide efficacy – chickpea Ascochyta

SDHI fungicides (FRAC 7) - Priaxor



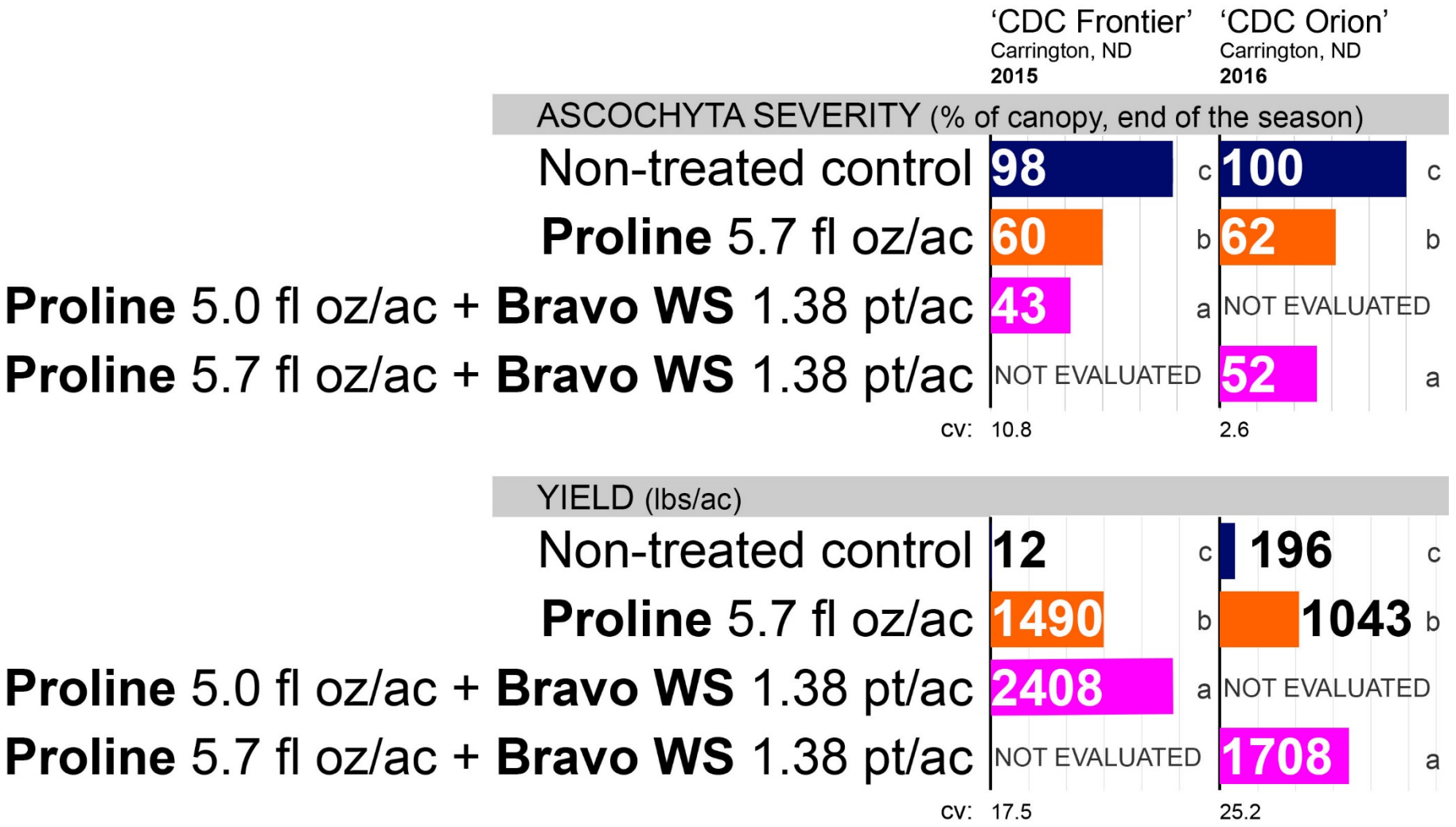
Fungicide efficacy – chickpea Ascochyta

SDHI fungicides (FRAC 7) - Priaxor



Fungicide efficacy – chickpea Ascochyta

FRAC M fungicide - chlorothalonil



DATA: Michael Wunsch, Michael Schaefer, Suanne Kallis, and Billy Kraft; **NDSU Carrington Research Extension Center**

Thank you!

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