SDS Seed Treatments and other management updates

Daren Mueller
Iowa State University Extension
@dsmuelle

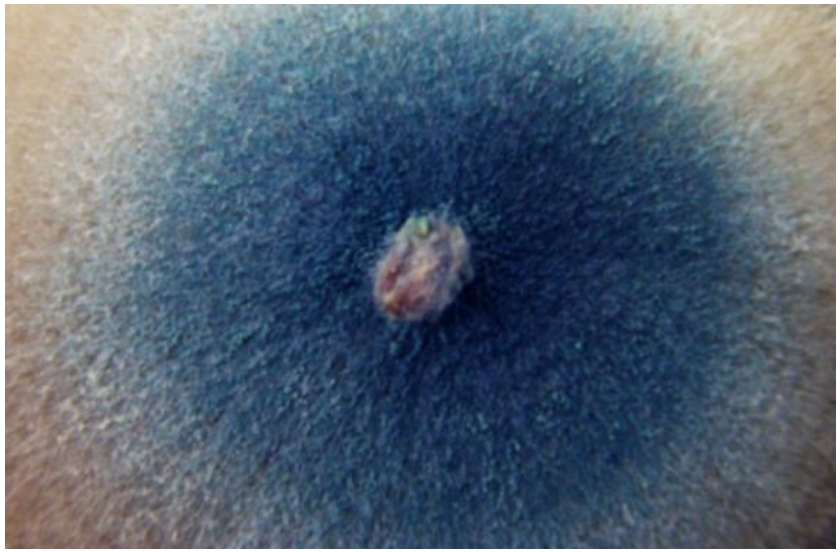
Sudden death syndrome

- **Yuba Kandel, Edward Ernat, Leonor Leandro:** Iowa State University
- **Travis Faske:** University of Arkansas
- **Alyssa Koehler:** University of Delaware
- **Nathan Kleczewski*, Keith Ames, Chelsea Harbach:** University of Illinois (*now with Growmark)
- **Darcy Telenko:** Purdue University
- **Eric Adee, Rodrigo Onofre:** Kansas State University
- **Carl Bradley:** University of Kentucky
- **Martin Chilvers, Adam Byrne:** Michigan State University
- **Kaitlyn Bissonette, Dan Sjarpe:** University of Missouri
- **Tamra Jackson-Ziems:** University of Nebraska
- **Sam Markell, Jess Halvorson:** North Dakota State University
- **Albert Tenuta:** OMAFRA, Ontario, Canada
- **Emmanuel Byamukama, Febina Mathew:** South Dakota State University
- **Damon L. Smith, Brian Mueller:** University of Wisconsin–Madison

Fusarium virguliforme

Soilborne pathogen

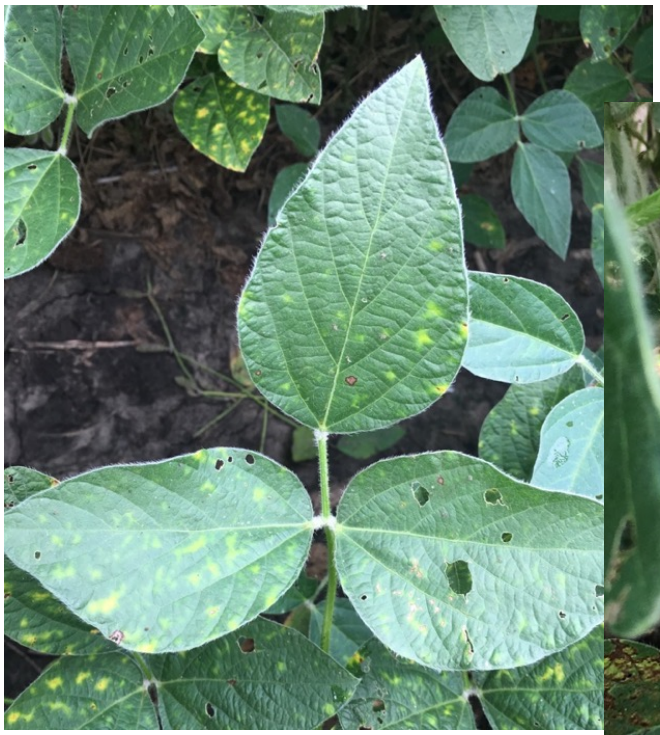
Fv culture



Root rot

Foliar symptoms

Chlorotic spots



Interveinal chlorosis and necrosis

Premature defoliation

2013 to 2021 product evaluation trials

- Trials in Arkansas, Delaware, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Missouri, Nebraska, North Dakota, South Dakota, Wisconsin and Ontario, Canada
- Each trial had susceptible and resistant varieties; some fields inoculated and/or irrigated
- Different seed treatments evaluated for foliar symptoms, root rot and yield

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FDX and relative yield loss

FDX = Disease incidence (%) x Disease severity of symptomatic plants (1-9) / 9

Every FDX unit increase at R5/R6 = ~ **0.5% yield reduction** or, ~ 50% reduction in yield expected if FDX is 100% at R5/R6

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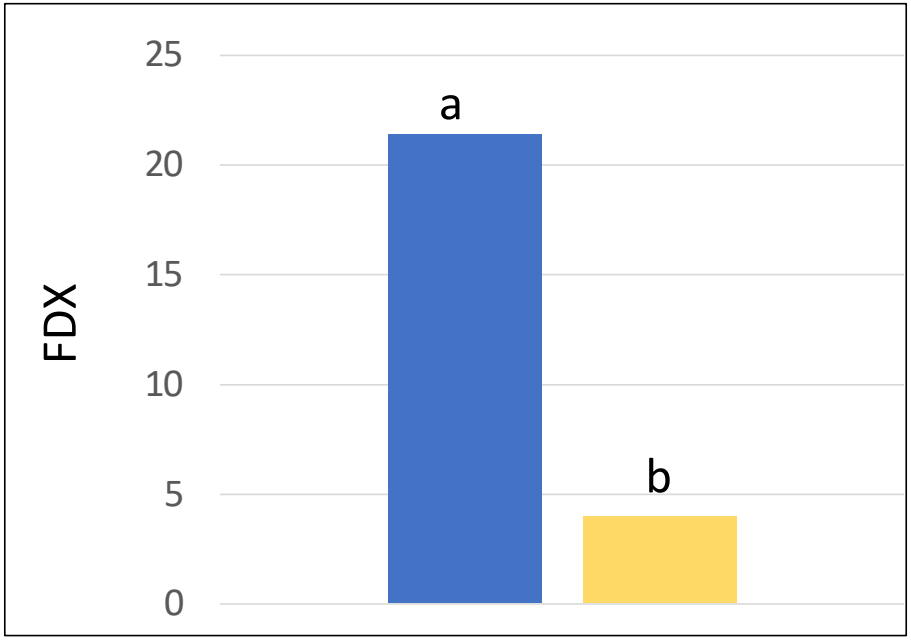
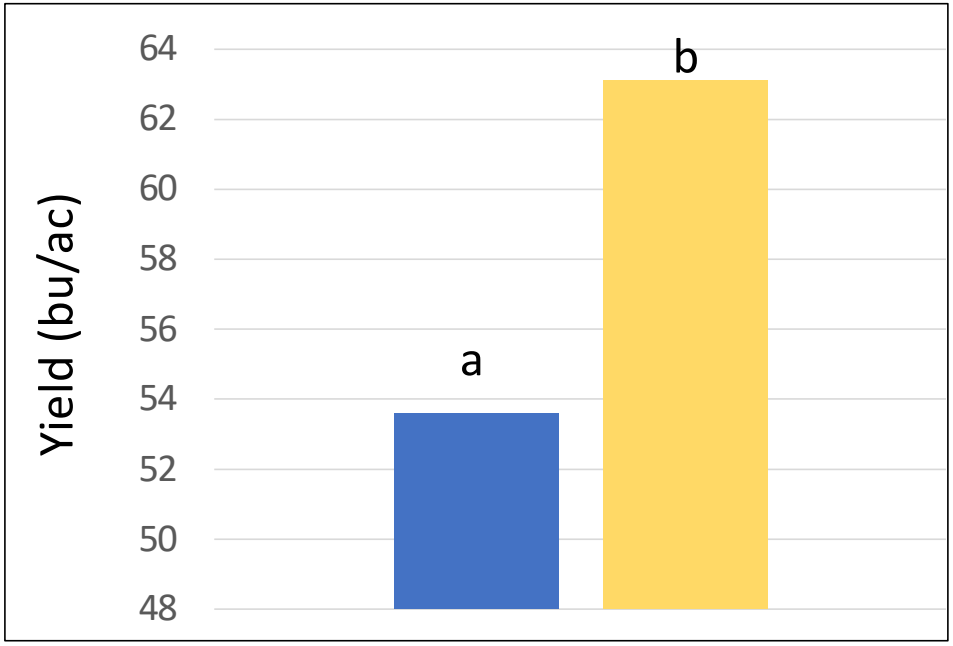
Expectations of resistant cultivar





Susceptible

Resistant

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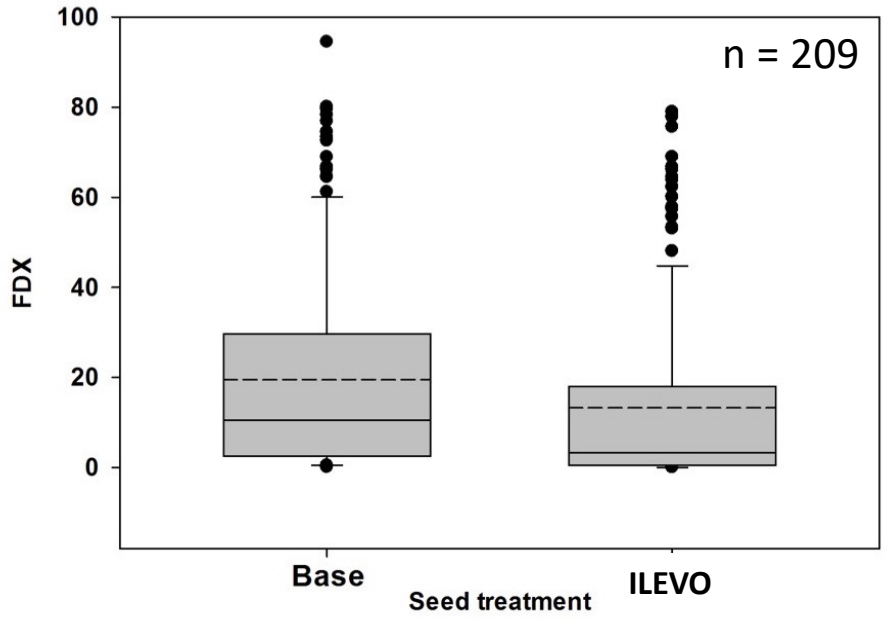
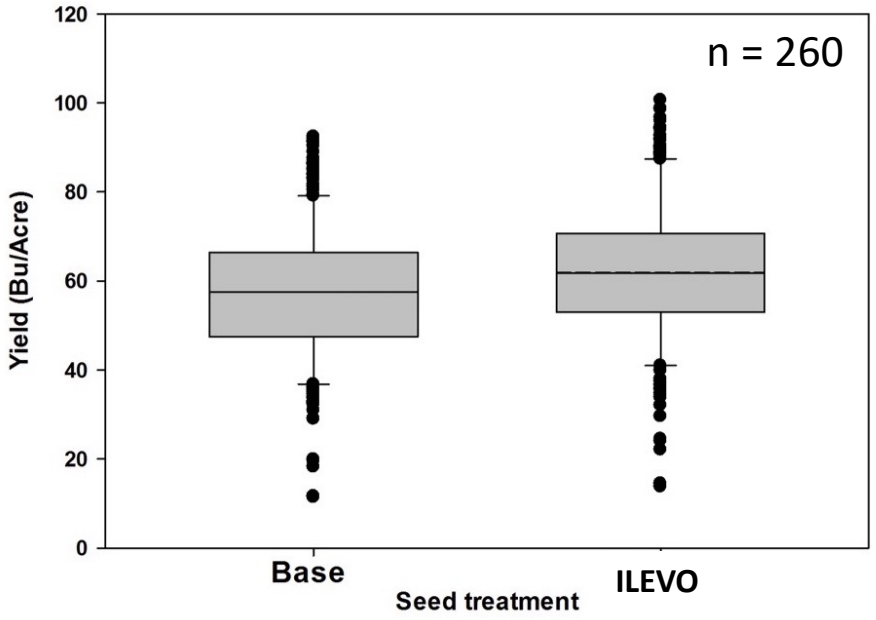
Resistant varieties
81.3% less FDX
15.1% more yield

Expectations of an effective seed treatment





Effective seed treatment

32.0% less FDX

7.3% more yield

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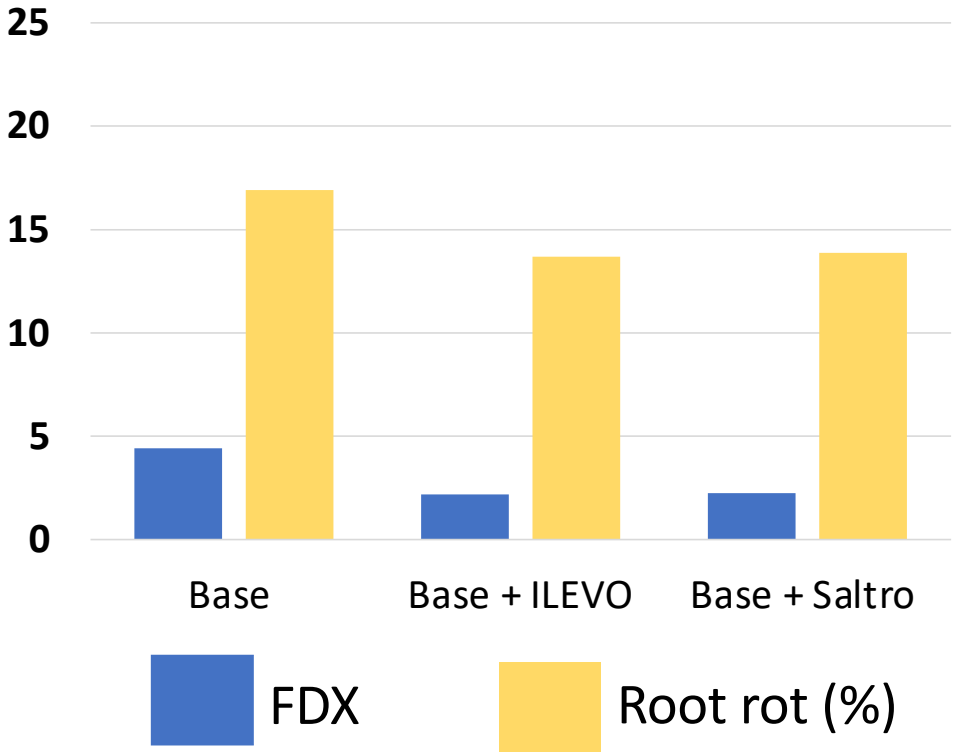
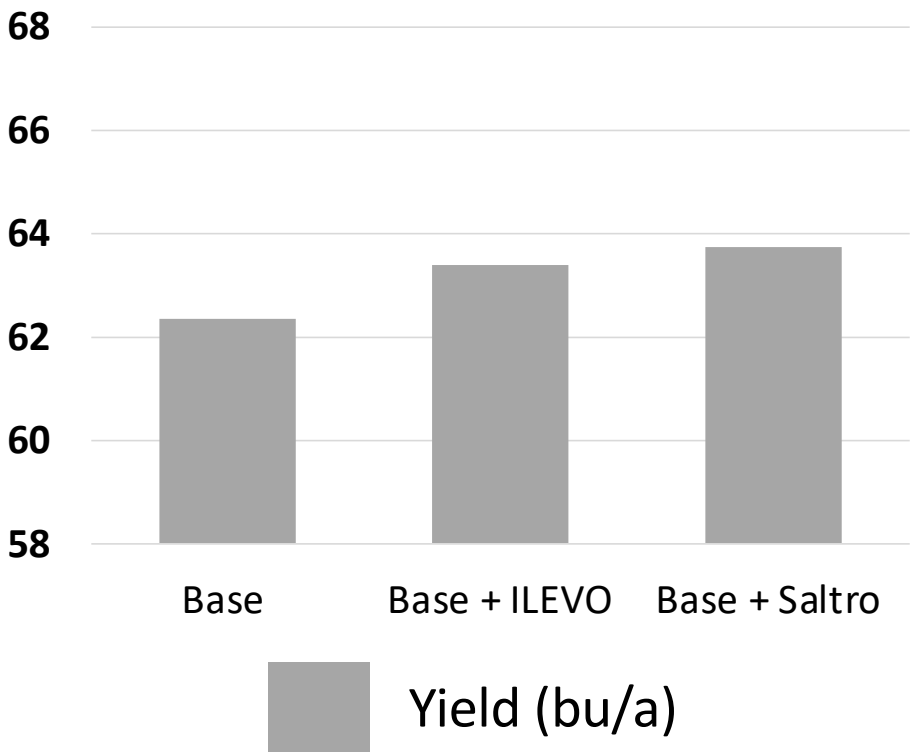
ILEVO vs. Saltro – 122 trials in 2020 and 2021





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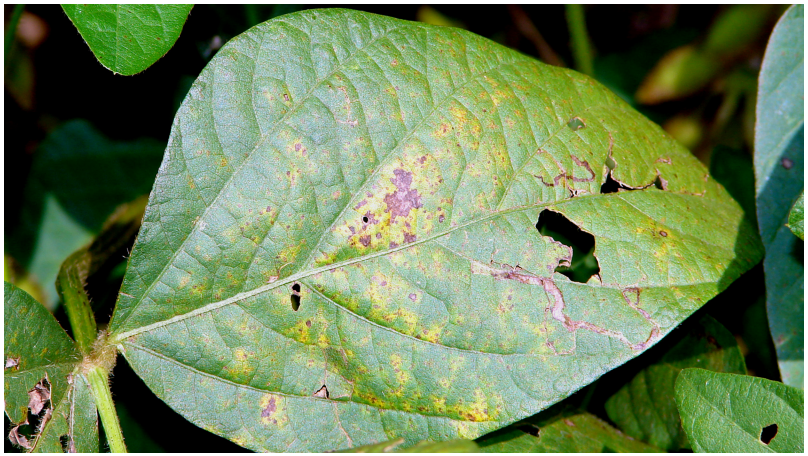
Take home

- SDS has two phases – root rot and foliar, both contribute to yield loss
- Resistant cultivars and effective seed treatments (ILEVO and Saltro) can reduce root rot and FDX

Foliar fungicide update

Diseases affected by foliar fungicides

- Frogeye leaf spot
- Brown spot
- Cercospora leaf blight
- White mold
- Soybean rust



Known fungicide resistance for soybean

Pathogen	Disease	Comments
Phakopsora pachyrhizi	Soybean rust	DMI (2008) QoI (2015)
Cercospora sojina	Frogeye leaf spot	QoI (2010)
Rhizoctonia solani	Aerial blight	QoI (2011)
Cercospora kikuchi	Cercospora leaf blight	QoI (2014)
Septoria glycines	Brown spot	QoI (2014)
Corynespora cassiicola	Target spot	QoI (2017)

www.frac.info

Frogeye leaf spot

- Can be found in all soybean growing areas, but *historically* more of a problem in southern regions
- Average loss in Midwestern states
  - 1996-2000: ~460,000 bushels/year ($0.04/ac)
  - 2016-2020: ~15.7 million bushels/year ($2.12/ac)
- Resistant cultivars available
- Now a main target of foliar fungicides across the U.S.

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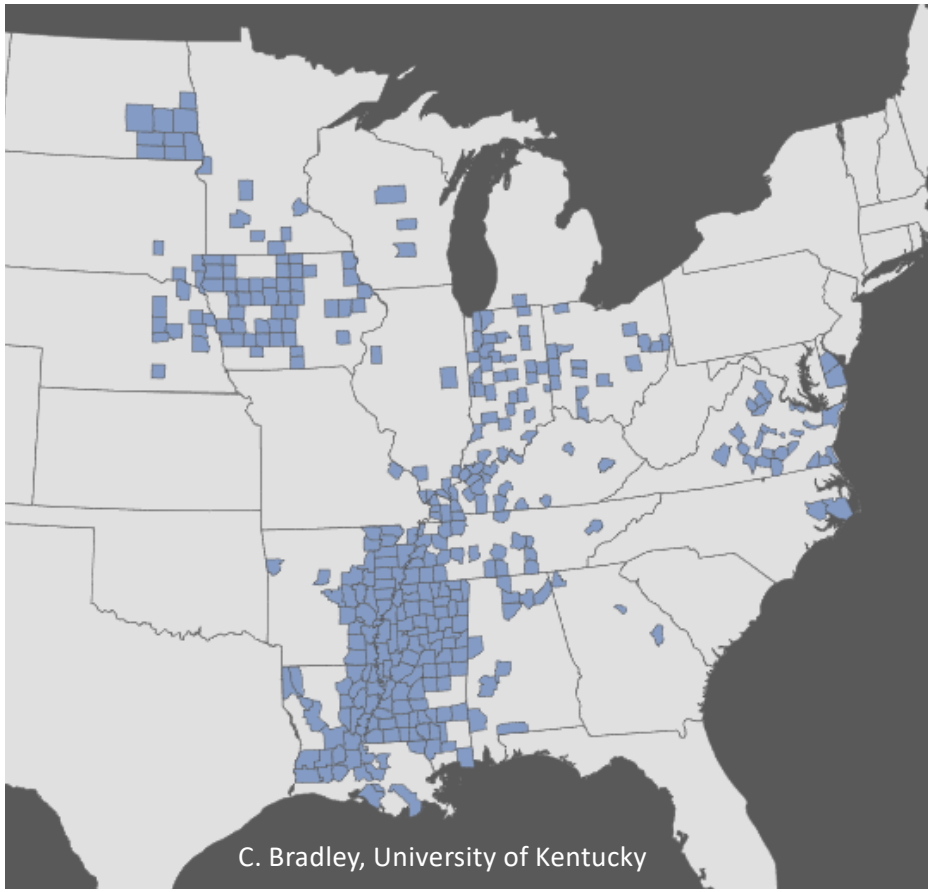
Fungicide resistance in the U.S.

- QoI resistant strains for *Cercospora sojina*
- Now confirmed in 21 states and 360 counties/parishes



Statewide fungicide trial

- Fungicide trials each year in multiple locations
  - 7 non-inoculated trials (map) each year
  - 1 inoculated trial in central Iowa each year
- Evaluate commercially available and experimental products
- Collect disease severity and yield data

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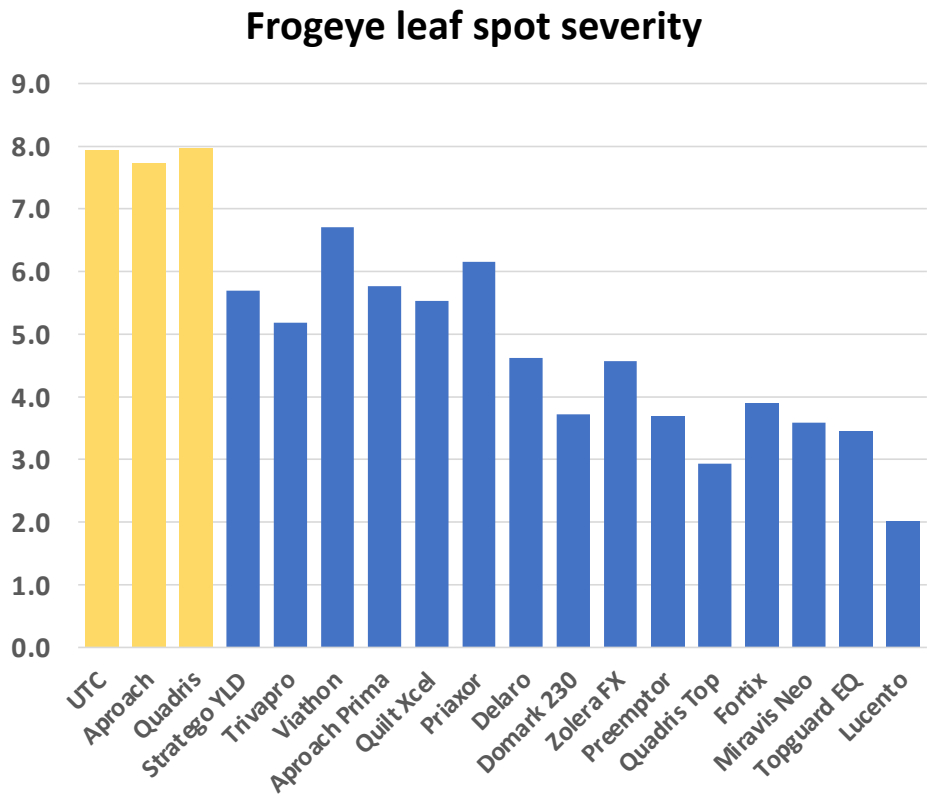
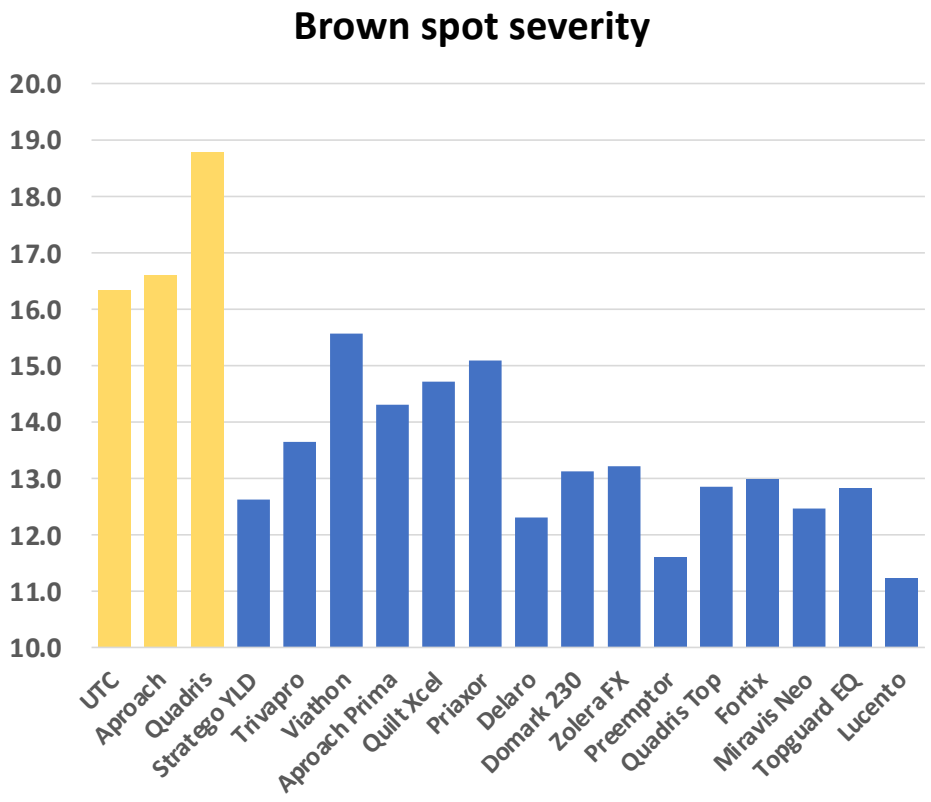
Fungicides differ





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Averaged across 7 locations

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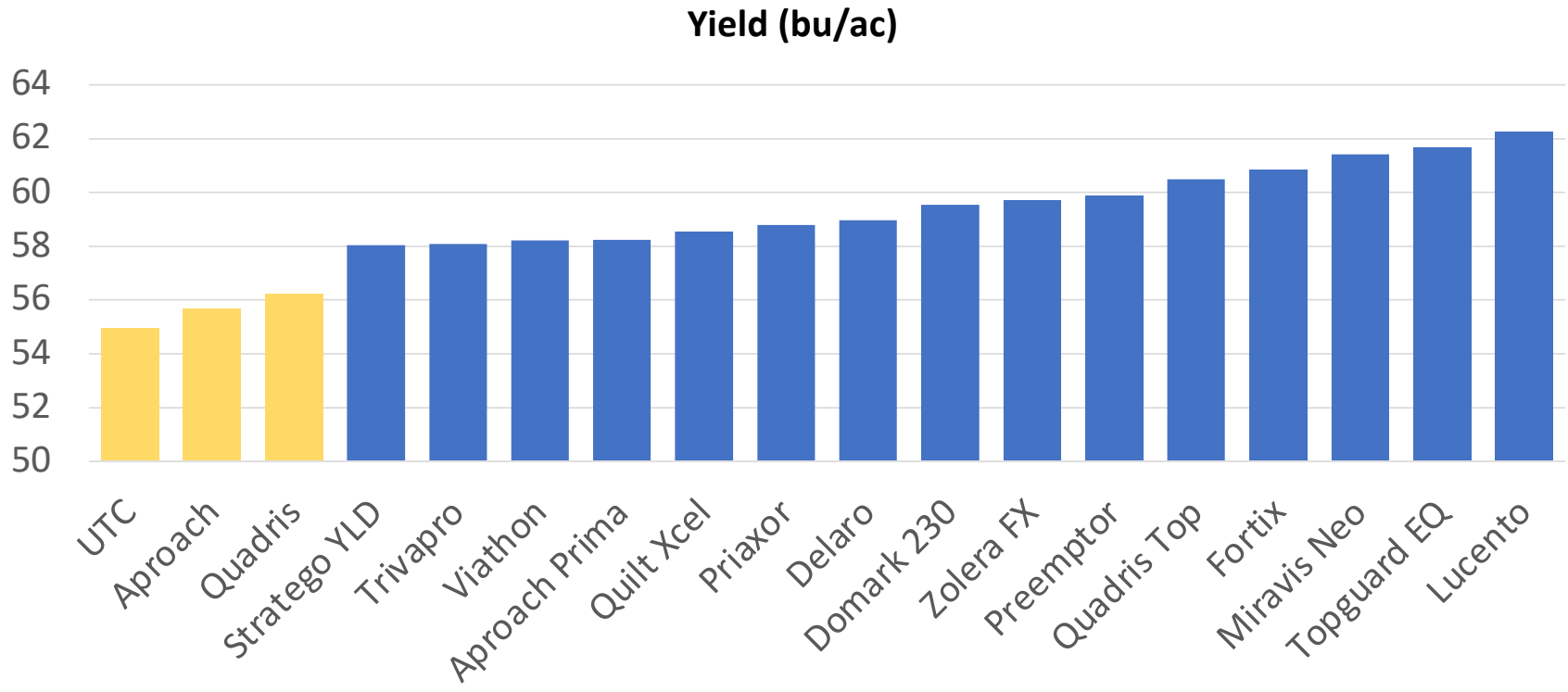
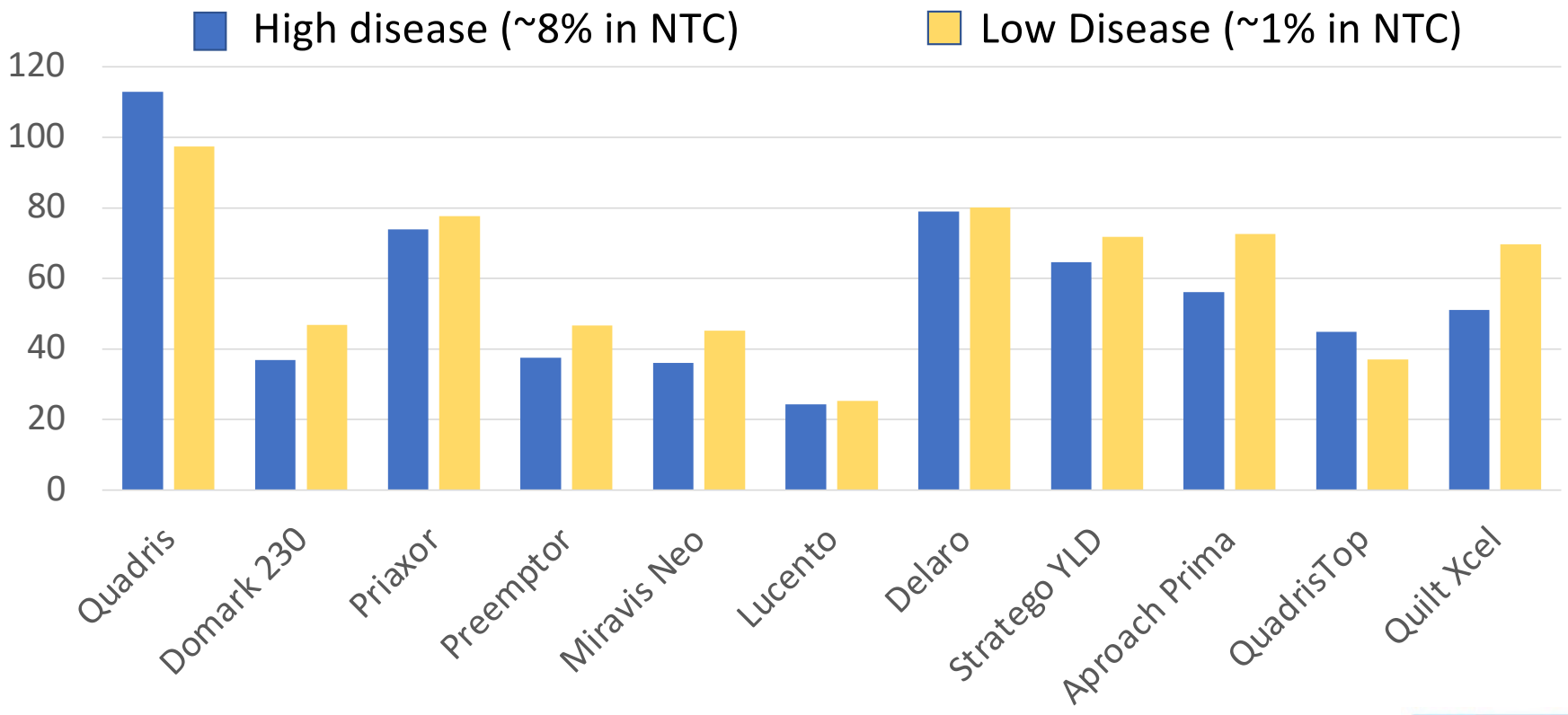
…and so do yield responses



Averaged across 7 locations

Percentage of frogeye leaf spot compared to UTC



Averaged across 7 locations each year

Resistance not just in plant pathogens

FUNGICIDES ARE MORE THAN A PLANT DISEASE MANAGEMENT TOOL

CPN 4009. Published October 11, 2021. DOI: doi.org/10.31274/cpn-20211011-000

- Aspergillosis is caused by *Aspergillus fumigatus*, a common fungus in outdoor agricultural settings.
- Mostly affects people who are immunocompromised or have severe lung disease and is not spread from person to person.
- Often treated with DMI fungicides (referred to as 'azoles' in the medical field).
- Fungicide resistance can occur in *A. fumigatus* in a similar manner as plant pathogens.
- Recently reported that azole-resistant strains of *A. fumigatus* likely acquired their resistance in agricultural settings rather than in a medical environment.
- More research needed to understand how fungicide applications in field crops affect non-target fungal populations, delaying fungicide resistance development in plant and human pathogens should continue to be an important goal for the agricultural industry.

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Follow the RULES to prevent fungicide resistance

R	Rotate or pre-mix fungicides of different groups.
U	Use labeled rates and at times of critical disease control.
L	Limit number of applications of any fungicide group in growing season.
E	Educate yourself about fungicide groups and resistance management tactics.
S	Select fungicides that are effective and/or have multiple sites of activity.

Adopted from J.W. Pscheidt, OSU

R = rotate or mix fungicide

Alternating and Mixing Fungicides

Use of fungicide products that contain a single active ingredient can increase selection pressure for fungicide resistant pathogen populations compared to using premix products or tank mixing products with active ingredients that have distinct modes of action. If a resistant fungal propagule is not killed by one fungicide mode of action in the tank mix, the other fungicide mode of action should kill it, reducing survival of propagules that can increase to become resistant populations. **This only works if both fungicides have the ability to manage the target pathogen.**

Fungicides Use in Field Crops: Web Book, Crop Protection Network

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R = rotate or mix fungicide

Product	DMI	SDHI	QoI
Headline	-	-	Pyraclostrobin
Priaxor	-	Fluxapyroxad	Pyraclostrobin
Revytek	Mefentrifluconazole	Fluxapyroxad	Pyraclostrobin
Delaro	Prothioconazole	-	Trifloxystrobin
Delaro Complete	Prothioconazole	Fluopyram	Trifloxystrobin
Lucento	Flutriafol	Bixafen	-
Domark	Tetraconazole	-	-
Trivapro	Propiconazole	Benzovindiflupyr	Azoxystrobin
Quilt Xcel	Propiconazole	-	Azoxystrobin
Miravis Top	Difenoconazole	Pydiflumetofen	-
Miravis Neo	Propiconazole	Pydiflumetofen	Azoxystrobin

U = use labeled rates and best timing

Labeled rates

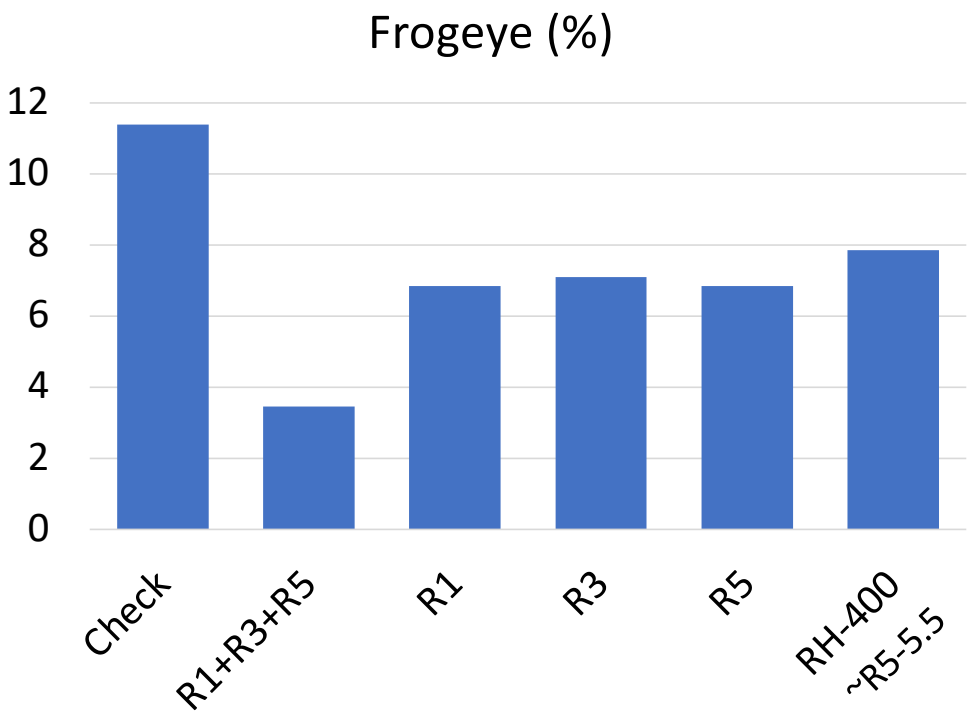
- Do not apply at rates lower than recommended rate on label
- Be sure to follow rates, restrictions and other application instructions on fungicide label
- Do not exceed total number of applications or total amount of material allowed per year

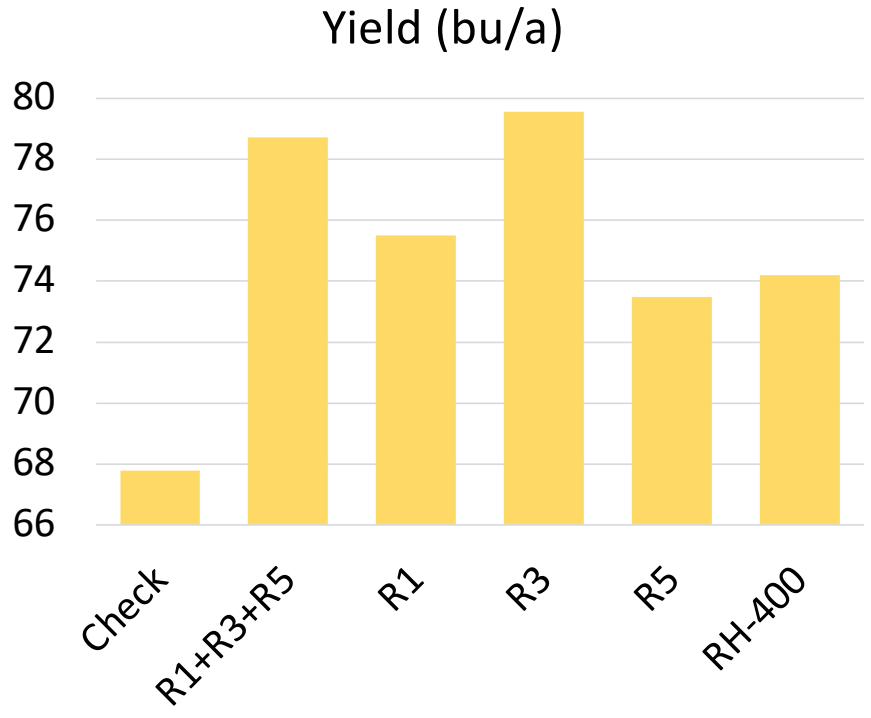
U = use labeled rates and best timing

Fungicide timing and weather-based models

- Multiple locations, 2 locs with severe frogeye leaf spot
- Growth stage-based applications (R1, R3, R5) of Delaro
- Weather-based applications
  - Relative humidity – 400 hours from R1
  - Precipitation (not triggered in our study)
- Disease and yield collected

U = use labeled rates and best timing





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Average from 2 locations with frogeye leaf spot

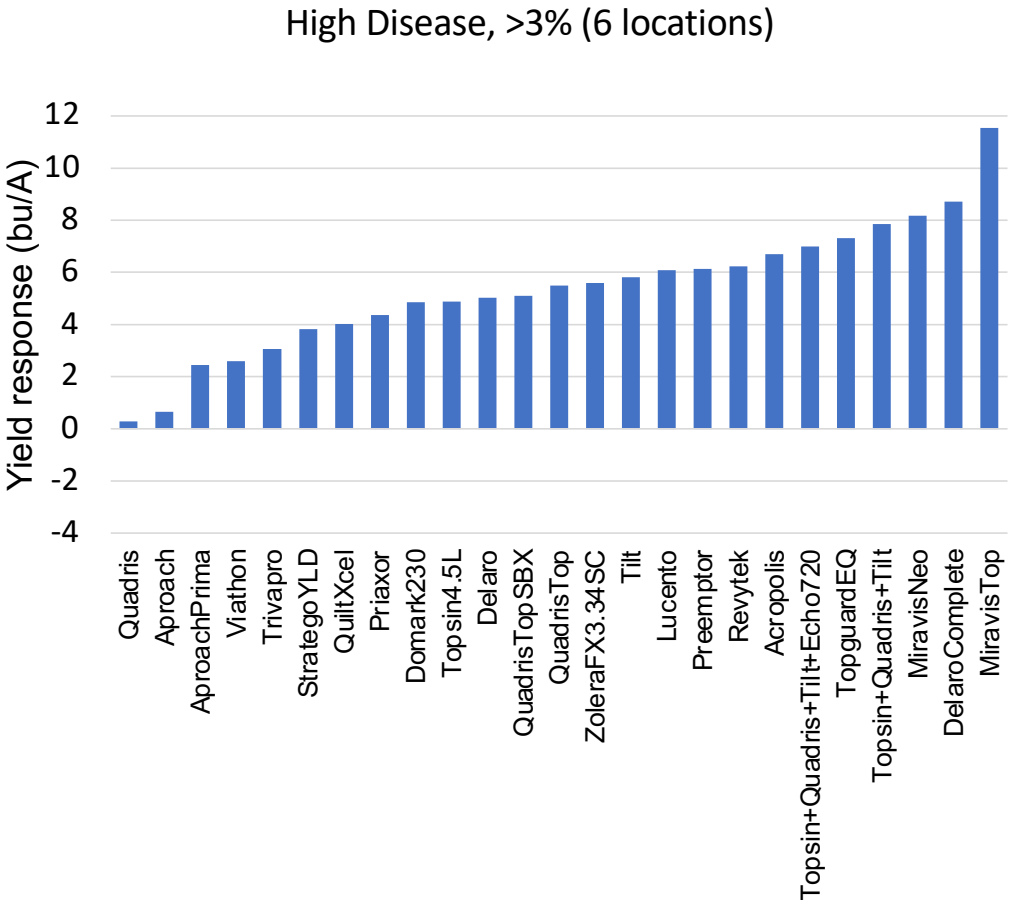
B. Bishop, ISU

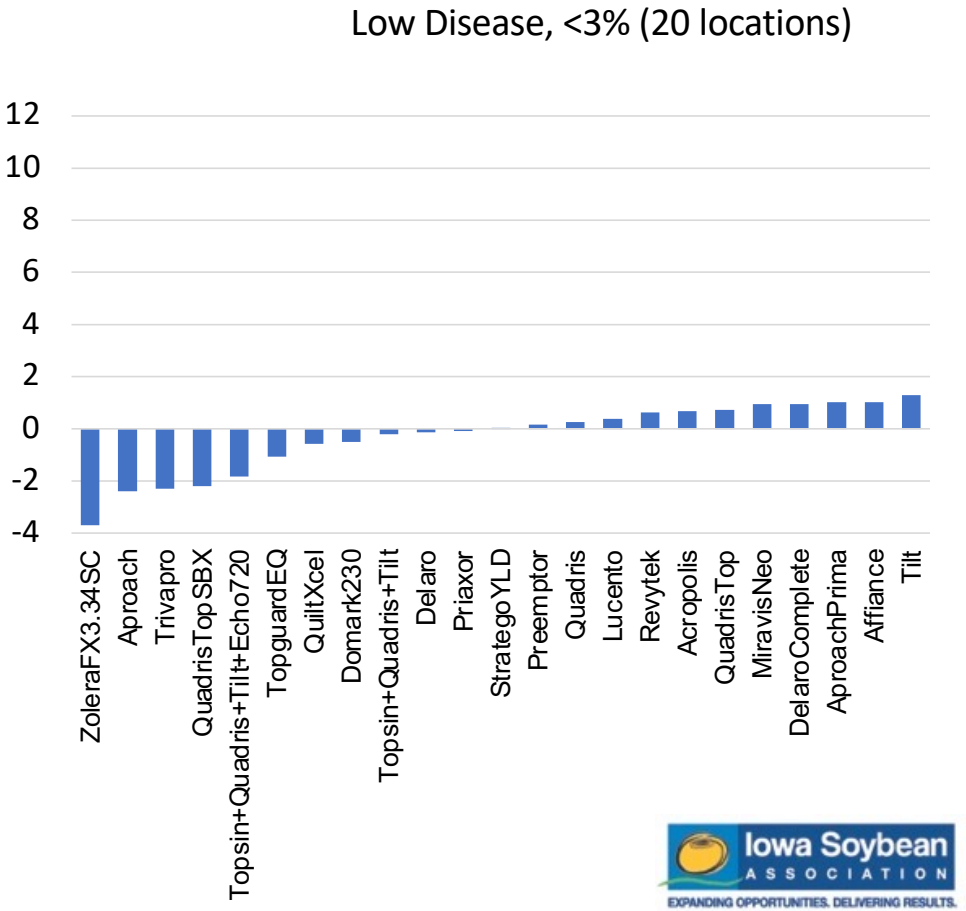
L = limit number of applications

Develop your own checklist to measure risk of disease developing

- Resistance to foliar diseases (mostly frogeye leaf spot)
- Weather during the season (I start at flowering)
  - U.S. Drought Monitor
  - Local weather forecasts
  - Morning dew is a good indicator of leaf wetness – the more dew the more active fungal pathogens will be
- Track diseases
  - Twitter
  - ipmPIPE (corn)
  - Local agronomists, ag business newsletters, etc.
- Are there other yield limiting factors?

L = limit number of applications





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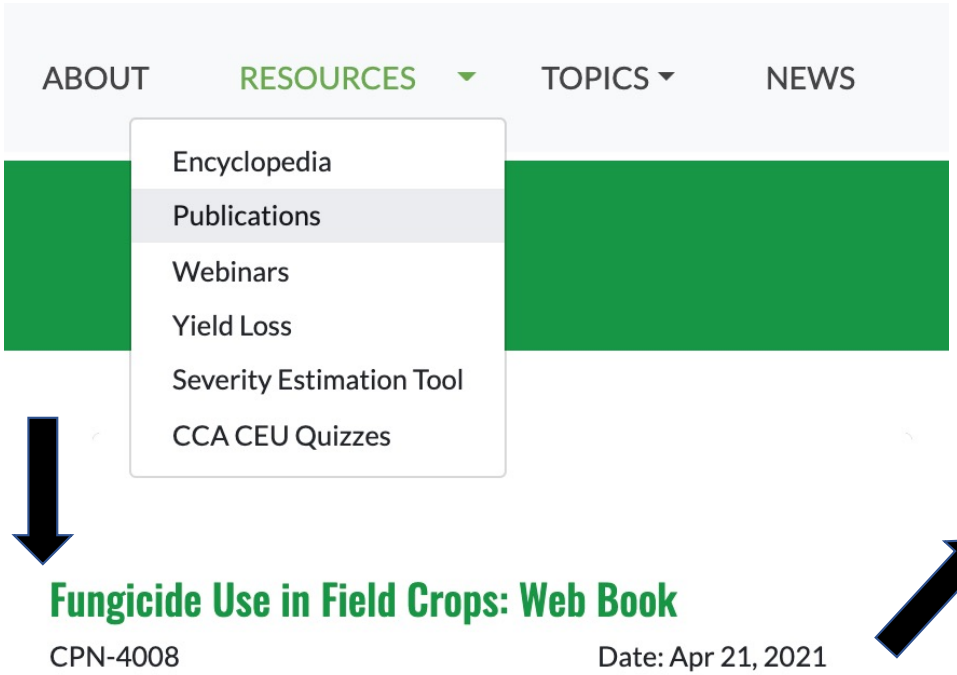
E = educate yourself

Free Web Book on Crop Protection Network



Fungicide Use in Field Crops: Web Book

CPN-4008 Date: Apr 21, 2021

doi.org/10.31274/cpn-20210329-0

Fungicide Use in Field Crops

CPN 4008. Published April 21, 2021. DOI: Doi.org/10.31274/cpn-20210329-0

Daren Mueller, Iowa State University; **Kiersten Wise**, University of Kentucky; **Carl Bradley**, University of Kentucky; **Adam Sisson**, Iowa State University; **Damon Smith**, University of Wisconsin-Madison; **Erin Hodgson**, Iowa State University; **Albert Tenuta**, Ontario Ministry of Agriculture, Food, and Rural Affairs; **Andrew Friskop**, North Dakota State University; **Shawn Conley**, University of Wisconsin-Madison; **Travis Faske**, University of Arkansas; **Edward Sikora**, Auburn University; **Loren Giesler**, University of Nebraska-Lincoln; and **Martin Chilvers**, Michigan State University.

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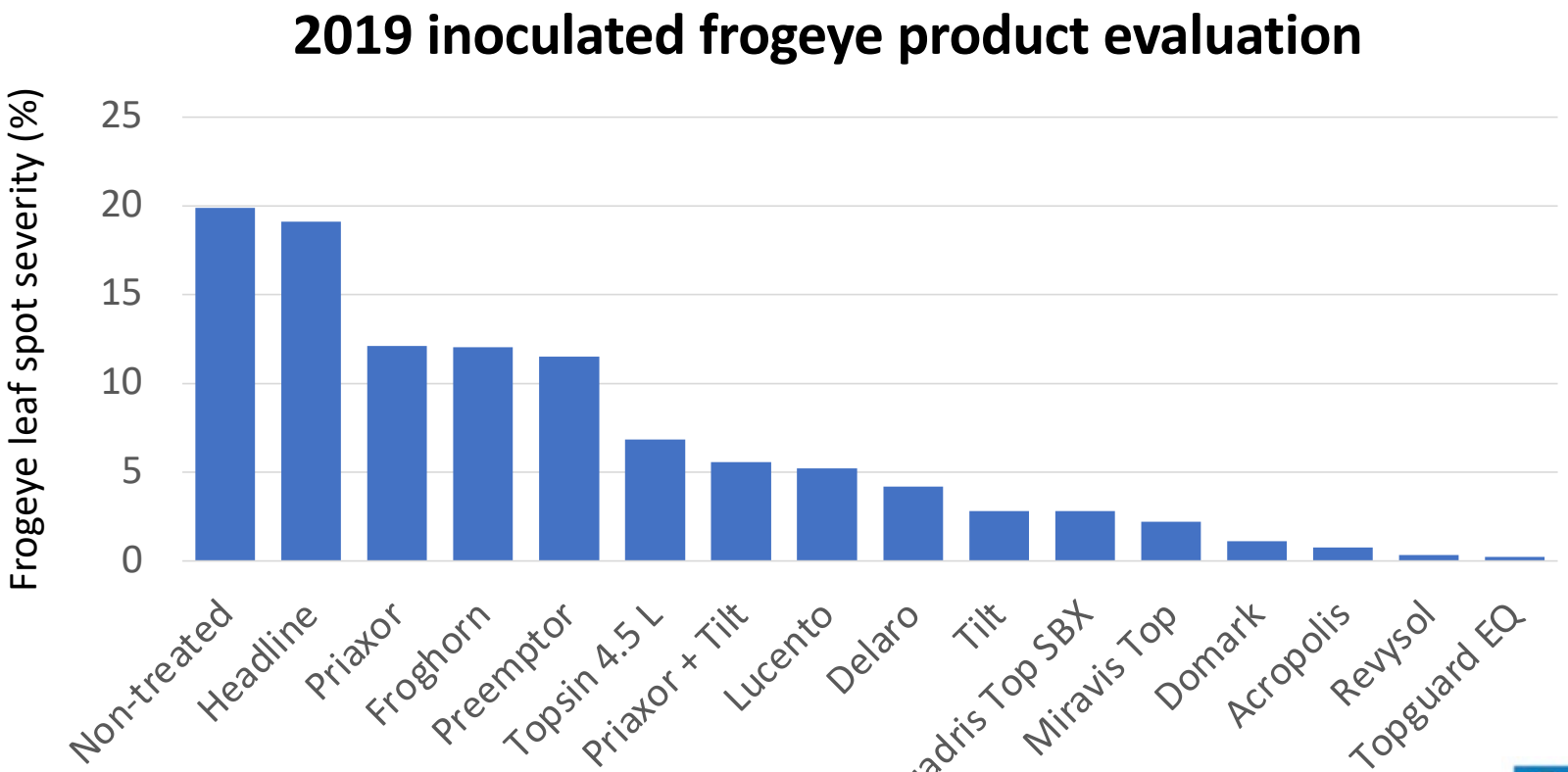
E = educate yourself

Implement an IPM strategy

- Plant disease-resistant varieties when possible
- Consider cultural control (e.g., crop rotation, residue management, etc.)
- Scout fields regularly
  - Note disease incidence and severity
  - Develop a field history for future disease management decisions
  - Monitor disease progression following fungicide application to check for potential fungicide resistance.
- Accept some level of disease. A completely clean crop is not necessary to maximize yield or economic returns.
- Ensure good agronomic practices are in place to minimize fungicide need
- Maintain proper soil fertility
- Consider fungicide and application costs

S = select correct fungicide



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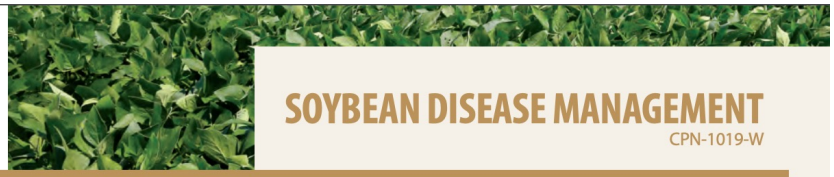
S = select correct fungicide



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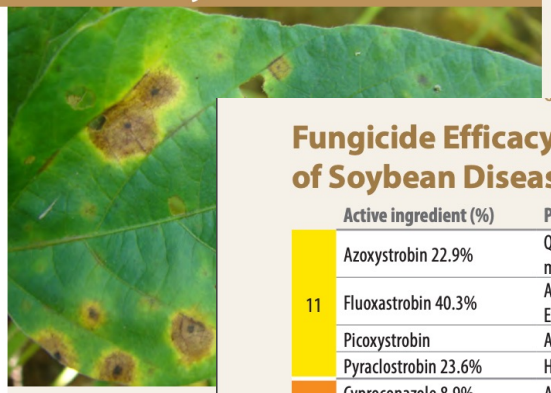
SOYBEAN DISEASE MANAGEMENT
CPN-1019-W

Fungicide Efficacy for Foliar Soybean Diseases



The North Central Regional Committee on Soybean Diseases (NCERA-137) has developed the following information on foliar fungicide efficacy for control of major foliar soybean diseases in the United States. Efficacy ratings for each fungicide listed in the table were determined by field-testing the materials over multiple years and locations by the members of the committee. Efficacy ratings are based upon level of disease control achieved by product, and are not necessarily reflective of yield increases obtained from product application. Efficacy depends upon proper application timing, rate, and application method to achieve optimum effectiveness of the fungicide as determined by labeled instructions

Fungicide Efficacy for Control of Soybean Diseases Table (03/2021)

	Active ingredient (%)	Product/Trade name	Rate/A (fl oz)	Aerial web blight	Anthracnose	Brown spot[2]	Cercospora leaf blight[3]	Frogeye leaf spot[4]	*Diaporthe* (Pod and stem blight)	Soybean rust	Target spot	White mold[5]	Harvest restriction[6]
11	Azoxystrobin 22.9%	Quadris 2.08 SC, multiple generics	6.0 – 15.5	VG	VG	P-G	P	P	U	G-VG	P-F	P	14 days
	Fluoxastrobin 40.3%	Aftershock 480 SC, Evito 480 SC	2.0 – 5.7	VG	G	P-G	P	P	U	U	U	NL	30 days, R5
	Picoxystrobin	Aproach 2.08 SC	6.0 – 12.0	VG	G	P-G	P	P	U	G	U	G[9]	14 days
	Pyraclostrobin 23.6%	Headline 2.09 EC/SC	6.0 – 12.0	VG	VG	P-G	P	P	U	VG	P-F	NL	21 days
3	Cyproconazole 8.9%	Alto 100SL	2.75 – 5.5	U	U	VG	F	F	U	VG	U	NL	30 days
	Flutriafol 11.8%	Topguard 1.04 SC	7.0 – 14.0	U	VG	VG	P-G	G-VG	U	VG-E	P	F	21 days
	Propiconazole 41.8%	Tilt 3.6 EC, multiple generics	4.0 – 6.0	P	VG	G	NL	F	NL	VG	U	NL	R5
	Prothioconazole 41.0%	Proline 480 SC	2.5 – 5.0	NL	NL	NL	NL	G-VG	NL	VG	U	F	21 days
	Tetraconazole 20.5%	Domark 230 ME	4.0 – 5.0	NL	VG	VG	P-G	F-G	U	VG-E	P	F	R5
7	Boscalid 70%	Endura 0.7 DF	3.5 – 11.0	U	NL	VG	U	P	NL	NL	U	VG	21 days
	Inpyrfluxam 31.25%	Excalia SC	2.0	E	NL	NL	NL	NL	NL	U	NL	NL	R5
1	Thiophanate-methyl	Topsin-M, multiple generics	10.0 – 20.0	U	U	U	F	VG	U	G	U	F	21 days
29	Fluazinam 40.0%	Omega 500 DF	0.75 – 1.0 pts	NL	NL	NL	NL	NL	NL	NL	U	G	R3

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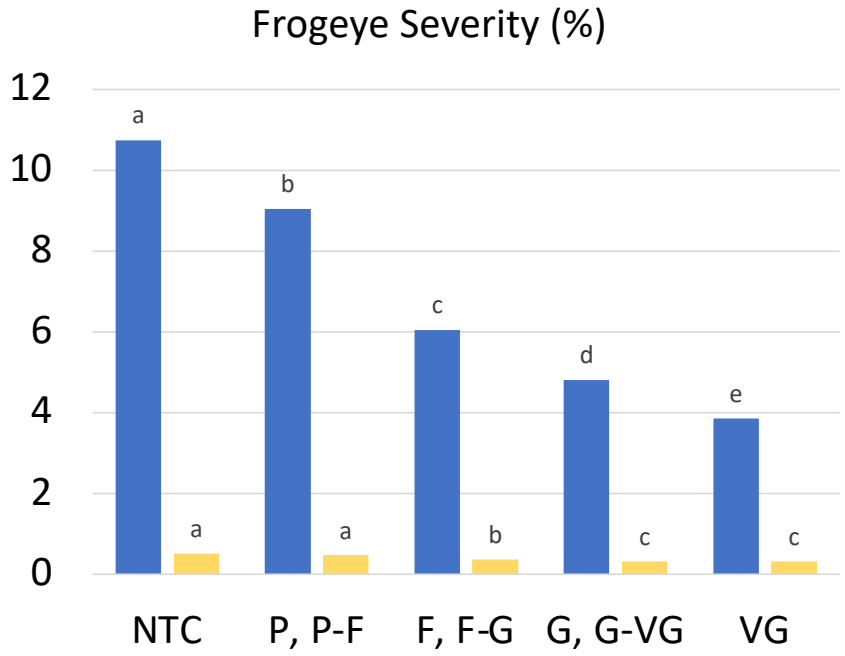
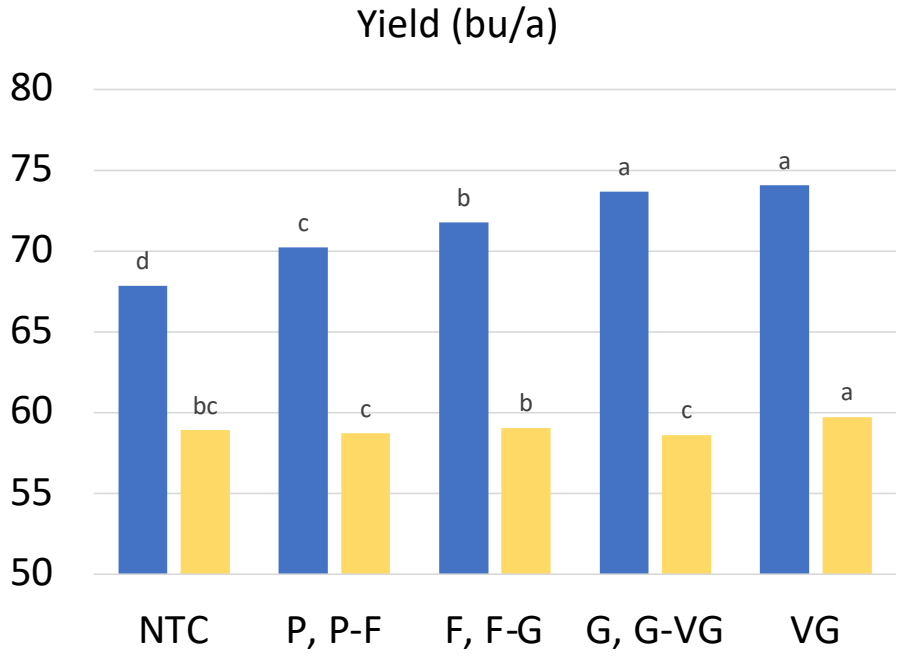
S = select correct fungicide





Frogeye >3% in NTC (6 locs)

Frogeye <3% in NTC (~25 locs)

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Foliar fungicide summary

- Fungicide resistance for the frogeye leaf spot pathogen is widespread and should be a factor when selecting fungicides
- Remember fungicide-resistant strains of the brown spot have also been found in Iowa
- Plant pathology labs continue to monitor for resistance in other pathogens and other fungicide classes (FRAC 3, 7)
- Consider the RULES for fungicide stewardship

For more information on field crop diseases

CropProtectionNetwork.org


Thank you!
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