

Comparative efficacy of fungicides for managing *Ascochyta* blight in chickpeas: **PREMIX FUNGICIDES and OTHER MODES OF ACTION**

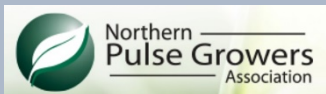
A comprehensive review of 45 chickpea *Ascochyta* fungicide efficacy studies conducted across North Dakota from 2007 to 2019.



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BASF, DuPont, Arysta LifeScience, and Syngenta



Comparative efficacy of fungicides for managing Ascochyta blight in chickpeas:

3. SDHI + DMI PREMIX FUNGICIDES (FRAC 7 + 3)

Including fungicides with primary FRAC 7 + 3 modes of action

MIRAVIS TOP: registered at 13.7 fl oz/ac

active ingredients: pydiflumetofen (FRAC 7) + difenoconazole (FRAC 3)

Efficacy at 13.7 fl oz/ac: **good to very good**

REVYTEK: registration anticipated in 2021 at 8.0 to 10.0 fl oz/ac

active ingredients: fluxapyroxad (FRAC 7) + mefentrifluconazole (FRAC 3) + pyraclostrobin (FRAC 11)

Efficacy at 8.0 fl oz/ac: **good to very good** Efficacy at 10.0 fl oz/ac: **very good**

APROVIA TOP: registered at 10.5-11.0 fl oz/ac

active ingredients: benzovindiflupyr (FRAC 7) + difenoconazole (FRAC 3)

Not enough data to rigorously assess efficacy

PROPULSE: registered at 8.0 to 13.6 fl oz/ac

active ingredient: fluopyram (FRAC 7) + prothioconazole (FRAC 3)

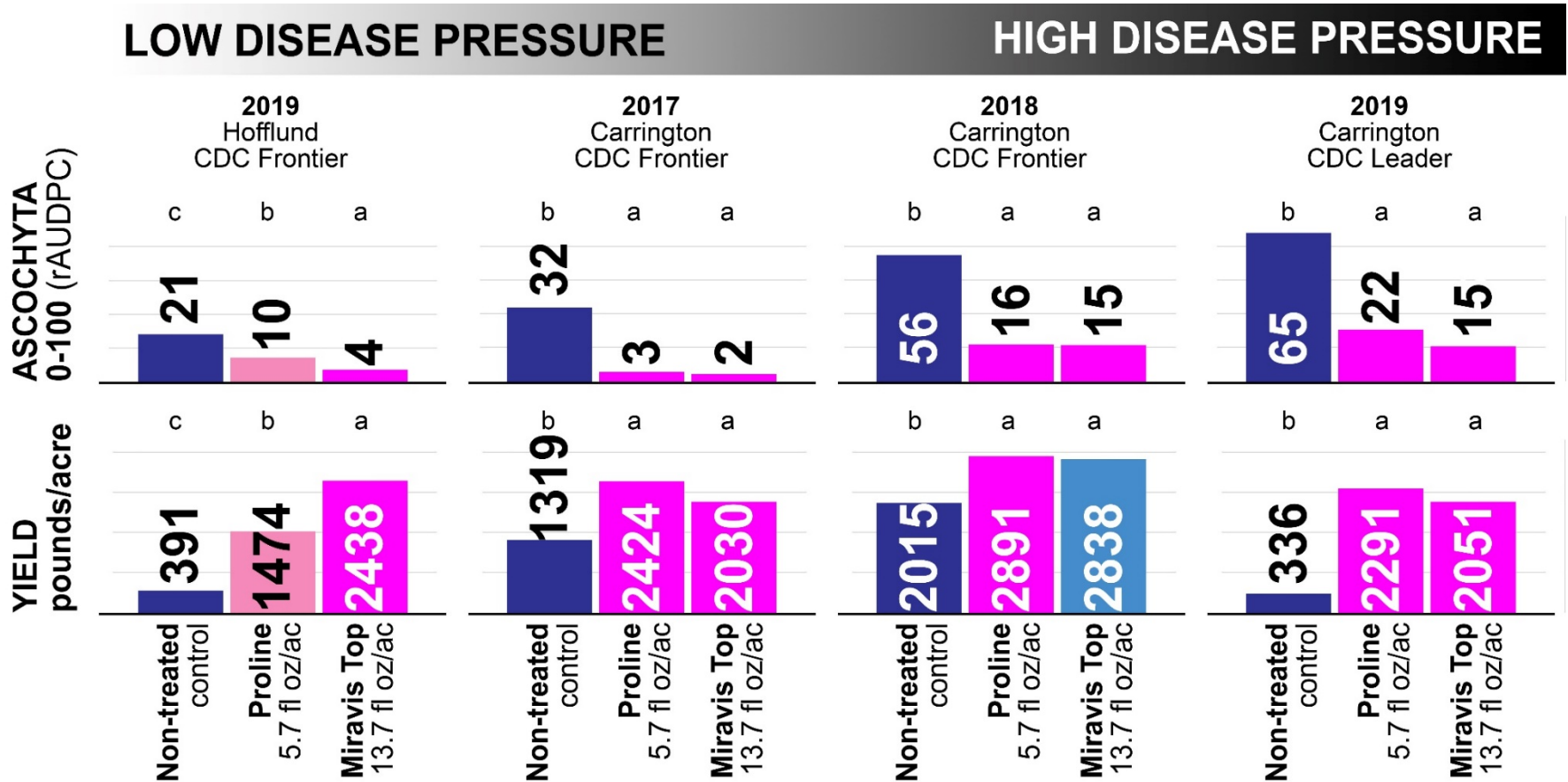
Not enough data to rigorously assess efficacy

Fungicide efficacy, chickpea *Ascochyta* – SDHI + DMI (FRAC 7 + 3) premix fungicides:

Miravis Top, 13.6 fl oz/ac

MIRAVIS TOP at 13.6 fl oz: 30.6 grams pydiflumetofen (FRAC 7) + 50.5 g difenoconazole (FRAC 3)

Across four studies conducted in Carrington and Hofflund (30 mile east of Williston) from 2017-2019, Miravis Top (13.6 fl oz) performed similarly or better than Proline (5.7 fl oz).



Fungicide efficacy, chickpea *Ascochyta* – SDHI + DMI (FRAC 7 + 3) premix fungicides:

Revytek, 8.0 fl oz/ac

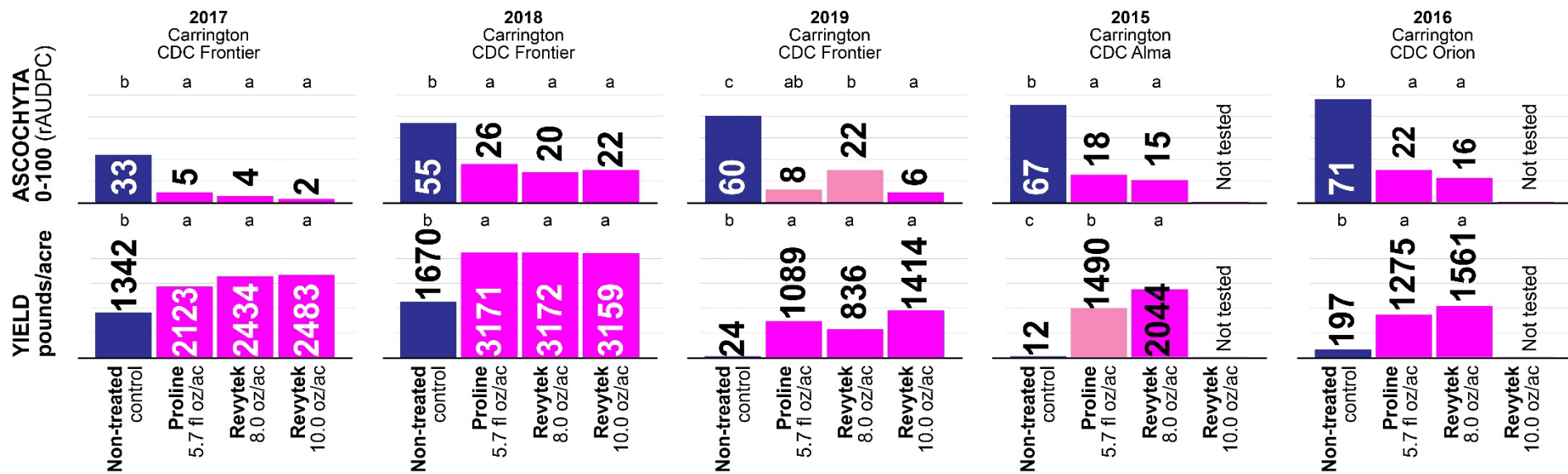
MIRAVIS TOP at 13.6 fl oz: 30.6 grams pydiflumetofen (FRAC 7) + 50.5 g difenoconazole (FRAC 3)

Under low to moderate *Ascochyta* disease pressure,
Revytek (8.0 or 10.0 fl oz) has performed similarly to Proline (5.7 fl oz).

Under high *Ascochyta* disease pressure,
Revytek (8.0 or 10.0 fl oz) performed better than Proline (5.7 fl oz).

LOW DISEASE PRESSURE

HIGH DISEASE PRESSURE

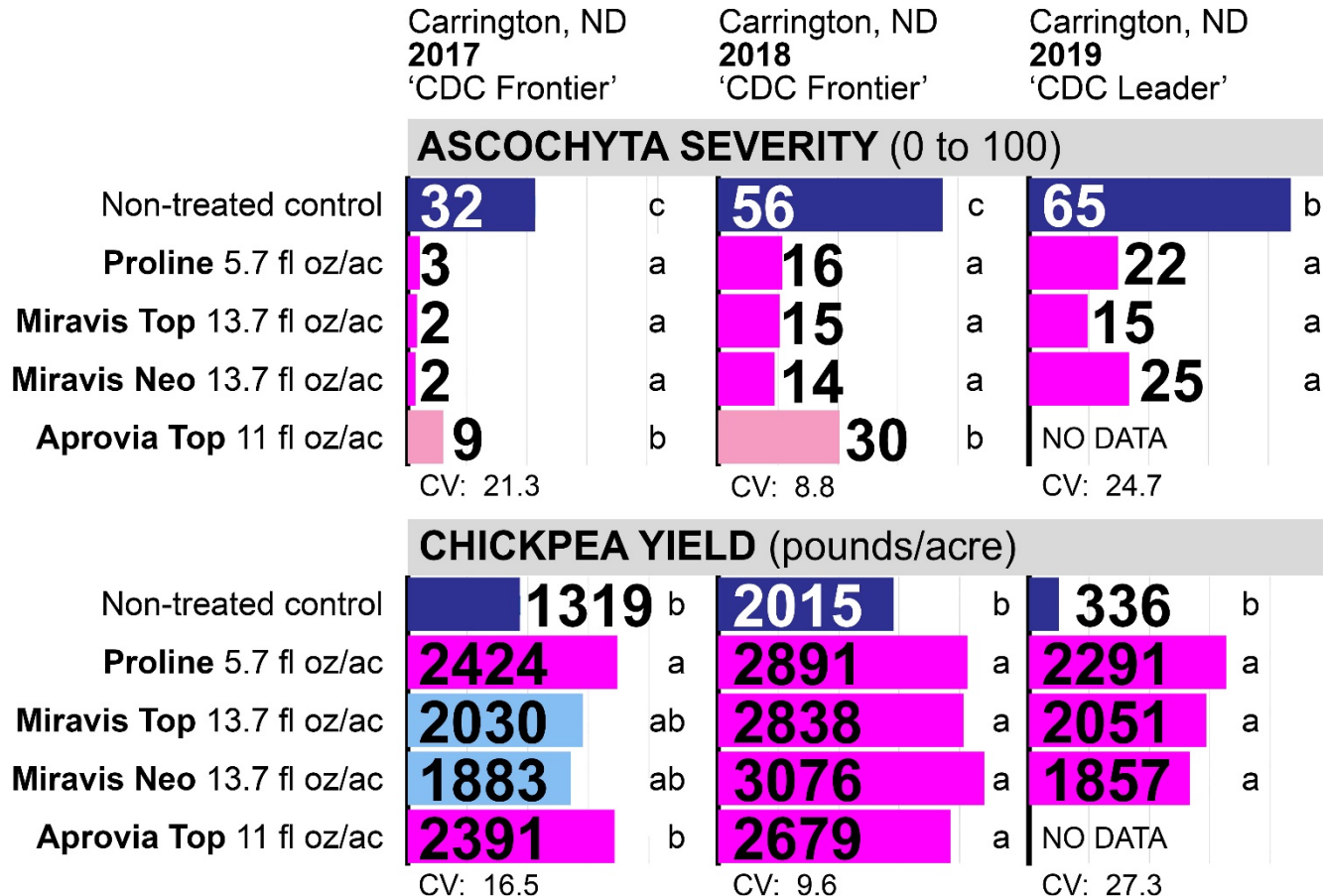


Fungicide efficacy, chickpea *Ascochyta* – SDHI + DMI (FRAC 7 + 3) premix fungicides:

Aprovia Top, registered at 10.5 – 11.0 fl oz/ac

APROVIA TOP at 11.0 fl oz contains 25.3 g benzovindiflupyr (FRAC 7) + 40.5 g difenoconazole (FRAC 3)

In limited testing conducted in 2017 and 2018 in Carrington, Aprovia Top (11.0 fl oz) was less effective than Proline (5.7 oz/ac) at managing *Ascochyta* foliar symptoms, but yield responses were similar.

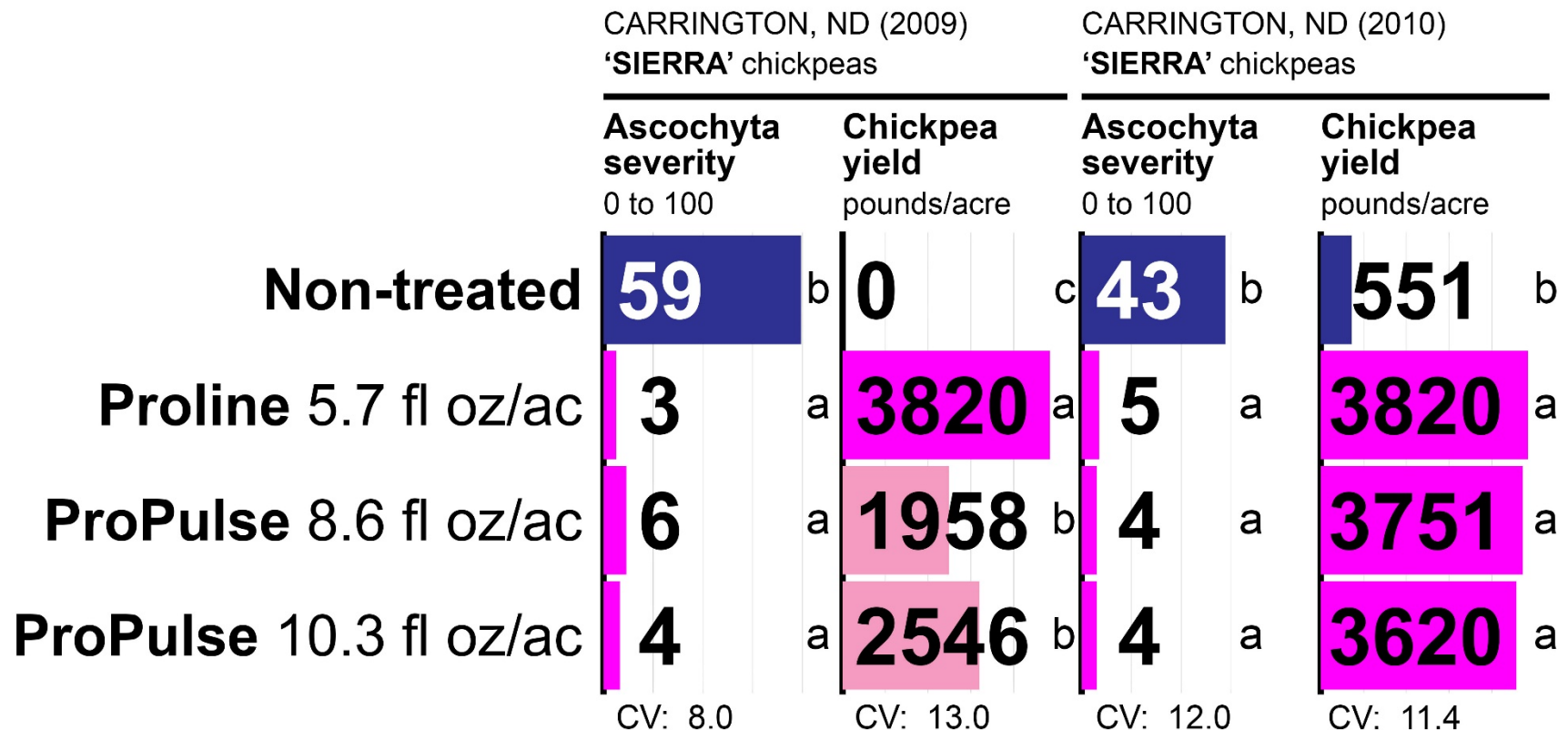


Fungicide efficacy, chickpea *Ascochyta* – SDHI + DMI (FRAC 7 + 3) premix fungicides:

ProPulse, registered at 8.0 – 13.6 fl oz/ac

PROPULSE at 8.6 fl oz contains 50.9 g fluopyram (FRAC 7) + 50.9 g prothioconazole (FRAC 3)
 PROPULSE at 10.3 fl oz contains 61.0 g fluopyram (FRAC 7) + 61.0 g prothioconazole (FRAC 3)

In limited testing conducted on a very susceptible chickpea variety, ProPulse (8.6 or 10.3 fl oz) did not perform as well as Proline (5.7 fl oz). ProPulse exhibited a rate response; will likely perform better at 13.6 fl oz/ac.



Comparative efficacy of fungicides for managing Ascochyta blight in chickpeas:

4. OTHER FUNGICIDE MODES OF ACTION

Active ingredients in FRAC groups 9, 12, 29, and M5

OMEGA: registered at 8.0 to 13.6 fl oz/ac

active ingredients: fluazinam (FRAC 29)

Efficacy at 13.0-14.0 fl oz/ac: **fair**

BRAVO WEATHER STIK: registered at 1.38 to 2.0 pt/ac

active ingredient: chlorothalonil (FRAC M5)

Efficacy at 1.38 pt/ac: **fair**

BRAVO WEATHER STIK (1.38 pt/ac) + PROLINE (5.0 or 5.7 fl oz/ac):

active ingredients: chlorothalonil (FRAC M5) + prothioconazole (FRAC 3)

Efficacy, Bravo WS (1.38 pt) + Proline (5.0 or 5.7 fl oz): **excellent**

SWITCH: registered at 11.0 to 14.0 fl oz/ac

active ingredient: cyprodinil (FRAC 9) + fludioxonil (FRAC 12)

No efficacy data available.

Omega, registered at 8.0 to 13.6 fl oz/ac

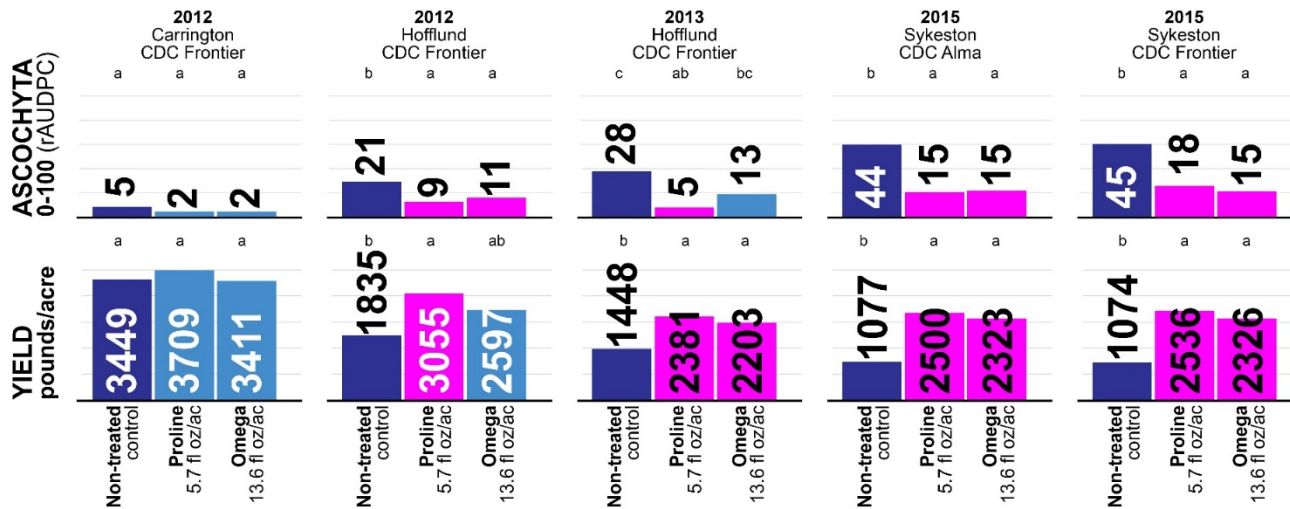
OMEGA at 8.0 fl oz contains 118.2 grams fluazinam (FRAC 29)

OMEGA at 13.6 fl oz contains 201.0 grams fluazinam (FRAC 29)

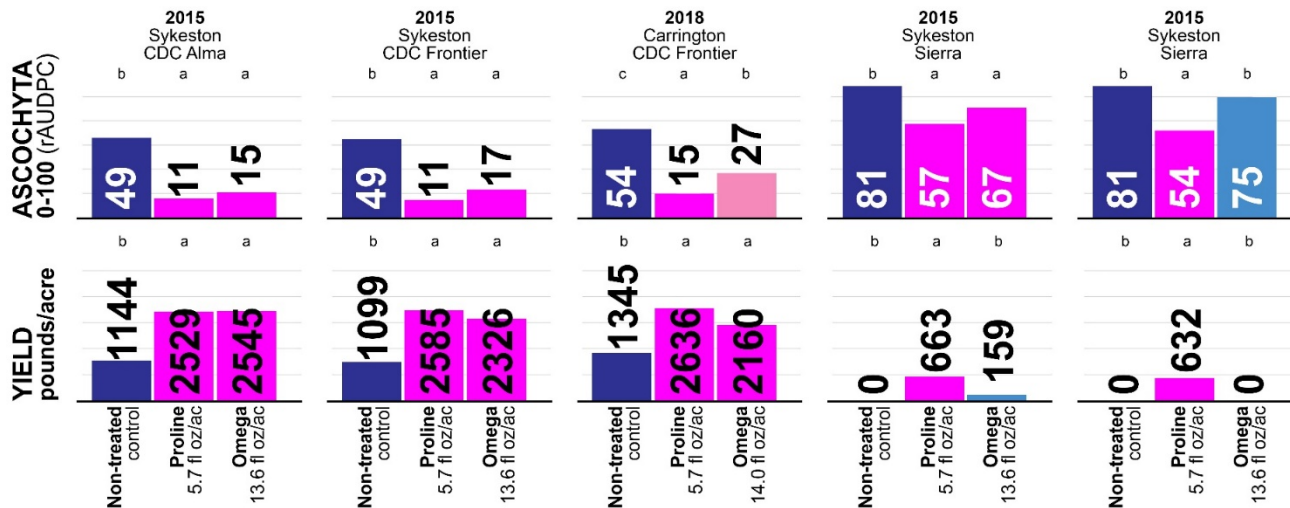
At low to moderate *Ascochyta* pressure: Omega (13.6 fl oz/ac) was slightly less effective than Proline (5.7 fl oz/ac).

Under high *Ascochyta* pressure: Omega (13.6 or 14.0 fl oz/ac) was less effective than Proline (5.7 fl oz/ac)

LOW DISEASE PRESSURE



HIGH DISEASE PRESSURE



Fungicide efficacy, chickpea *Ascochyta* – FRAC 29 fungicide:

Omega, registered at 8.0 to 13.6 fl oz/ac

OMEGA at 8.0 fl oz contains 118.2 grams fluazinam (FRAC 29)

OMEGA at 13.6 fl oz contains 201.0 grams fluazinam (FRAC 29)

Across all studies in which Omega (13.6-14.0 fl oz) and Proline (5.7 fl oz) were evaluated:

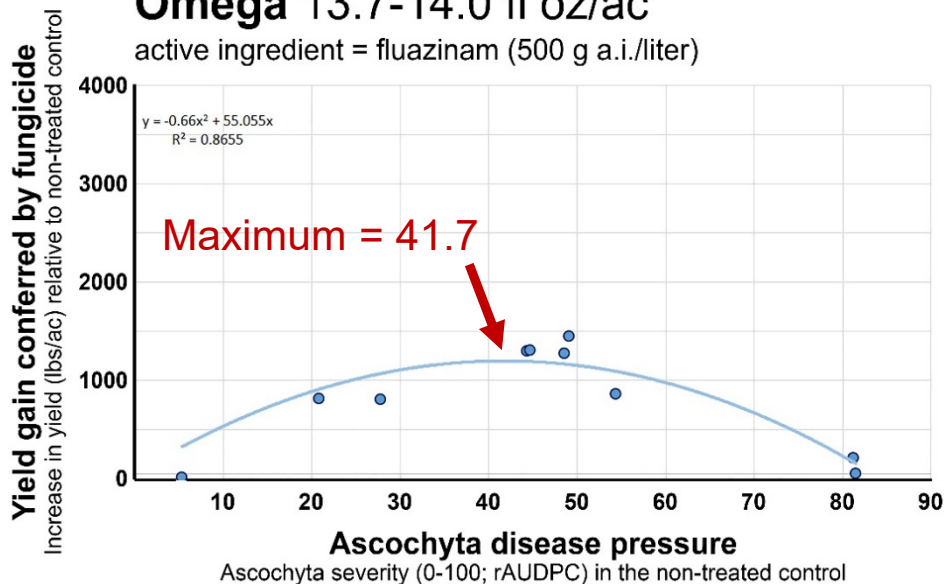
- Omega (13.6-14.0 fl oz/ac) was overwhelmed by *Ascochyta* at lower levels of disease pressure than Proline (5.7 fl oz/ac)

Blue dots: Each dot corresponds to the performance of the fungicide in one field trial.

IMPACT OF FUNGICIDE ON YIELD:

Omega 13.7-14.0 fl oz/ac

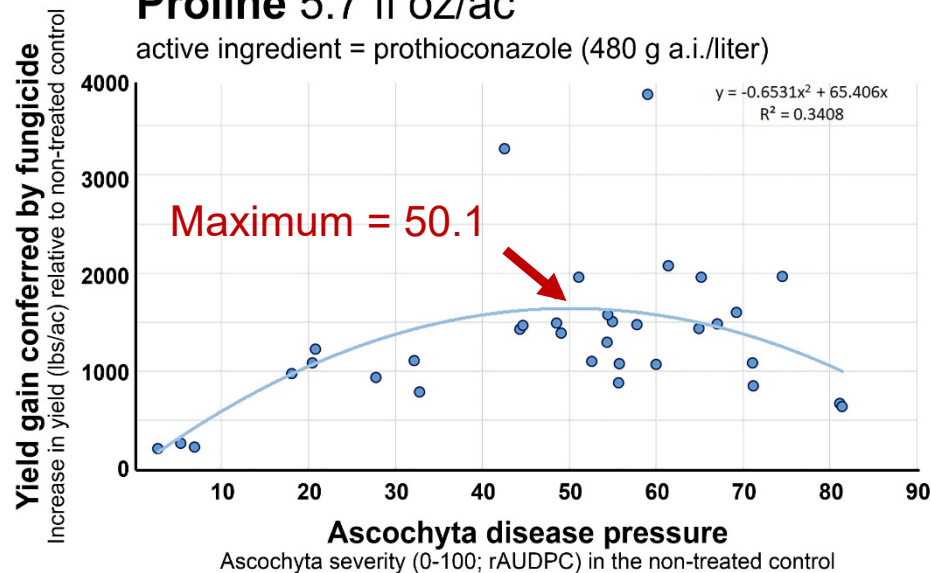
active ingredient = fluazinam (500 g a.i./liter)



IMPACT OF FUNGICIDE ON CHICKPEA YIELD:

Proline 5.7 fl oz/ac

active ingredient = prothioconazole (480 g a.i./liter)



Fungicide efficacy, chickpea *Ascochyta* – FRAC M5 fungicides:

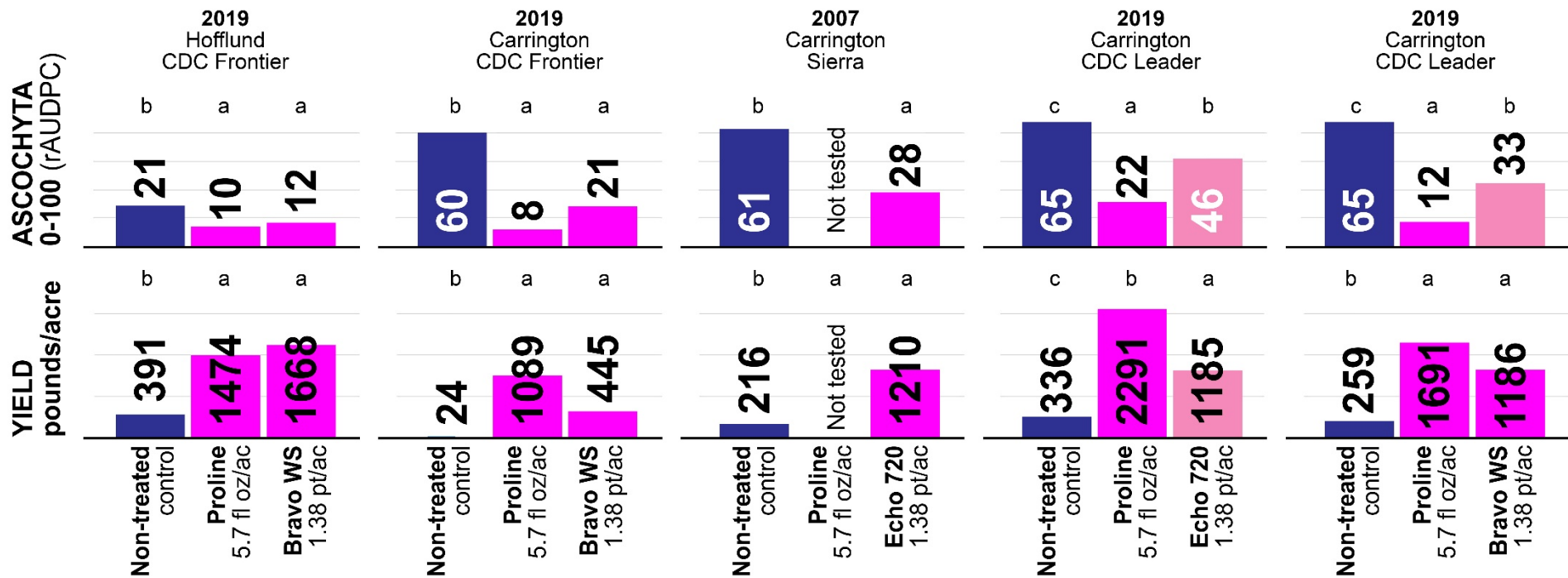
Bravo WeatherStik, registered at 1.38 to 2.0 pt/ac

BRAVO WEATHER STIK at 1.38 pints contains 469.5 grams chlorothalonil (FRAC M5)
 Many brands of chlorothalonil are available, and testing was also conducted with Echo 720.

Across five studies conducted in Carrington and Hofflund (30 miles east of Williston),
 Bravo WeatherStik or Echo 720 (1.38 pt/ac) was less effective than
 Proline (5.7 fl oz/ac) except under low disease pressure.

LOW DISEASE PRESSURE

HIGH DISEASE PRESSURE



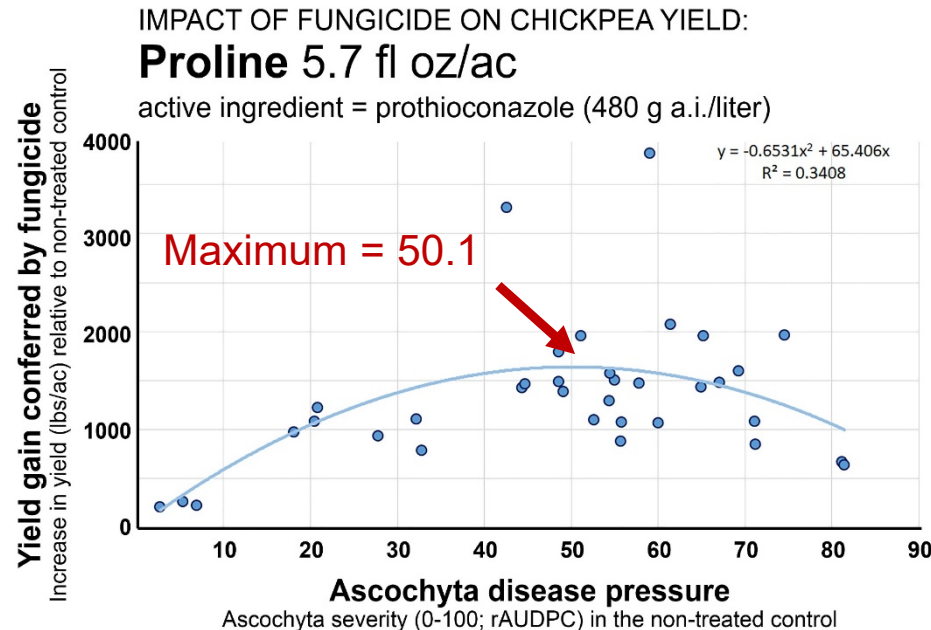
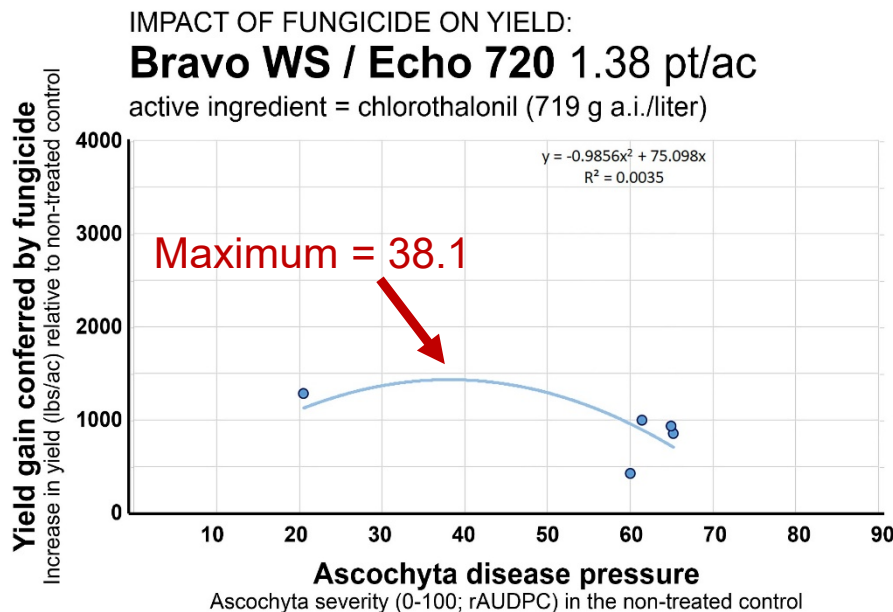
Bravo WeatherStik, registered at 1.38 to 2.0 pt/ac

BRAVO WEATHER STIK at 1.38 pints contains 469.5 grams chlorothalonil (FRAC M5)
Many brands of chlorothalonil are available, and testing was also conducted with Echo 720.

Across all studies in which Bravo Weather Stik or Echo 720 (1.38 pt) and Proline (5.7 fl oz) were evaluated:

- Bravo Weather Stik / Echo 720 was overwhelmed by *Ascochyta* at lower levels of disease pressure than Proline (5.7 fl oz/ac)

Blue dots: Each dot corresponds to the performance of the fungicide in one field trial.



Fungicide efficacy, chickpea *Ascochyta*
FRAC M5 fungicide:

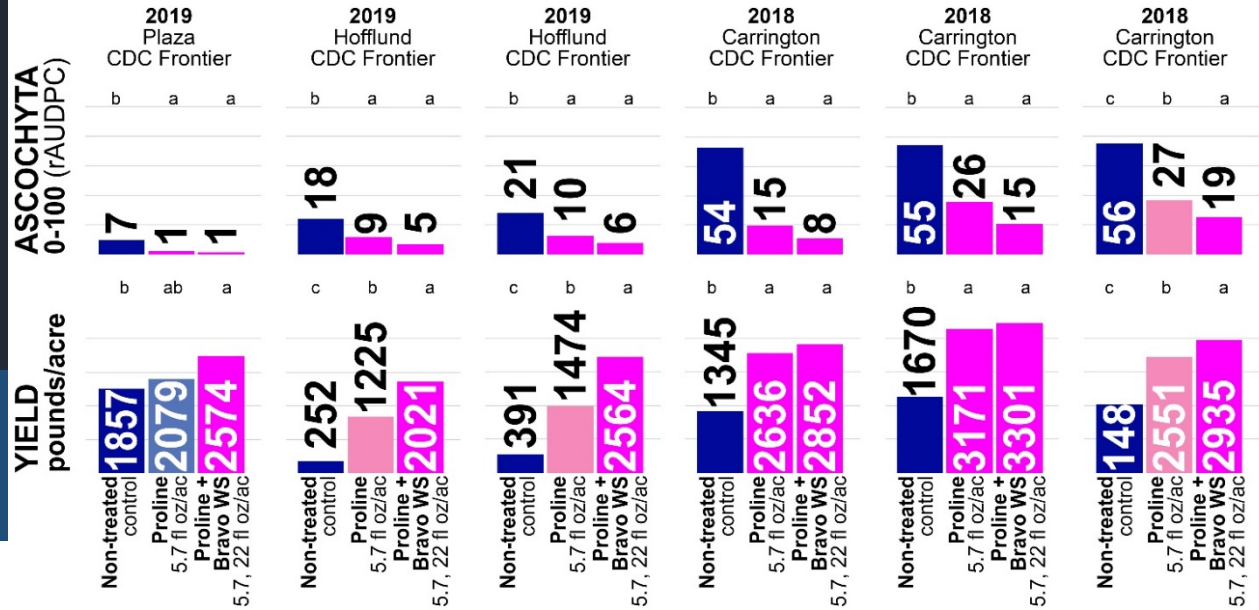
Bravo WeatherStik
(1.38 pt/ac)
tank-mixed with **Proline**
(5.0 or 5.7 fl oz/ac)

Bravo Weather Stik is most effective as a tank-mix partner with other fungicides

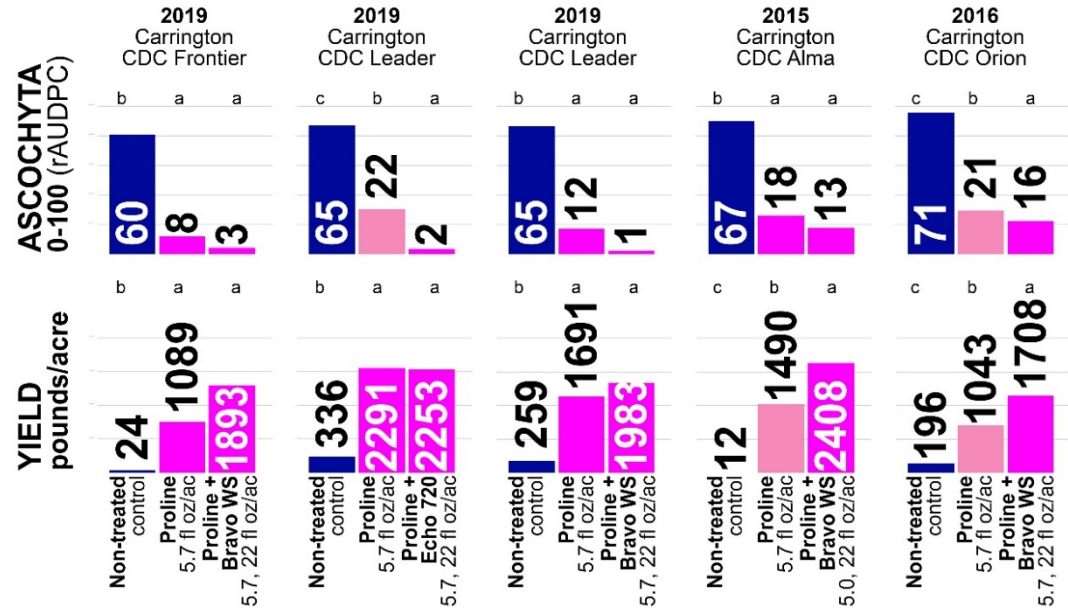
Across 11 studies conducted over 4 years, Tank-mixing Bravo WeatherStik (1.38 pt/ac) and Proline (5.0 or 5.7 fl oz/ac) consistently improved *Ascochyta* management relative to Proline applied alone.

Gains in disease control and yield were observed at low, moderate and high *Ascochyta* disease pressure.

LOW DISEASE PRESSURE



HIGH DISEASE PRESSURE



Fungicide efficacy, chickpea *Ascochyta* FRAC
M5 fungicide:

Bravo WeatherStik

(1.38 pt/ac)

tank-mixed with **Proline**

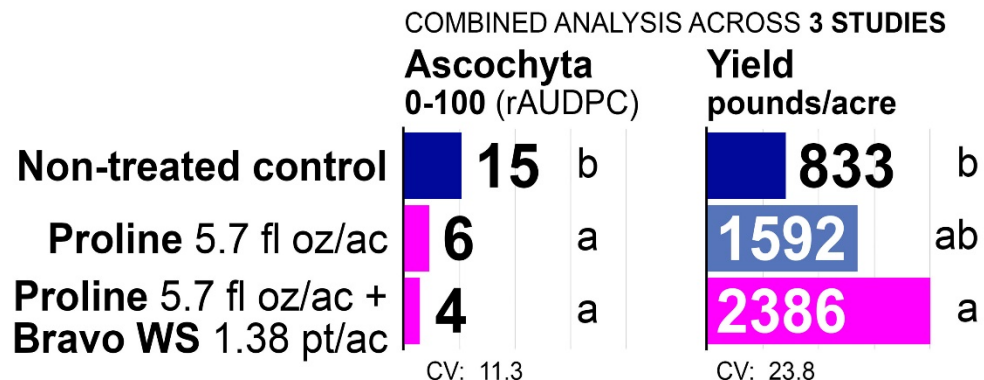
(5.0 or 5.7 fl oz/ac)

Bravo Weather Stik is
most effective as a tank-mix partner
with other fungicides

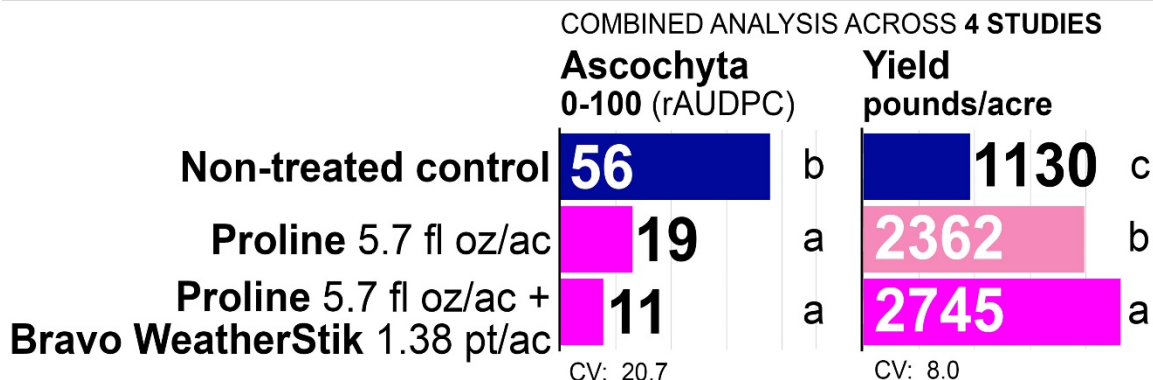
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Gains in disease control and yield were observed at low, moderate and high *Ascochyta* disease pressure.

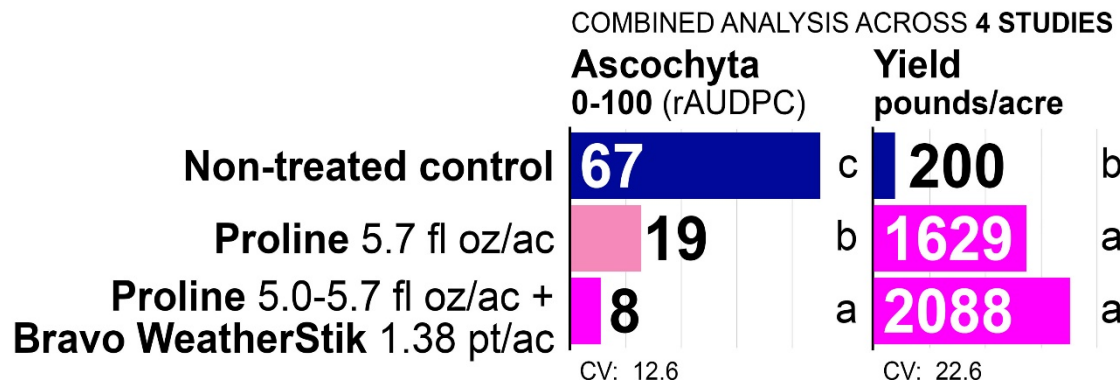
LOW DISEASE PRESSURE:



MODERATE to HIGH DISEASE PRESSURE:



HIGH to VERY HIGH DISEASE PRESSURE:



Fungicide efficacy, chickpea *Ascochyta* - FRAC M5 fungicide:

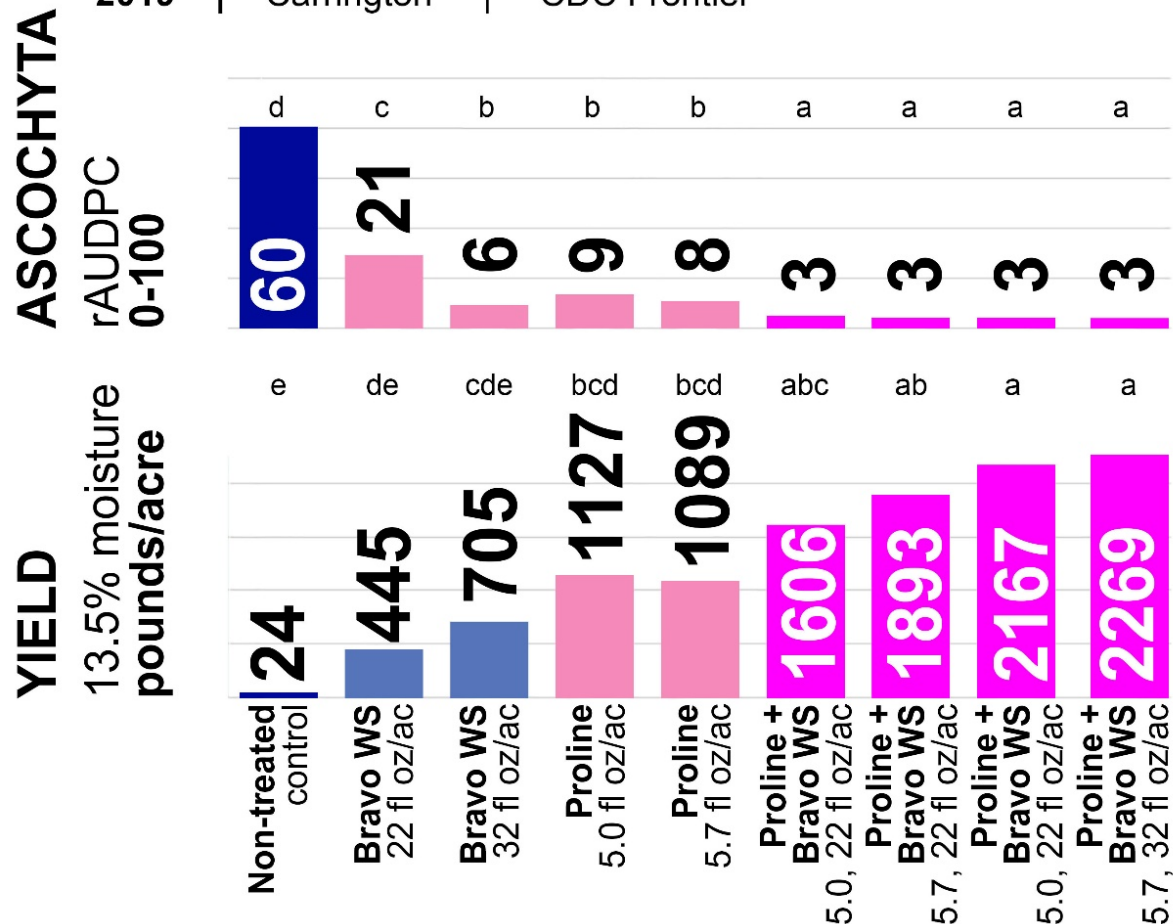
Bravo WeatherStik (1.38 or 2.0 pt/ac)
tank-mixed with **Proline** (5.0 or 5.7 fl oz/ac)

Bravo Weather Stik is most effective as a tank-mix partner with other fungicides

Preliminary data from a study conducted in Carrington in 2019:
Increasing the application rate of Bravo WeatherStik from 1.38 pt/ac to 2.0 pt/ac may increase the efficacy of tank-mixes with Proline.

Optimizing application rates: Bravo WeatherStik, Proline tank-mix

2019 | Carrington | 'CDC Frontier'



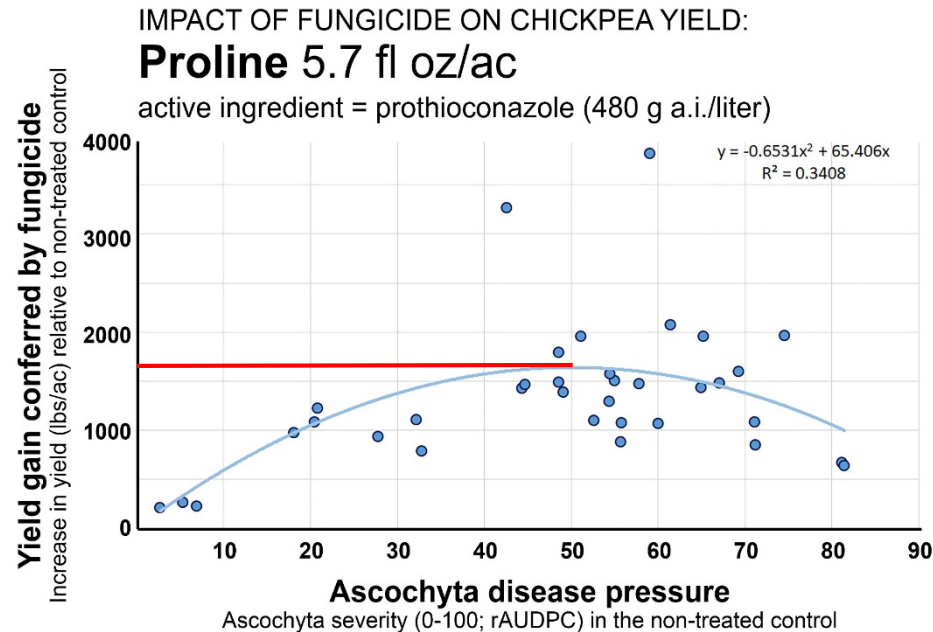
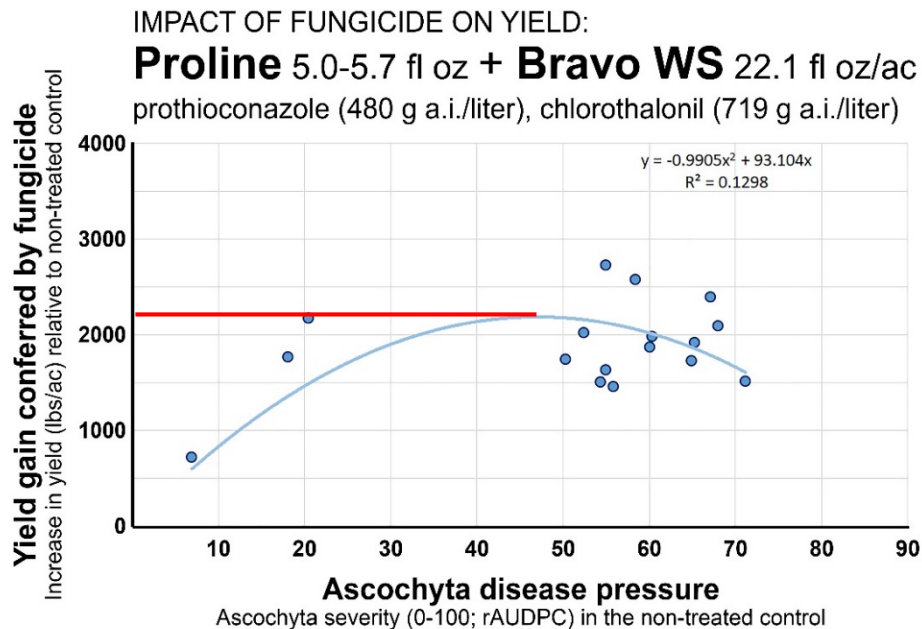
Fungicide efficacy, chickpea *Ascochyta* - FRAC M5 fungicide:
Bravo WeatherStik (1.38 or 2.0 pt/ac)
tank-mixed with **Proline (5.0 or 5.7 fl oz/ac)**

Bravo Weather Stik is most effective as a tank-mix partner with other fungicides

Across all studies in which Proline (5.0-5.7 fl oz) + Bravo WS (1.38 pt) and Proline (5.7 fl oz) were evaluated:

- At very high *Ascochyta* pressure, the yield gains from the tank-mix also declined just as with Proline applied alone, but average yield gains at any given level of disease pressure were higher with the tank-mix.

Blue dots: Each dot corresponds to the performance of the fungicide in one field trial.



Managing Ascochyta blight of chickpeas with fungicides:

Methods

FUNGICIDE APPLICATION TIMING AND METHODS

Fungicide application timing:

- The first application was made at the first appearance of Ascochyta symptoms (one or two small lesions on a low percentage of plants).
 - In dry years, this typically has corresponded to early bloom.
 - In wet years, this typically has corresponded to late vegetative growth.
- Subsequent applications were made 10-14 days apart until chickpeas began to senesce except when there is an extended stretch of dry weather, in which case an application is delayed until shortly before forecasted rain.
 - In most years, this corresponds to 3 to 5 applications.

Managing Ascochyta blight of chickpeas with fungicides:

Methods

FUNGICIDE APPLICATION TIMING AND METHODS

Fungicide application methods:

- Spray volume: 15 or 17.5 gal/ac.
- Droplet size: fine or medium
- Nozzles, pressure: TeeJet extended-range flat-fan nozzles, 30 to 40 psi

Fungicide rotation: Rotating fungicide modes of action

- Rotating fungicide modes of action is critical for maintaining the effectiveness of fungicides. It also improves disease control.
- When conducting fungicide efficacy testing in chickpeas, the same fungicide is applied sequentially in order to ensure that every fungicide is exposed to the same conditions all season.
- The fungicide efficacy results are meant to be used as tools for choosing appropriate fungicides when developing fungicide rotation strategies.

Managing Ascochyta blight of chickpeas with fungicides:

Overview

UNDERSTANDING THE FACTORS THAT INFLUENCE FUNGICIDE EFFICACY

The comparative performance of fungicides sometimes differs across studies.

Fungicides differ in residual activity – how long a fungicide confers satisfactory disease control after being applied.

- When disease pressure occurs primarily shortly after fungicides are applied, both long and short-residual fungicides perform well.
- When disease onset is late, only long-residual fungicides perform well.

Fungicides differ in the level of disease pressure that can be successfully controlled by the fungicide.

- Under low to moderate disease pressure, many fungicides may perform well.
- Under high disease pressure, only the most effective fungicides perform well.



Thank you!

Research funded by:

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