Wheat and Corn Diseases: Familiar Foes and Emerging Threats

Andrew Friskop – Cereal Crop Extension Pathologist

NDSU | EXTENSION

You will be driving the conversation today……

The Destinations

The Tar Spot Situation in ND

Tillering and Flag Leaf Fungicide Research - Wheat

2022 to 2024 FHB Fungicide Data Summaries

Fungicide Studies in ND Corn

Applied Research on BLS and Ergot in HRSW

Wheat and Corn Disease Trends in ND

Scan the QR or use link to join

https://forms.office.com/r/2D7ysa2JBX

Copy link

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What do you want to hear about today?

The Tar Spot Situation in ND

2022 to 2024 FHB Fungicide Data Summaries

Applied Research on BLS and Ergot in HRSW

Tillering and Flag Leaf Fungicide Research - Wheat

Fungicide Studies in ND Corn

The Tar Spot Situation in North Dakota

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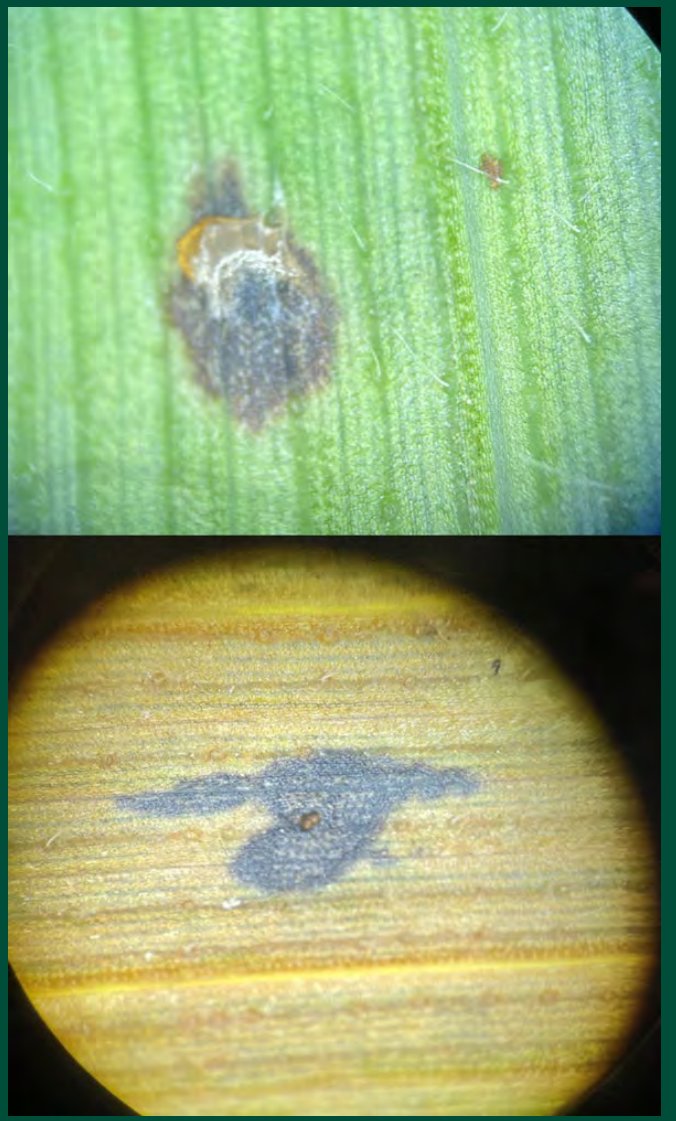
What is Tar Spot?

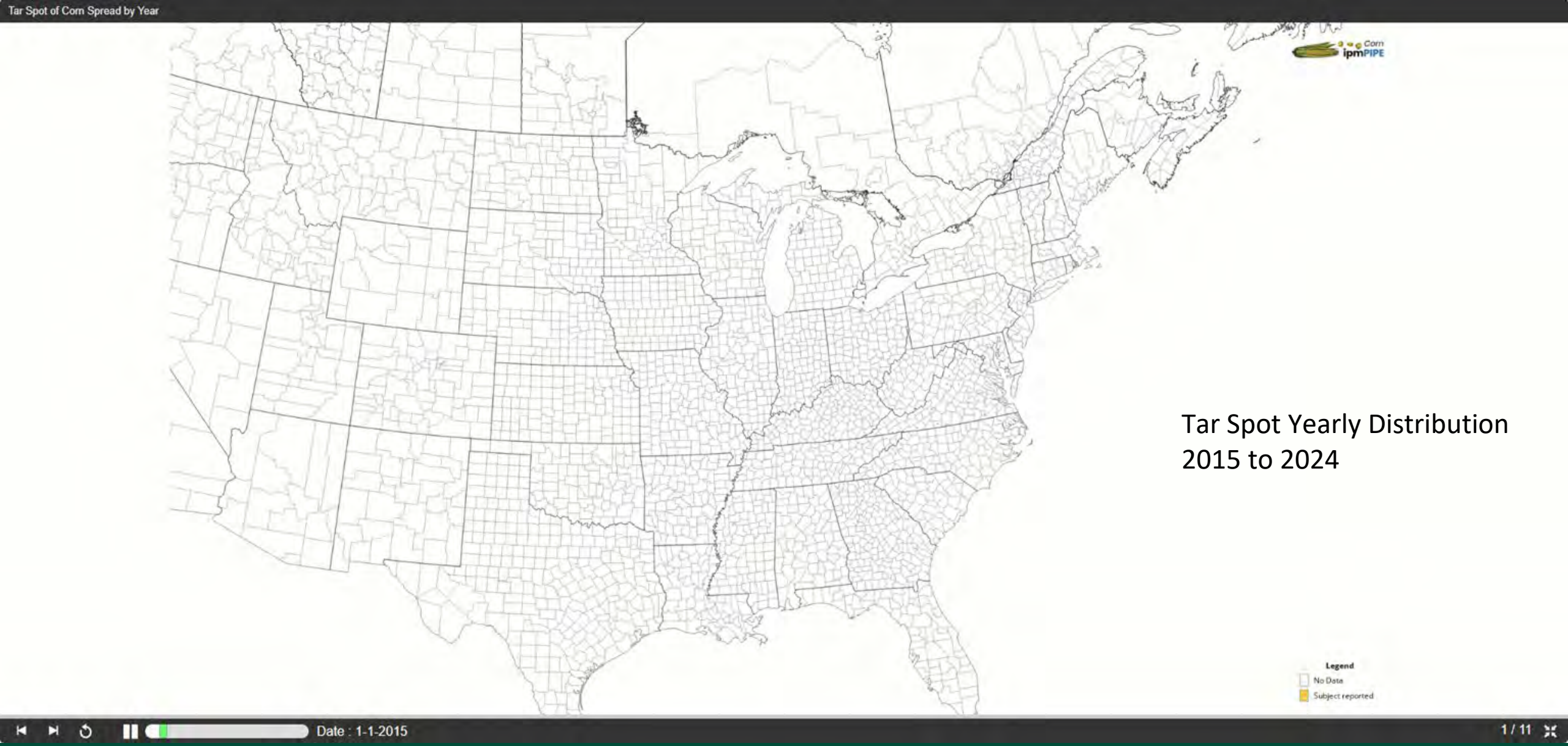
- Fungal leaf disease (*Phyllachora maydis*)
- Cool (64-73F) and wet (free moisture) disease
- First identified in USA in 2015
- Confirmed in ND on September 20, 2024
- Has the potential to cause extensive yield loss
- Fungicides and hybrid selection (not sure on susceptibility of northern corn hybrids)



Tar Spot

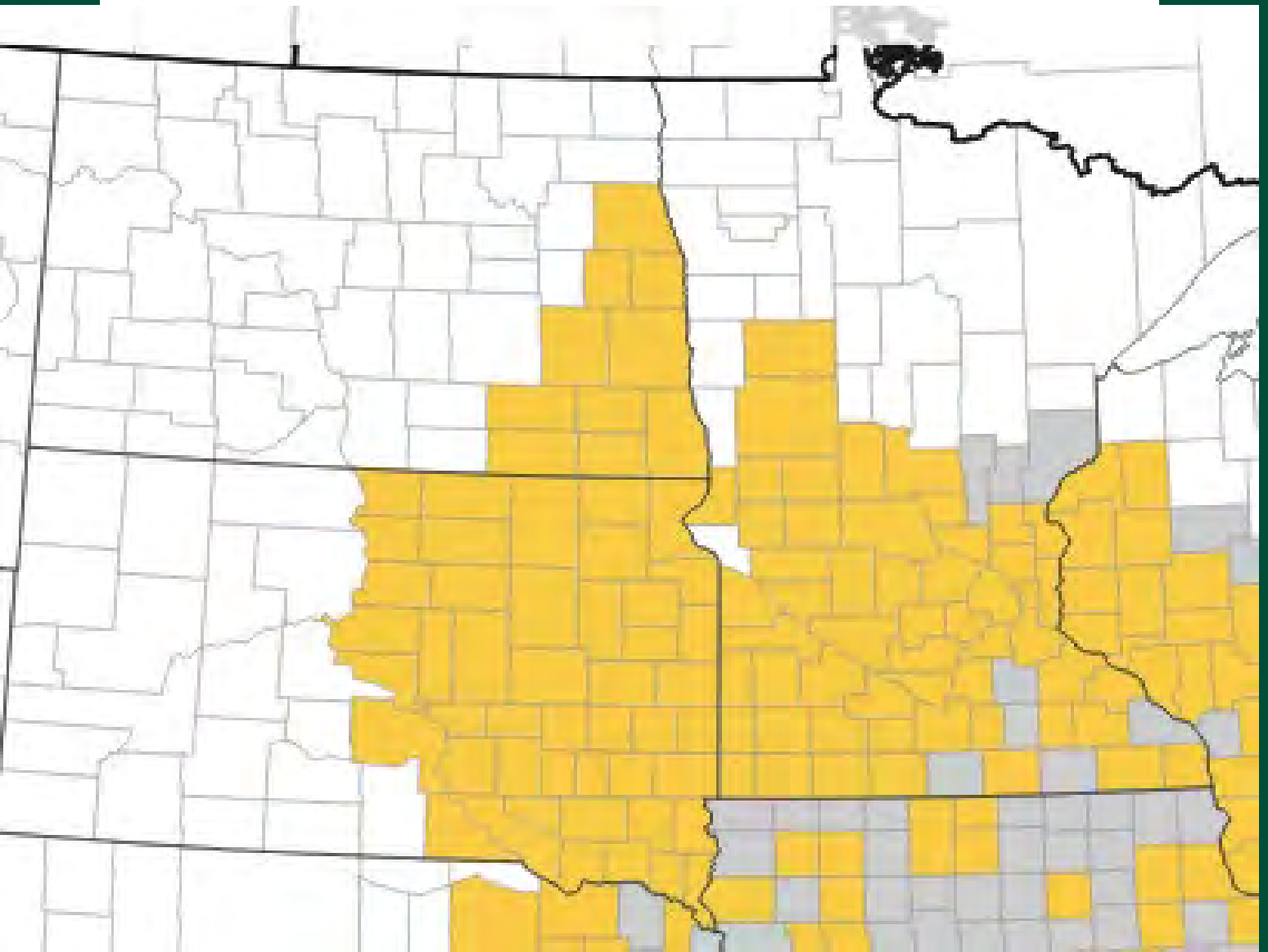
NDS

Tar spot in the USA



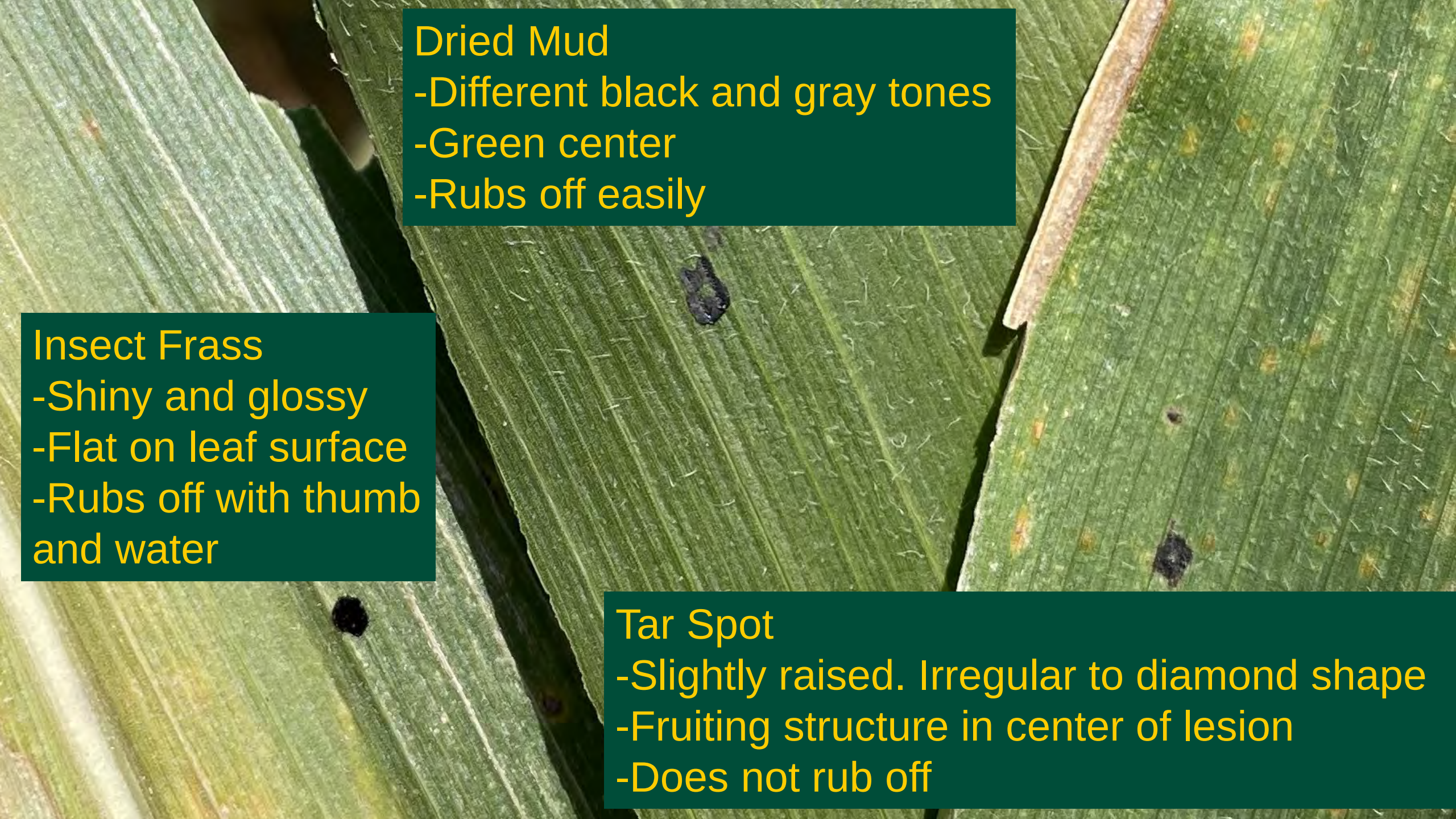
Tar Spot Yearly Distribution
2015 to 2024

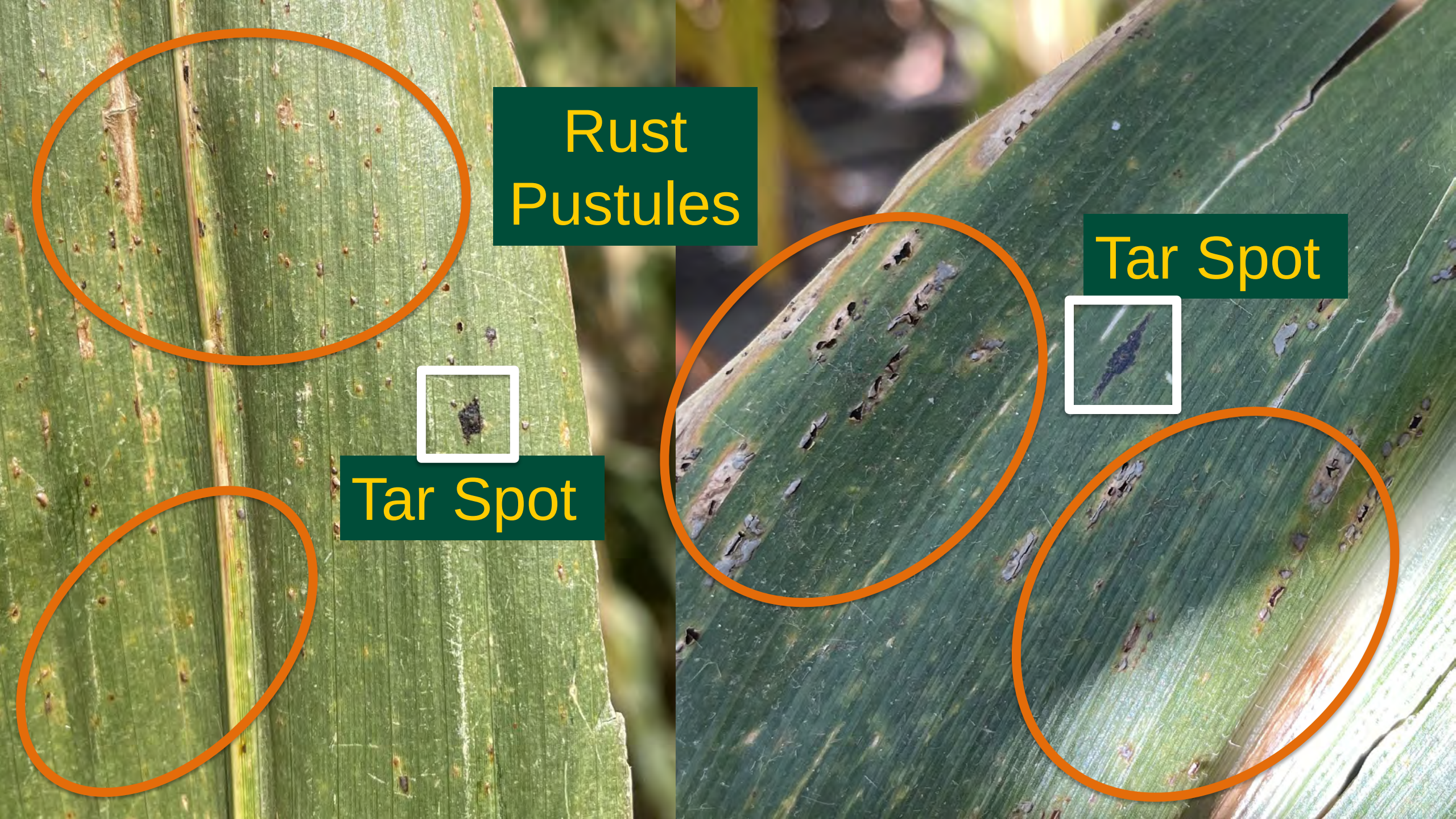
Corn ipmPIPE



https://corn.ipmpipe.org/tar-spot/

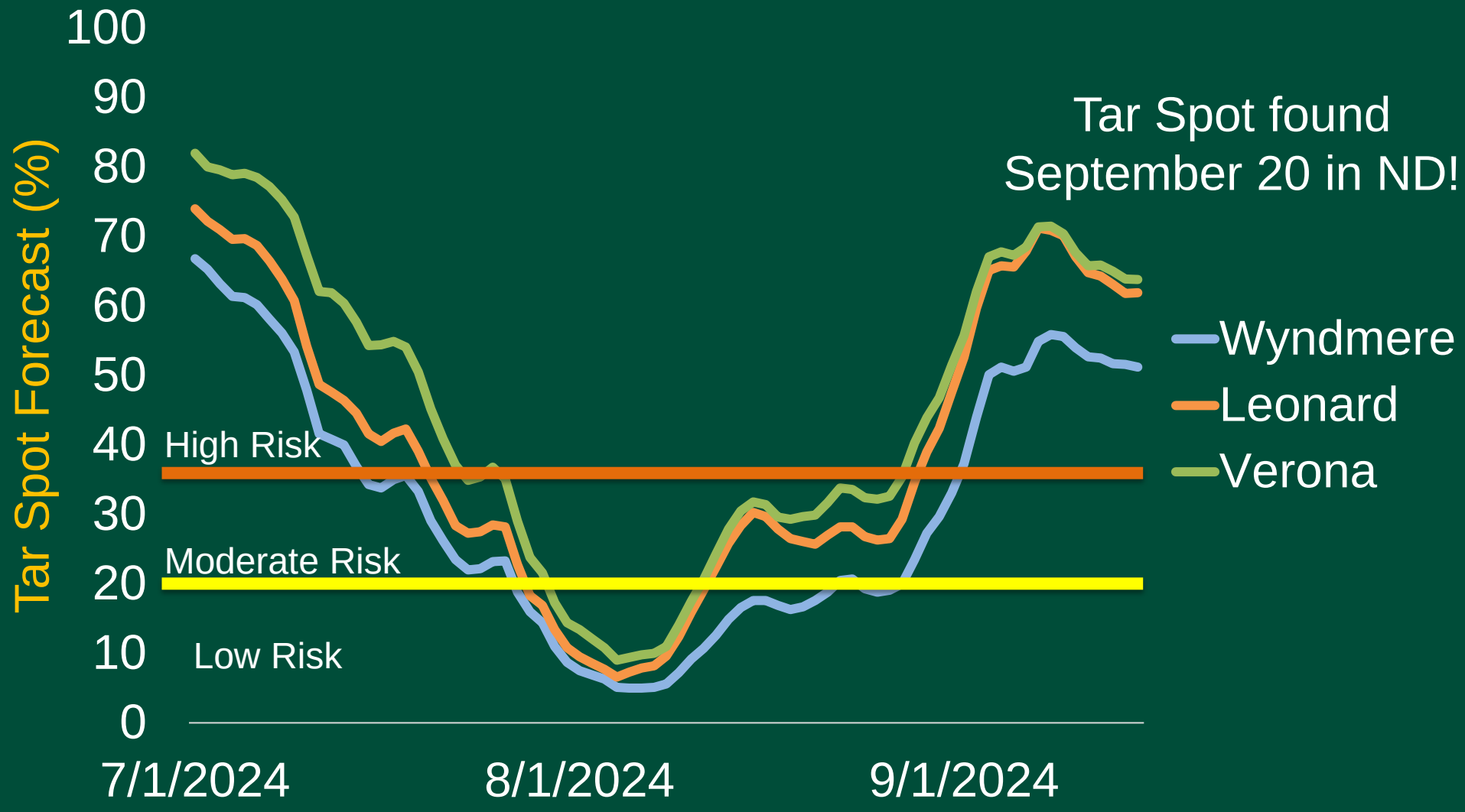
How to identify tar spot


Dried Mud
-Different black and gray tones
-Green center
-Rubs off easily
Insect Frass
-Shiny and glossy
-Flat on leaf surface
-Rubs off with thumb and water
Tar Spot
-Slightly raised. Irregular to diamond shape
-Fruiting structure in center of lesion
-Does not rub off


Rust
Pustules
Tar Spot
Tar Spot

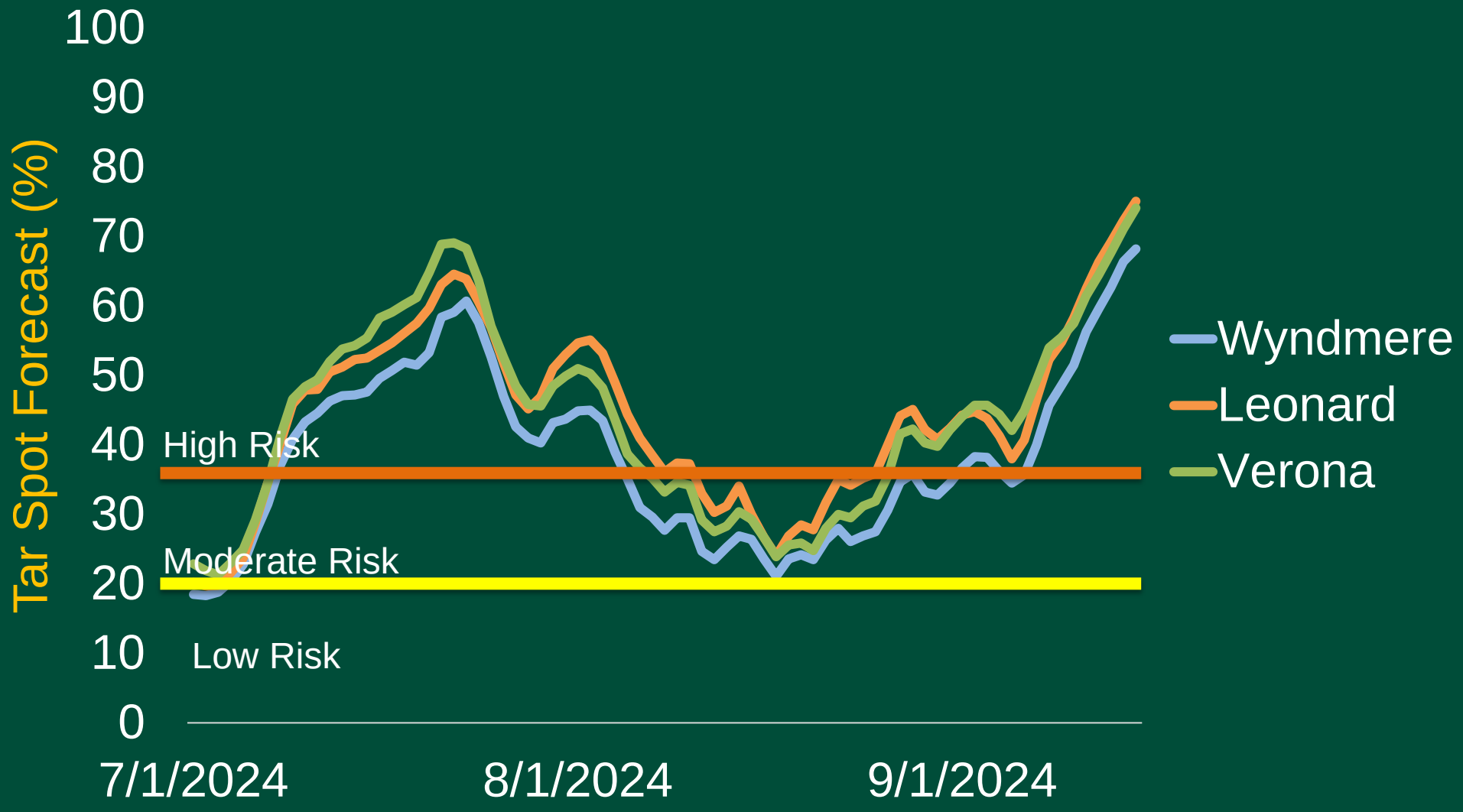
Does ND provide a favorable environment for tar spot?

2024 Tar Spot Risk (Tarspotter App)



Damon Smith
University of Wisconsin

2023 Tar Spot Risk (Tarspotter App)



Damon Smith
University of Wisconsin

National Research Efforts on Tar Spot

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Multi-state Fungicide Efficacy Trials to Manage Tar Spot and Improve Economic Returns in Corn in the United States and Canada

Published: 08/21/2024
DOI: doi.org/10.31274/cpn-20240904-0
CPN-5015

Morgan Goodnight, Purdue University; **Darcy E. P. Telenko**, Purdue University; **Tiffanna J. Ross**, Purdue University; **Martin I. Chilvers**, Michigan State University; **Tom W. Allen**, Mississippi State University; **Keith Ames**, University of Illinois; **Adam M. Byrne**, Michigan State University; **Jill C. Check**, Michigan State University; **W. Scott Jay**, University of Guelph Ridgetown Campus; **Brian Mueller**, University of Wisconsin-Madison; **Camila Rocco da Silva**, Purdue University; **Emily M. Roggenkamp**, Michigan State University; **Sujoung Shim**, Purdue University; **Damon L. Smith**, University of Wisconsin-Madison; **Albert U. Tenuta**, Ontario Ministry of Agriculture, Food and Agribusiness; and **Nathanael M. Thompson**,Purdue University.

Related Resources

An Overview of Tar Spot

Fungicide Application Reminders to

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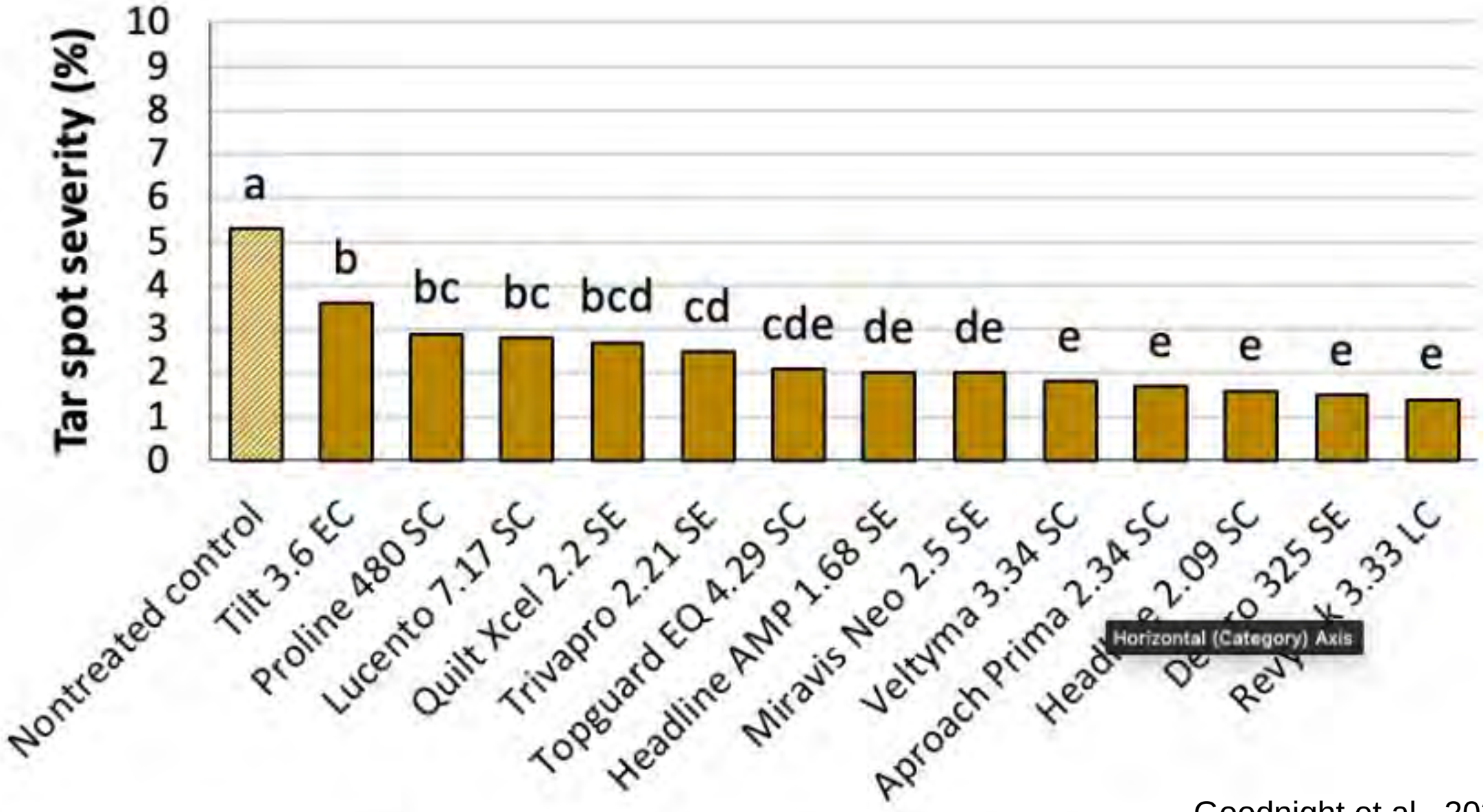
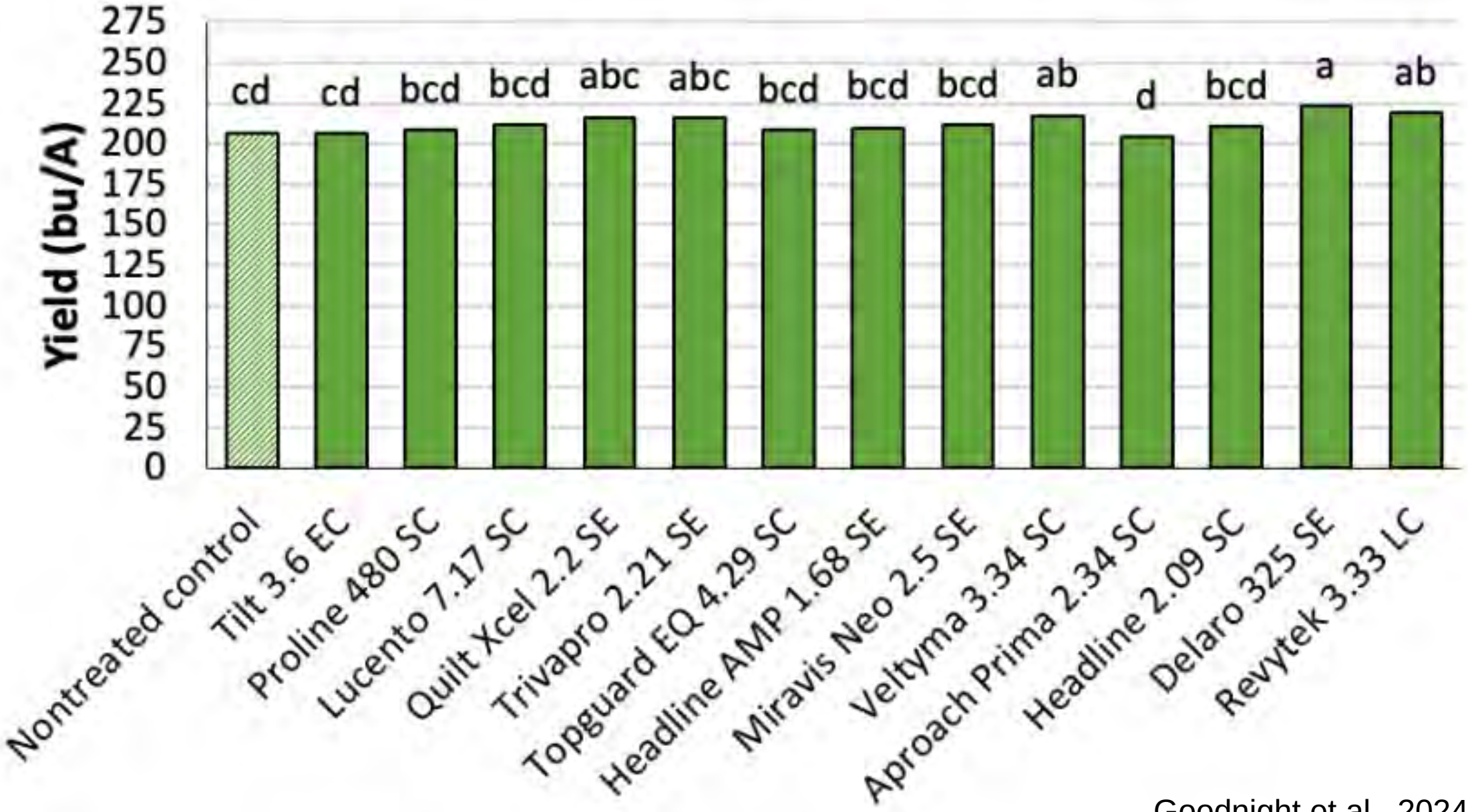
Fungicide Efficacy – VT/R1 Fungicide Trials



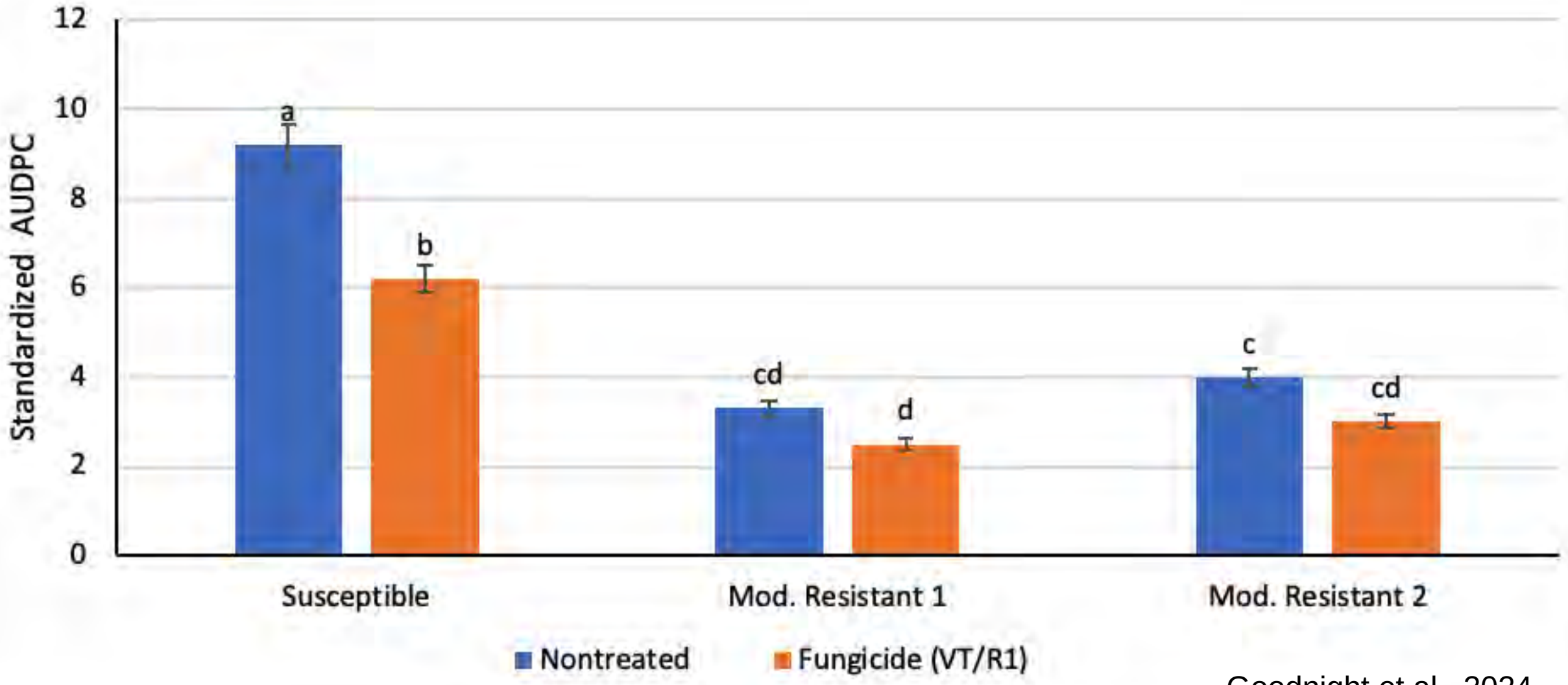
Goodnight et al., 2024

Fungicide Efficacy – VT/R1 Fungicide Trials



Goodnight et al., 2024

Fungicide by Hybrid Trials



Goodnight et al., 2024

Tar Spot Questions in ND in 2025?

Will tar spot appear again?

Field research in ND?

Crystal ball prediction?

Tar Spot Questions in ND in 2025?

Will tar spot appear again?	Maybe? Scout!
Field research in ND?	Monitoring, surveillance and management trials (NDCUC funded)
Crystal ball prediction?	ND has a very conducive environment for tar spot

Wheat and Corn Disease Trends in North Dakota

Andrew Friskop – Cereal Crop Extension Pathologist

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Wheat Disease Prevalence Data

Pest Surveys (2010 to 2023)

Disease Prevalence = % fields with a disease

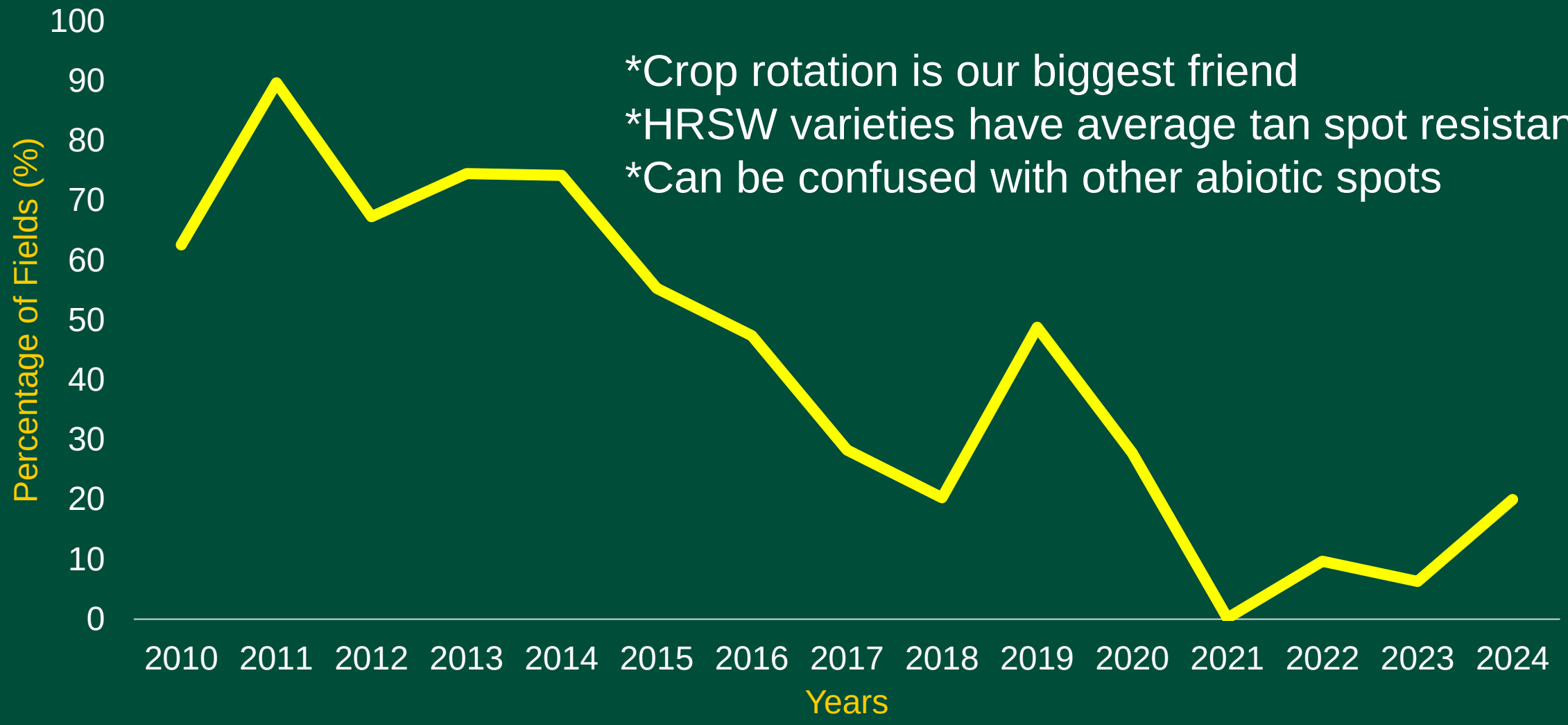
**Data summarized for field scouted between flag leaf and maturity*

Supported by USDA-NIFA, Crop Protection and Pest Management – Extension Implementation Program Current Award # 2021-70006-35330

Tan Spot

Tan Spot

Tan Spot – North Dakota

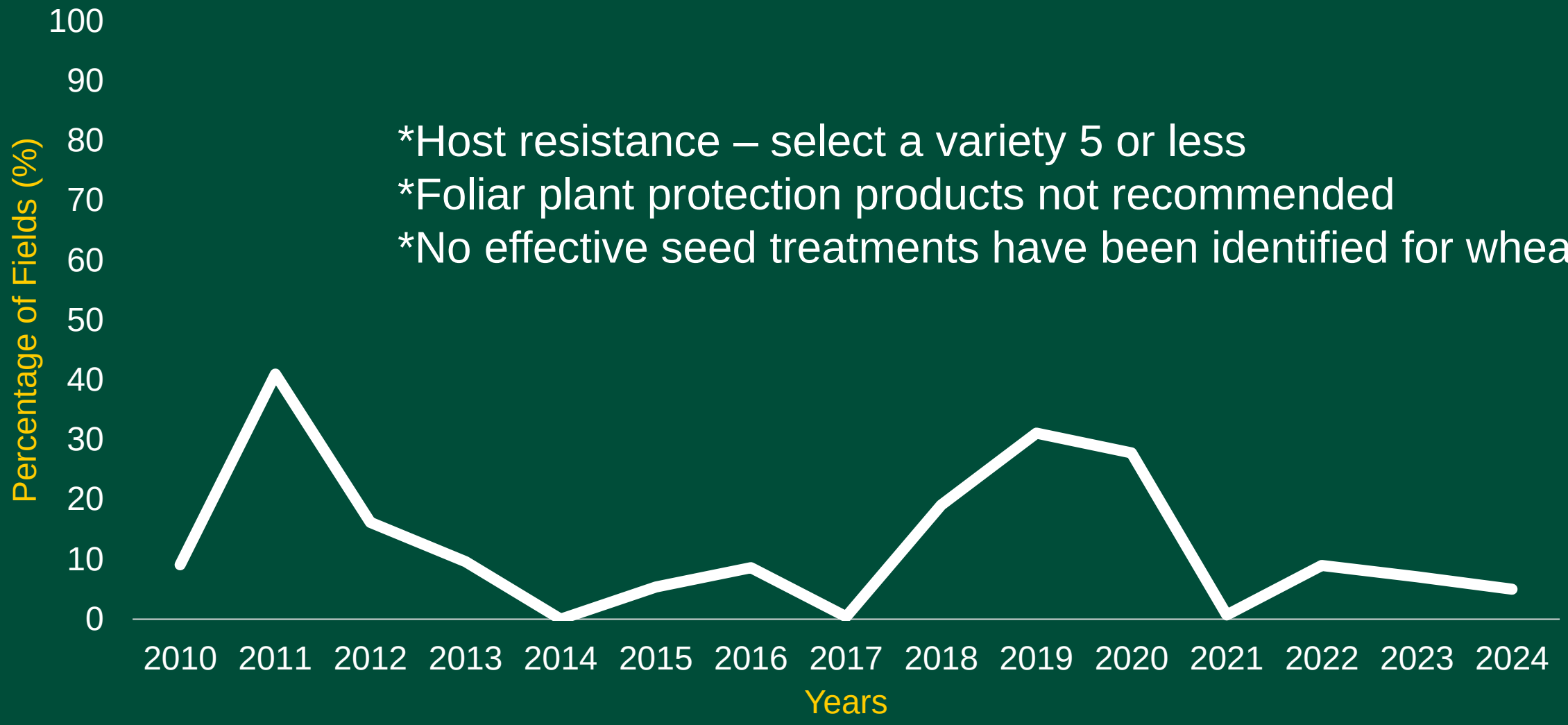


*Crop rotation is our biggest friend
*HRSW varieties have average tan spot resistance
*Can be confused with other abiotic spots

Bacterial Leaf Streak

Bacterial Leaf Streak

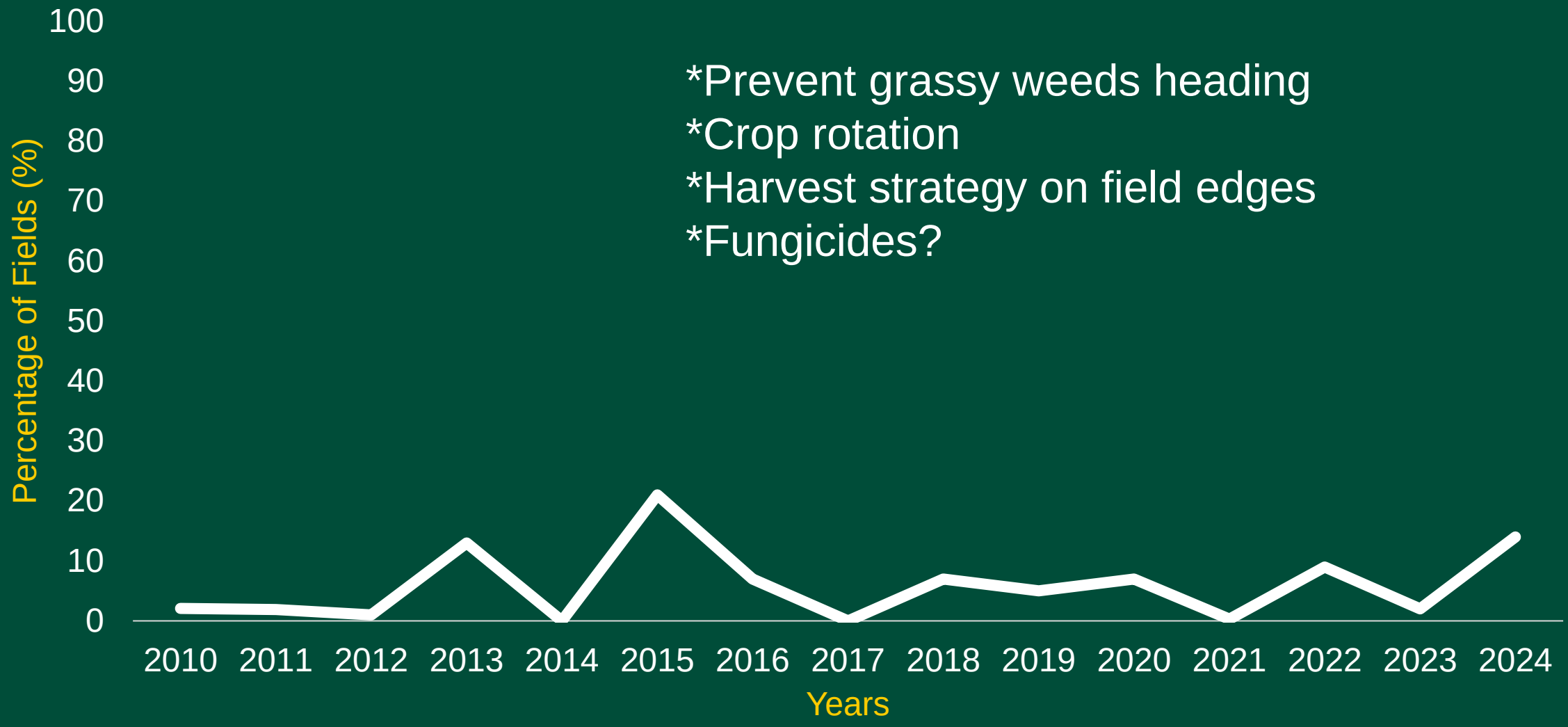
Bacterial Leaf Streak – North Dakota



*Host resistance – select a variety 5 or less
*Foliar plant protection products not recommended
*No effective seed treatments have been identified for wheat

Ergot

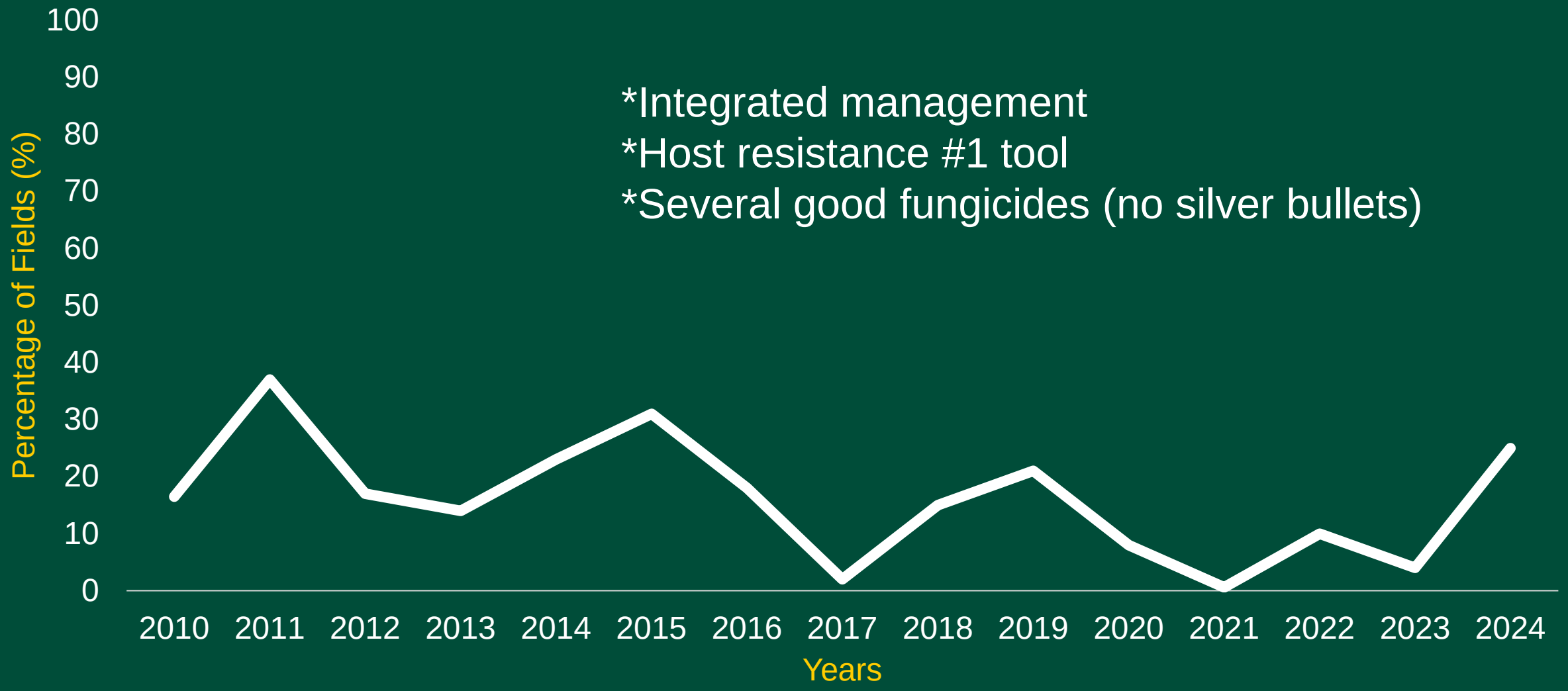
Ergot – North Dakota



*Prevent grassy weeds heading
*Crop rotation
*Harvest strategy on field edges
*Fungicides?

Fusarium Head Blight (Scab)

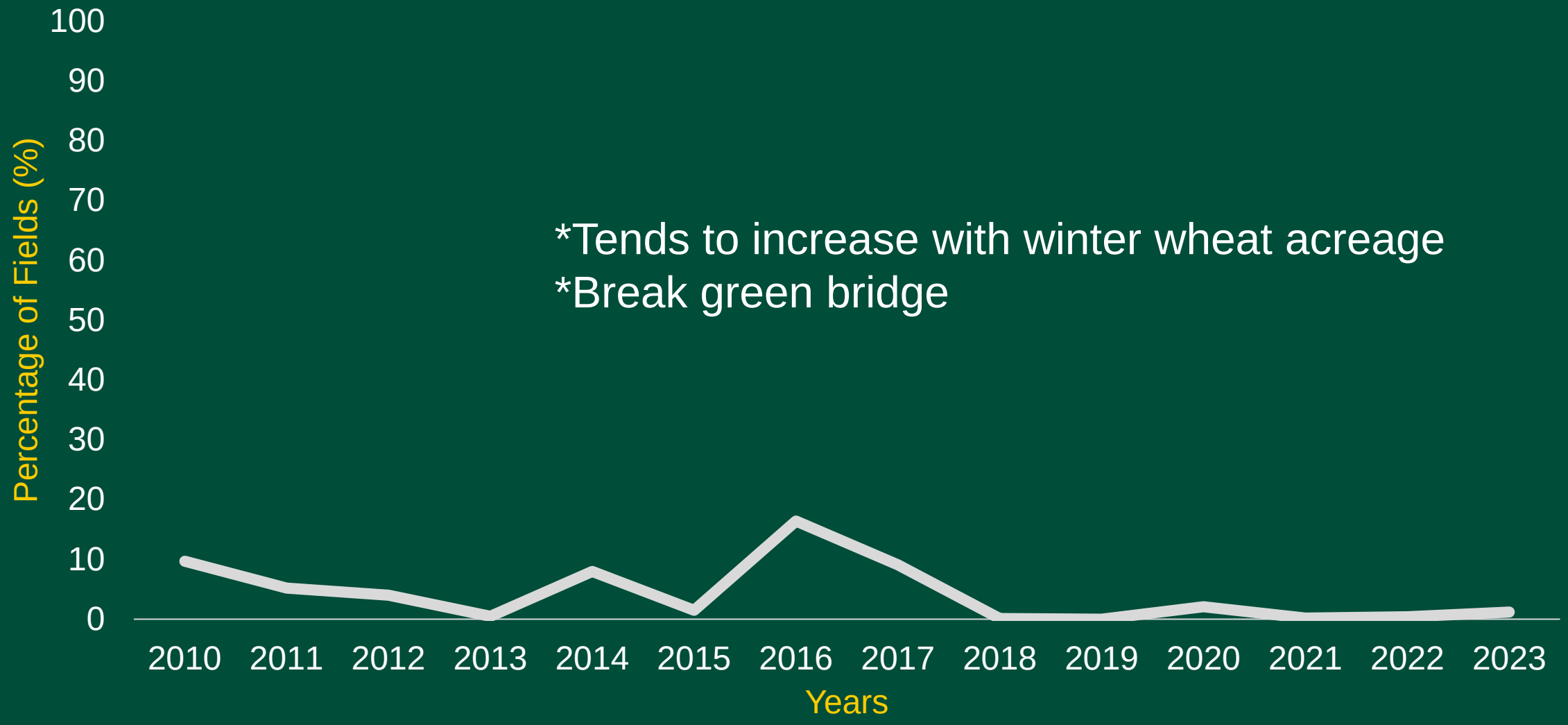
Fusarium Head Blight – North Dakota



*Integrated management
*Host resistance #1 tool
*Several good fungicides (no silver bullets)

Wheat Streak Mosaic

Wheat Streak Mosaic – North Dakota



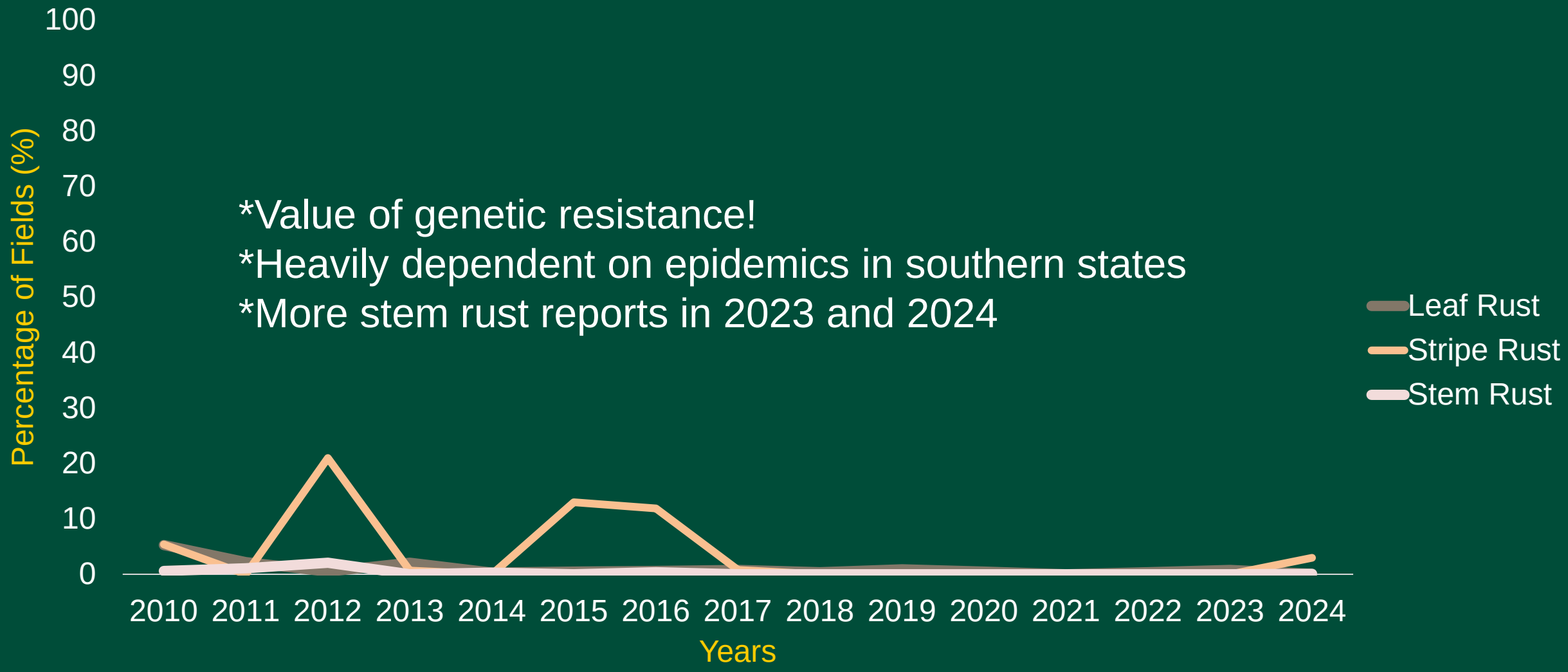
*Tends to increase with winter wheat acreage
*Break green bridge


Stripe Rust


Leaf Rust


Stem Rust

Leaf, Stripe and Stem Rust – North Dakota



Corn Disease Prevalence Data

Pest Surveys (2016 to 2024)

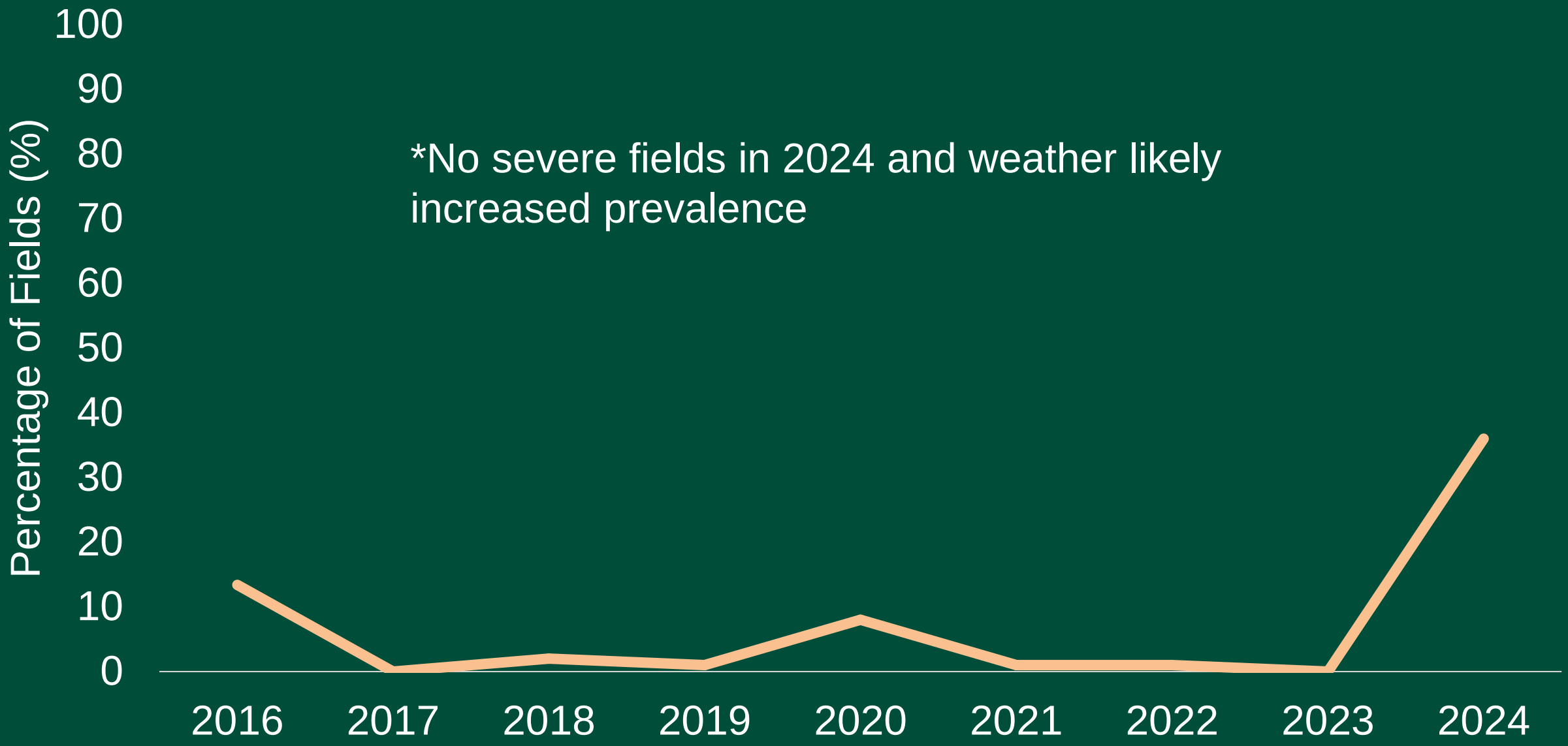
Disease Prevalence = % fields with a disease

**Data summarized for fields scouted between VT and R3*

Supported by North Dakota Department of Agriculture and North Dakota Corn Utilization Council

Northern Corn Leaf Blight

Northern Corn Leaf Blight – North Dakota

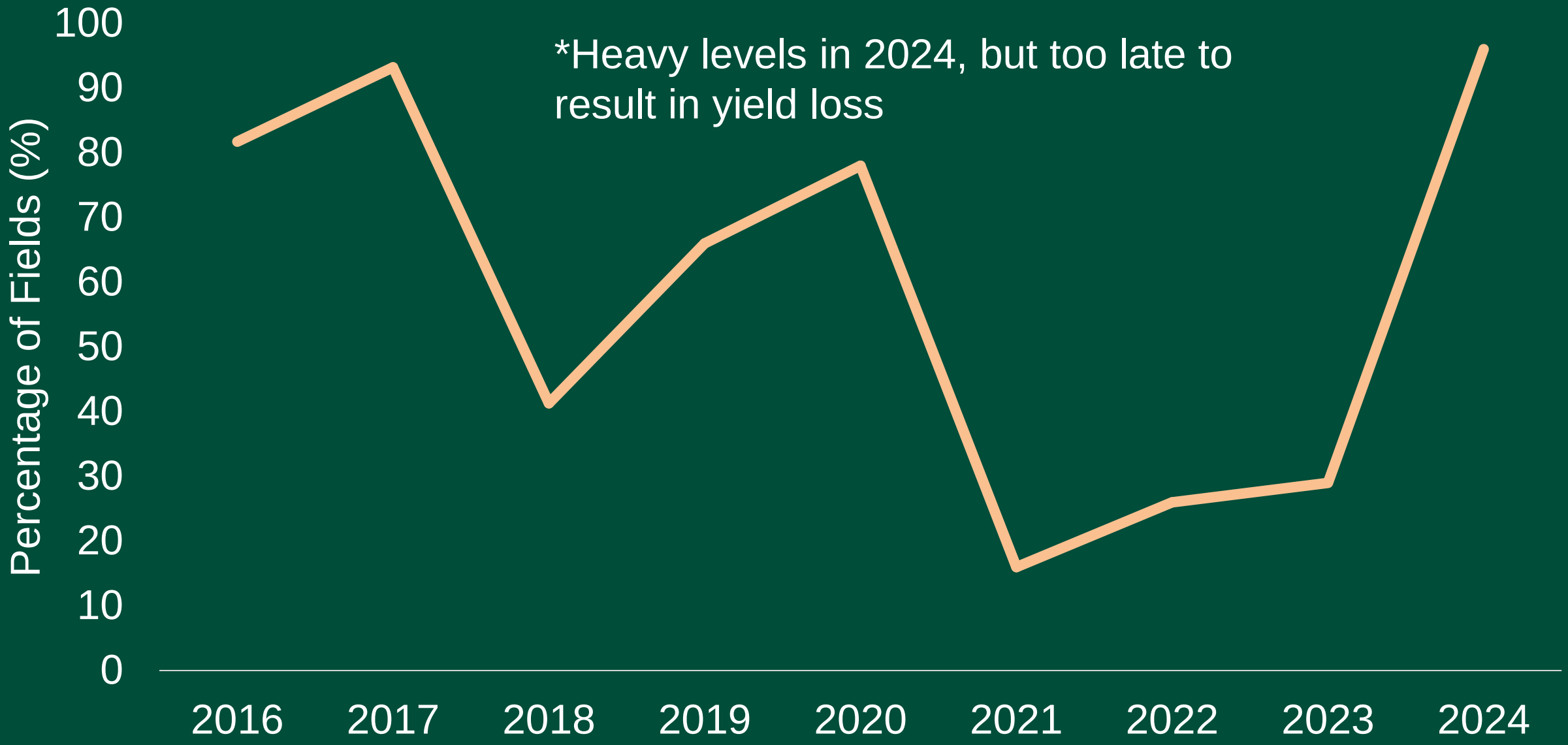


*No severe fields in 2024 and weather likely increased prevalence

Common Corn Rust

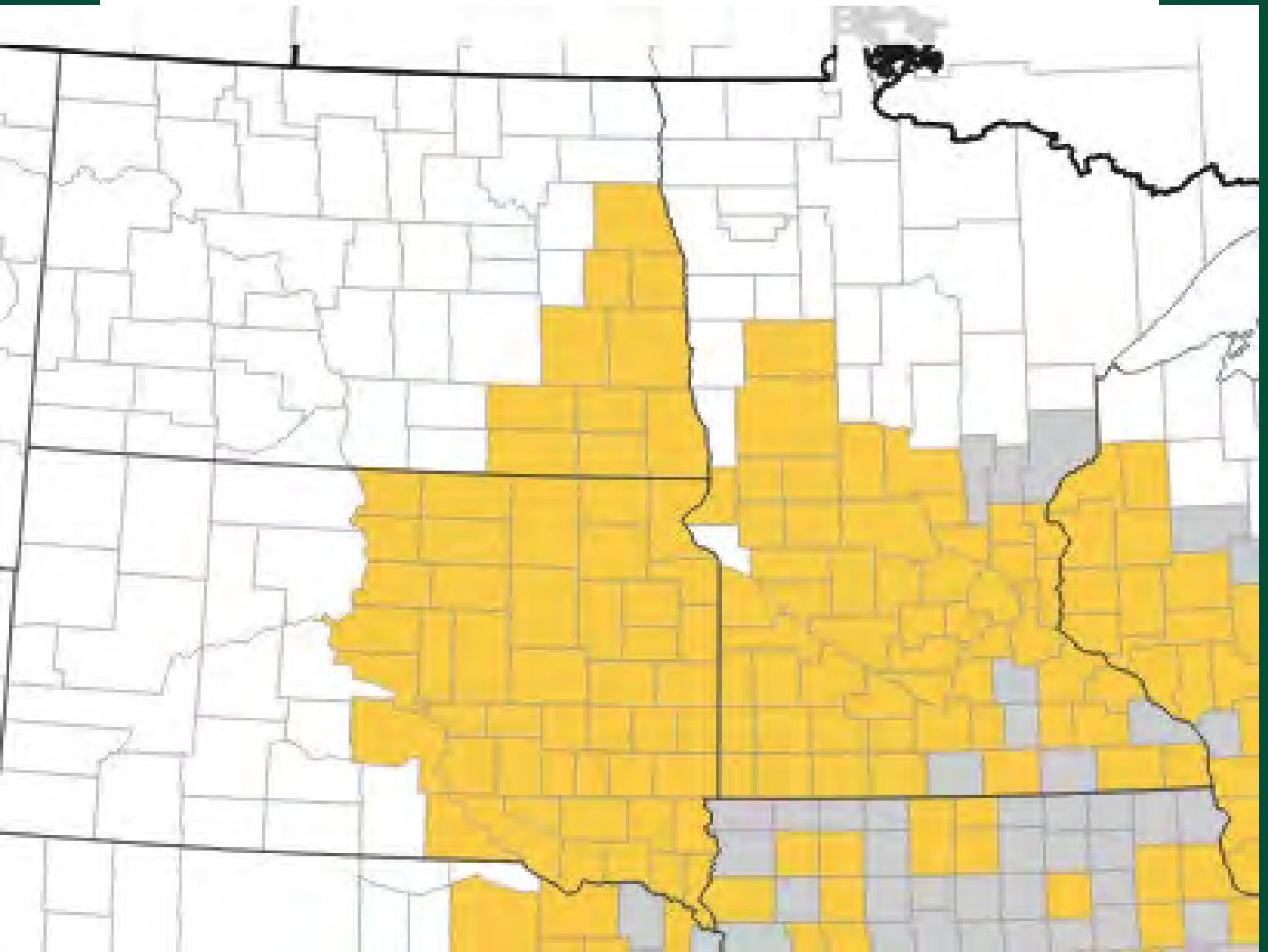

Common Rust
Southern Rust

Common Corn Rust – North Dakota



Tar Spot

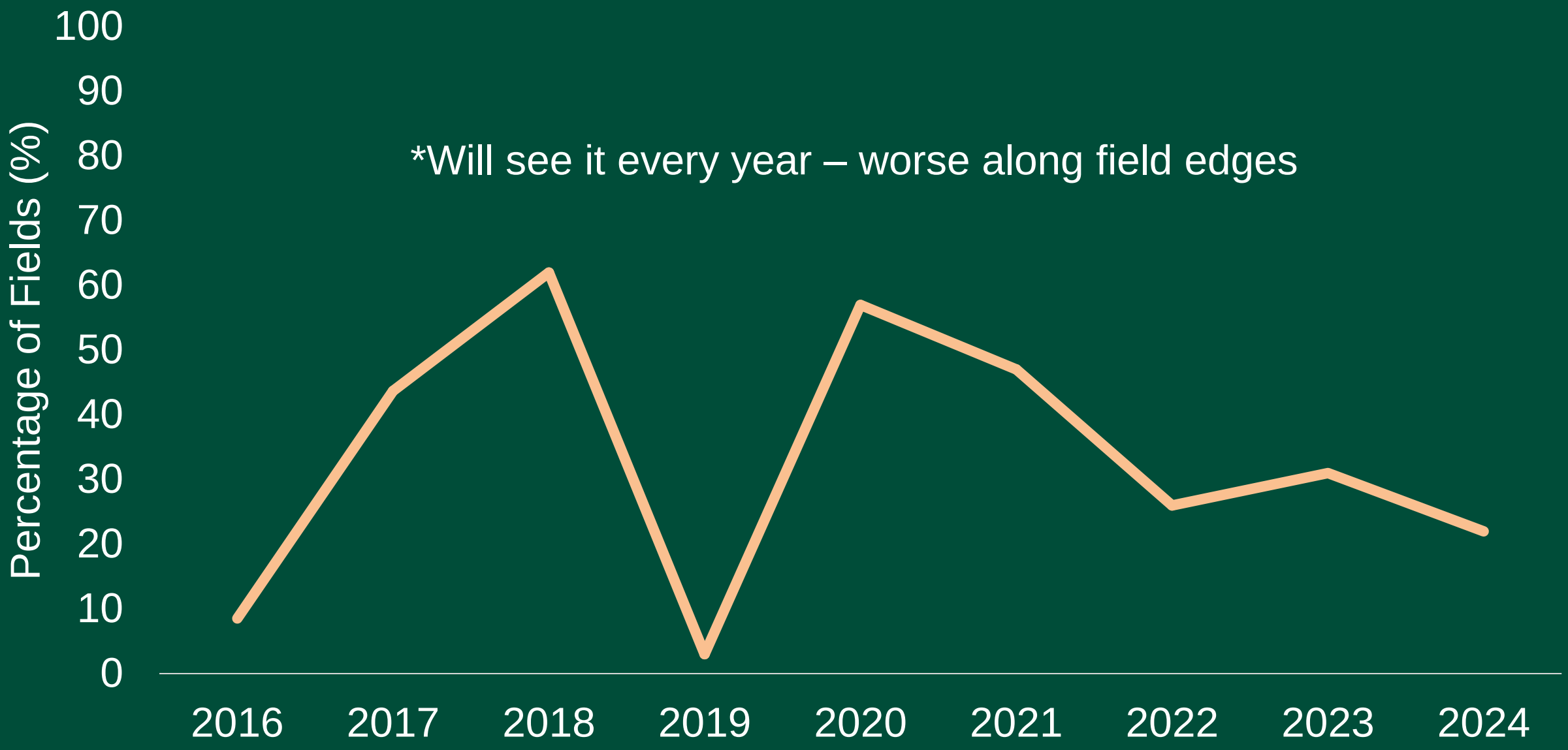
Corn ipmPIPE



https://corn.ipmpipe.org/tar-spot/

Common Corn Smut

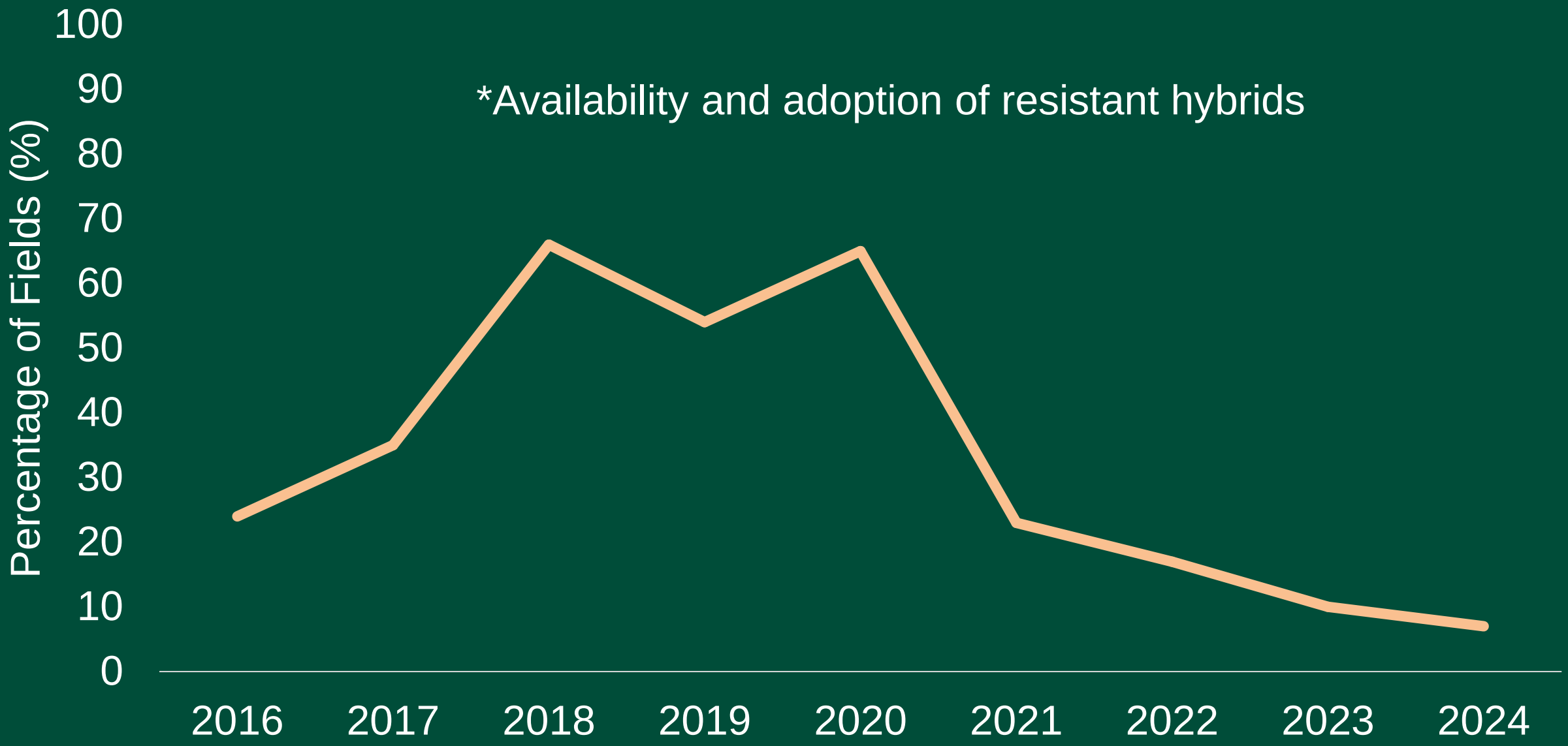
Common Smut – North Dakota



Crown Rots and Stalk Rots

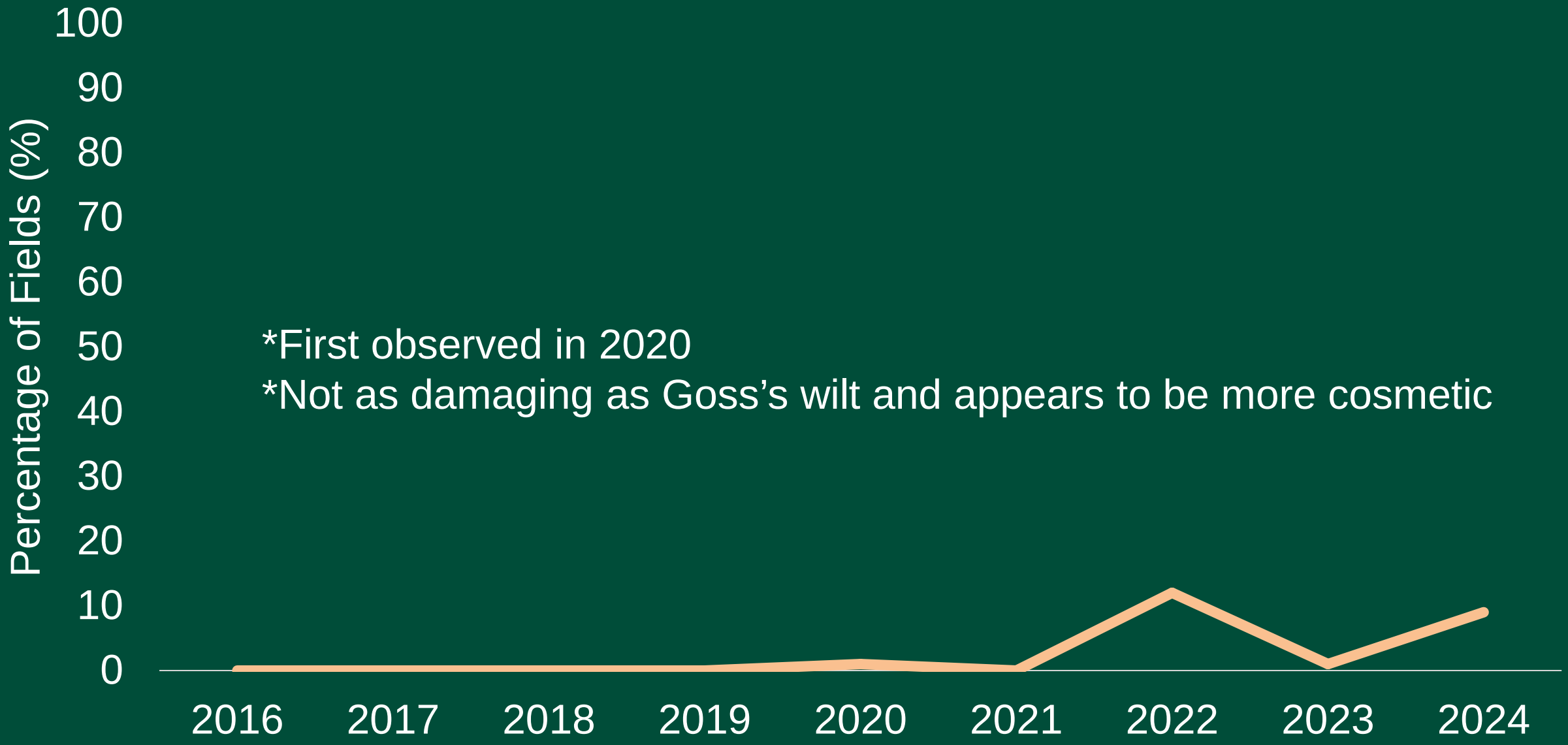
Goss’s Wilt

Goss's Wilt – North Dakota



Bacterial Leaf Streak

Bacterial Leaf Streak – North Dakota



*First observed in 2020

*Not as damaging as Goss's wilt and appears to be more cosmetic

Summary of Wheat and Corn Disease Trends

- Most amount of disease observe in past 5 years
- Weather drives most of our disease epidemics in ND
- Wheat rust susceptibility in the south could influence earlier arrivals
- Fusarium head blight has not gone away
- Be on the lookout for tar spot and stalk rot

Applied Research on BLS and Ergot in HRSW

Andrew Friskop – Cereal Crop Extension Pathologist

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Ergot

- Fungus (*Claviceps purpurea)*
- Produces black to purple sclerotia (ergot bodies)
- Hardened mass of fungal growth
- Infects and replaces kernel
- Sclerotia contains alkaloids


Winter Rye


Two-row
Spring Barley


Hard Red
Winter Wheat

59 Grass Hosts in ND

Tillage, Crop Rotation, and Using Ergoty Seed Lots

Evaluation of Ergot Resistance in HRSW

NDSU

Evaluation of Ergot Resistance in HRSW

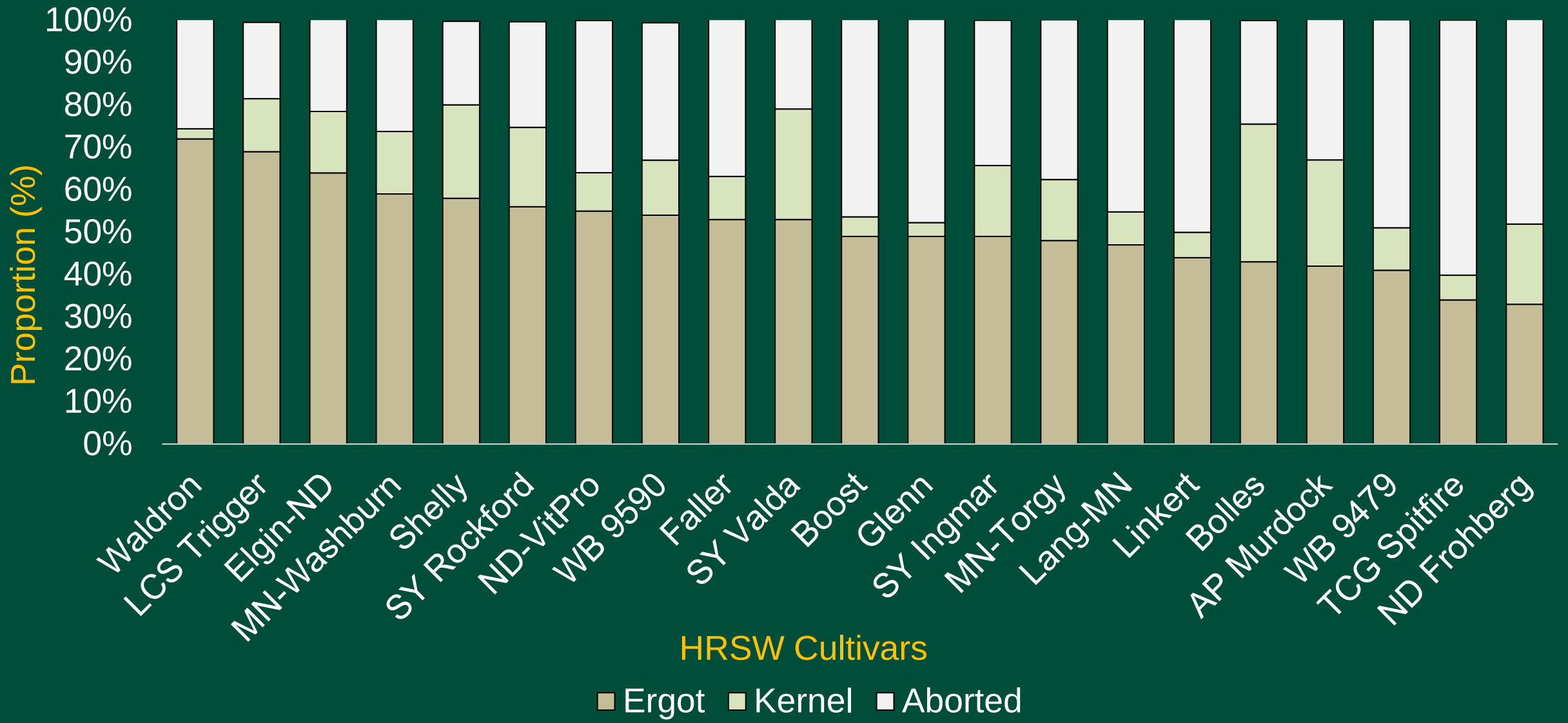
- Funded by ND Wheat Commission
- Dr. LeAnn Lux
- 21 HRSW Varieties

  Ergot Incidence

  Ergot Weight

  Ergot Sclerotium Characteristics

Ergot Resistance Screening – Greenhouse



What about sclerotium characteristics that effect cleaning?

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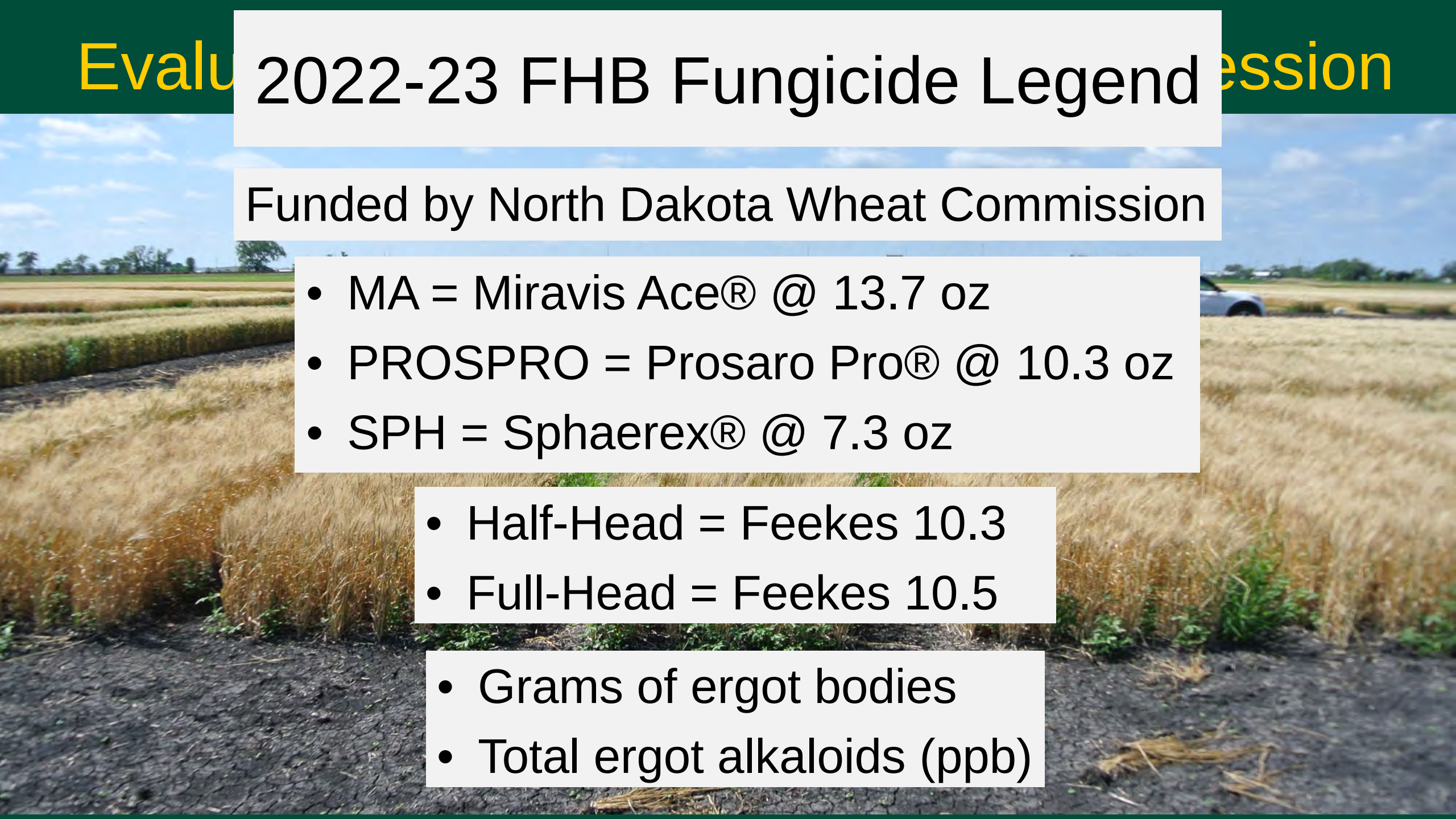
Logistical Resistance

Evaluating Fungicides for Ergot Suppression

Evalu 2022-23 FHB Fungicide Legend ession



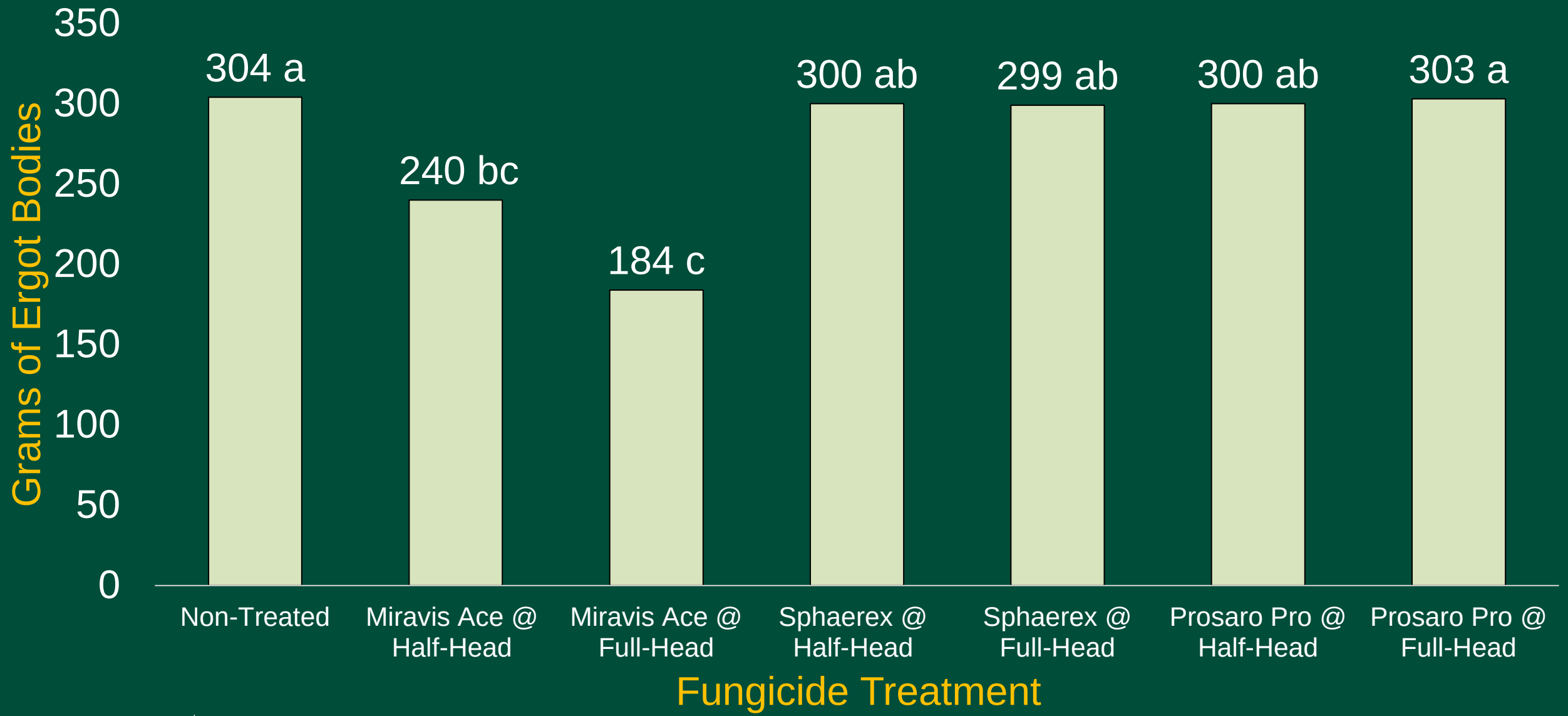
Funded by North Dakota Wheat Commission

- MA = Miravis Ace® @ 13.7 oz
- PROSPRO = Prosaro Pro® @ 10.3 oz
- SPH = Sphaerex® @ 7.3 oz

- Half-Head = Feekes 10.3
- Full-Head = Feekes 10.5

- Grams of ergot bodies
- Total ergot alkaloids (ppb)

Fungicide Trials – 2022 and 2023



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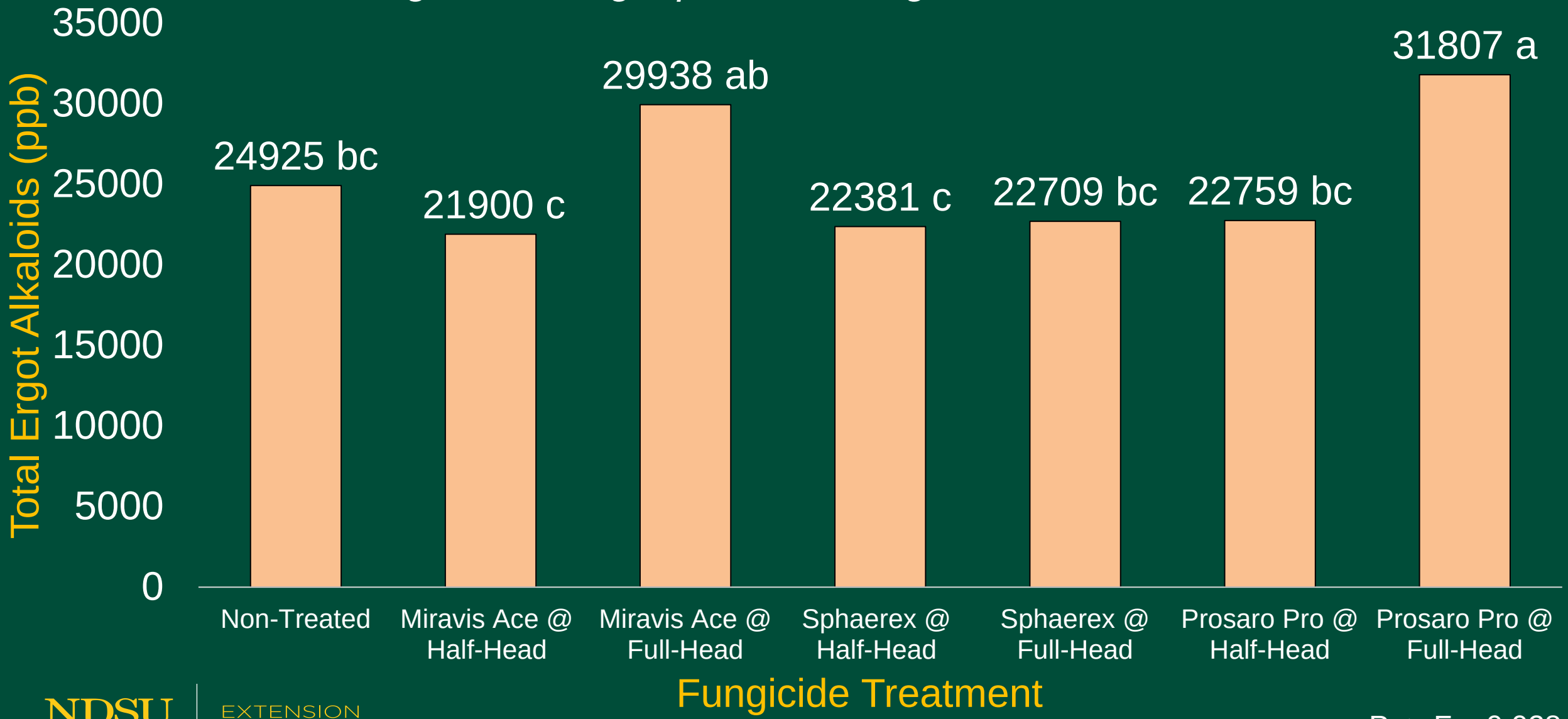
Pr > F = 0.001

Fungicide Trials – 2022 and 2023

0.5 grams of ergot placed in 80 grams of wheat



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Pr > F = 0.028

Bacterial Leaf Streak

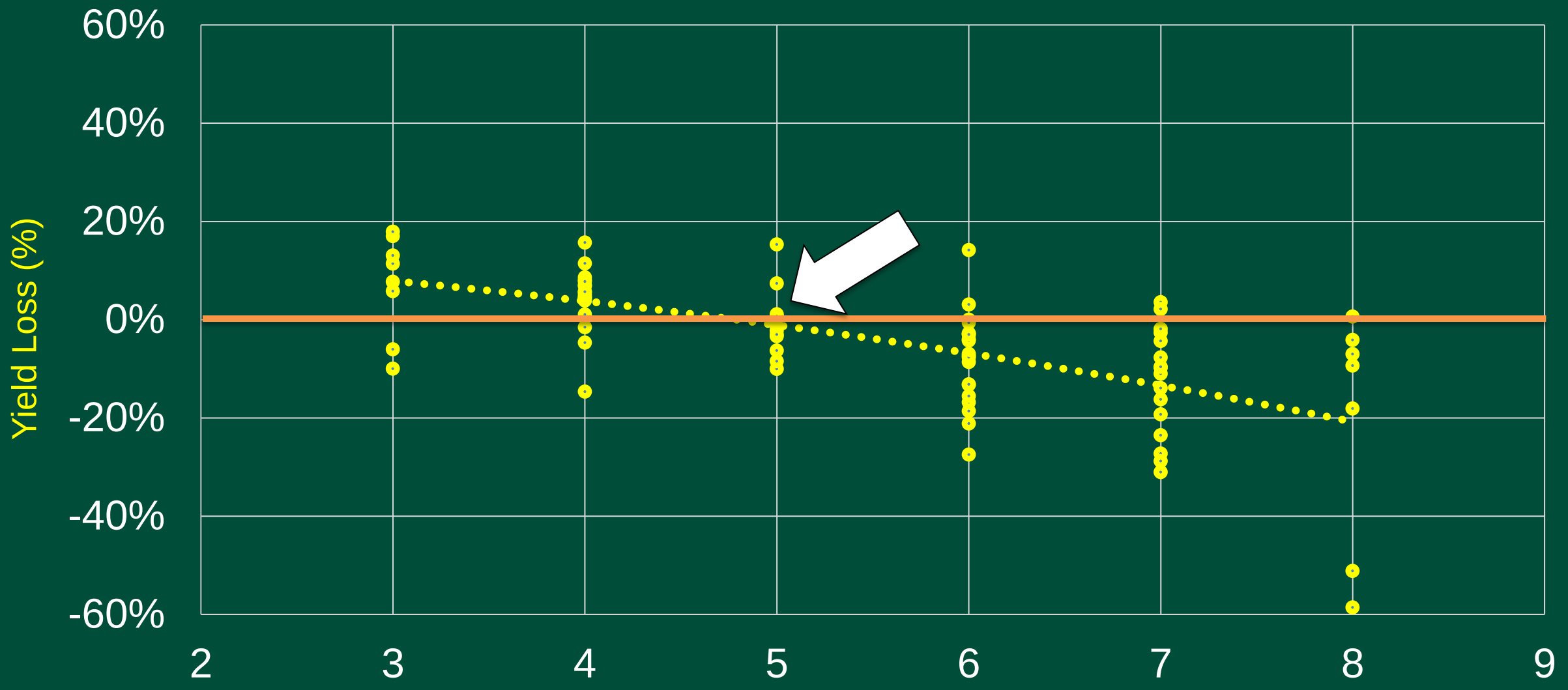
- *Xanthomonas translucens* pv. *undulosa*
- Seed borne and residue borne
- Favored by crop injury (hail, thunderstorms, etc.)
- Wide temperature range (59-86F)
- High humidity
- Symptoms most apparent at flag leaf stage

Bacterial Leaf Streak and Black Chaff

Yield Loss Caused by BLS?

- Natural BLS outbreaks in HRSW variety performance trials in eastern ND (2019 and 2020)
- Assessed 42 to 44 HRSW varieties for yield loss in moderate and high levels of BLS
- Compared to highest yielding varieties (top 25%)

Yield Loss BLS – Four Locations



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General Estimates of Average BLS Yield Loss

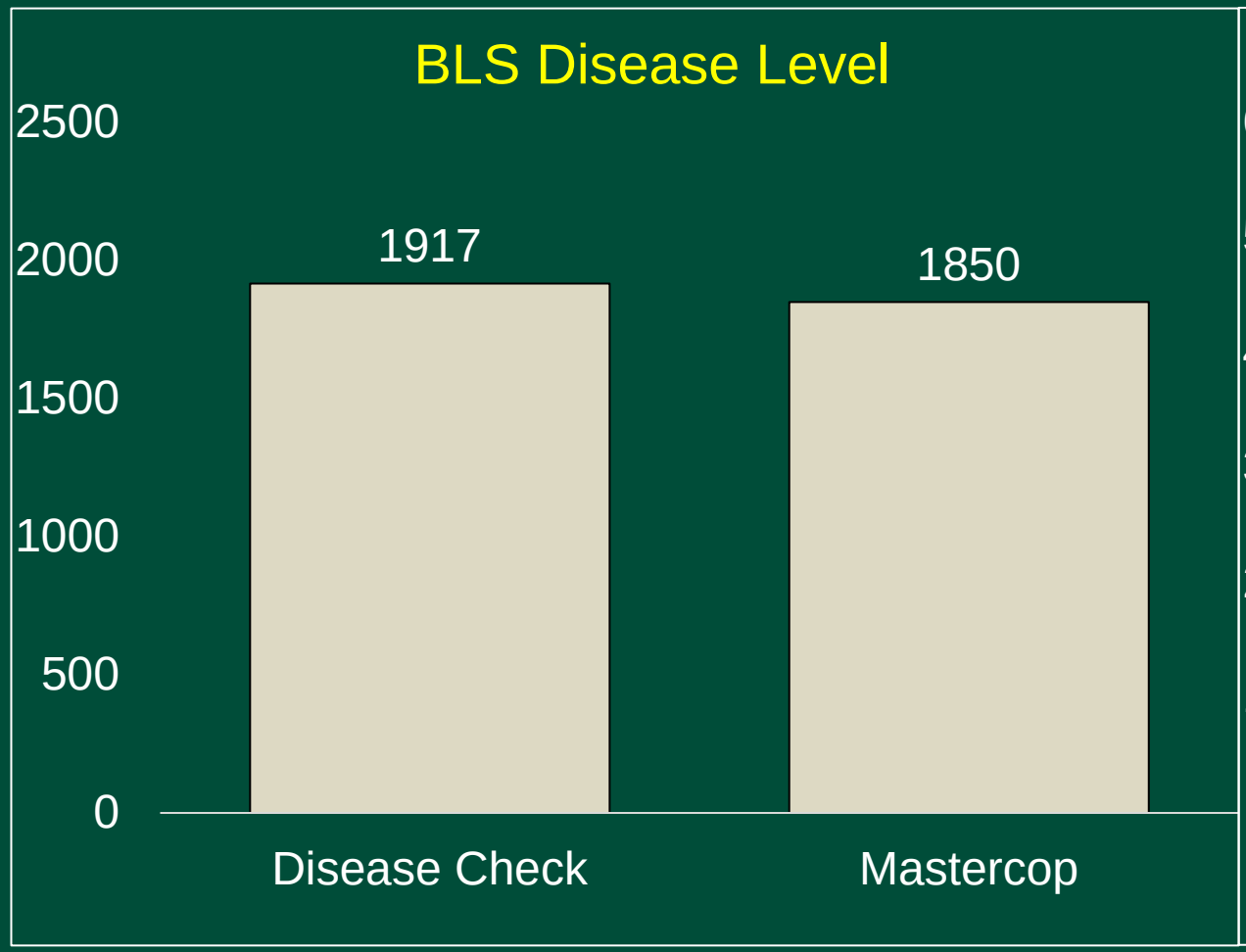
BLS Resistance Score	Average Yield Loss Range Observed in BLS Epidemics
2-3	0%
4	0 to 1%
5	0.2% to 5.7%
6	2.2% to 11.8%
7	7.8% to 16.9%
8-9	19.8% to 27.4%

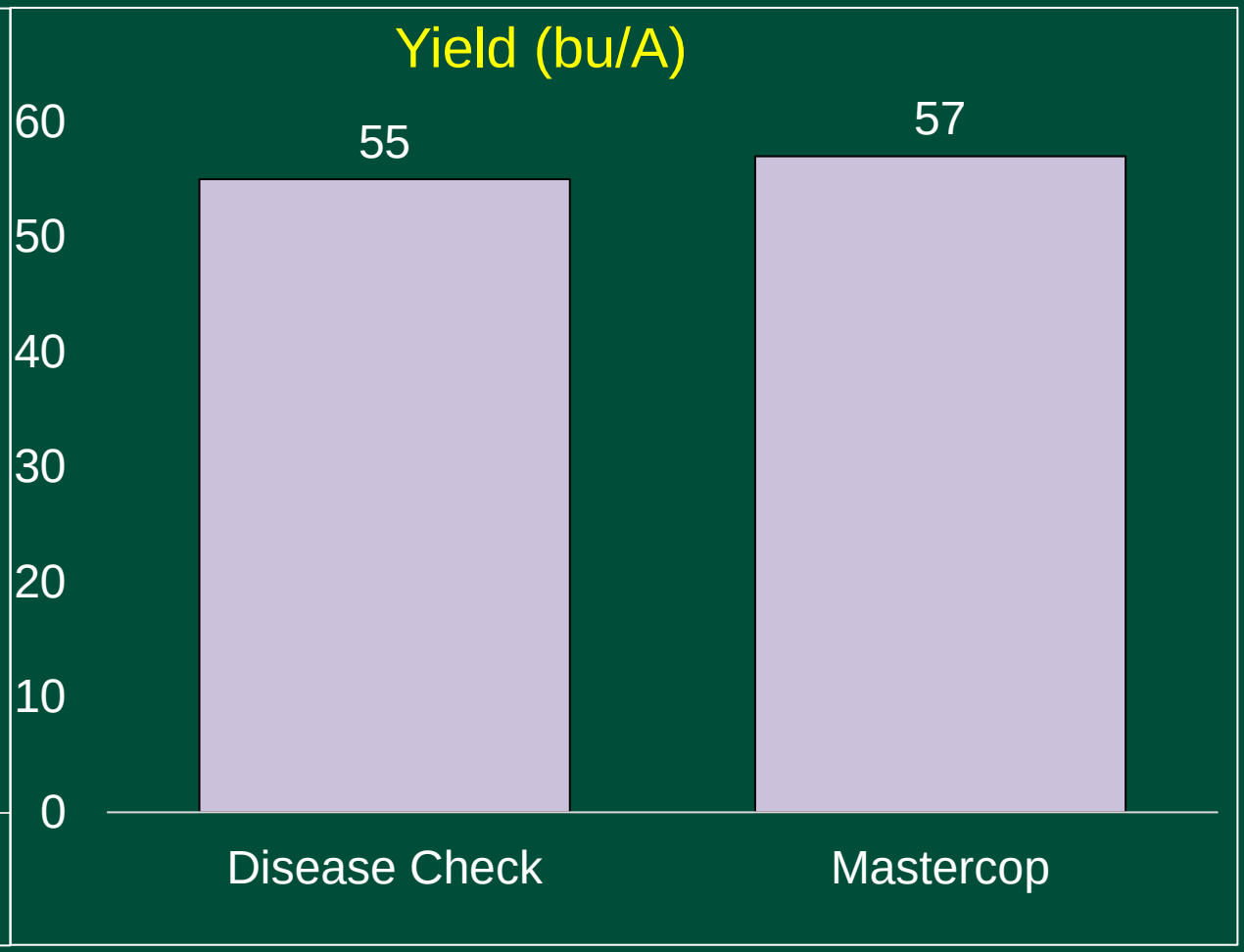
**Yield loss is variable and will depend on favorable conditions for BLS development*

Can I Spray?

- Four field trials conducted between 2019 to 2021
- Five varieties (Boost, ND-VitPro, SY-Valda, CP3910 and SY Rockford)
- Treatments: Non-inoculated (healthy check) or inoculated plots with application of Mastercop @ 16 oz/A @ flag leaf
- Lux et al. – Plant Health Progress

MasterCop Trials – 2020 to 2022





No statistical differences

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NDWC Funded

What About Other Plant Protection Products?

What About Seed Treatments?

Funded By:

NORTH DAKOTA WHEAT COMMISSION
Building Bigger Better Markets

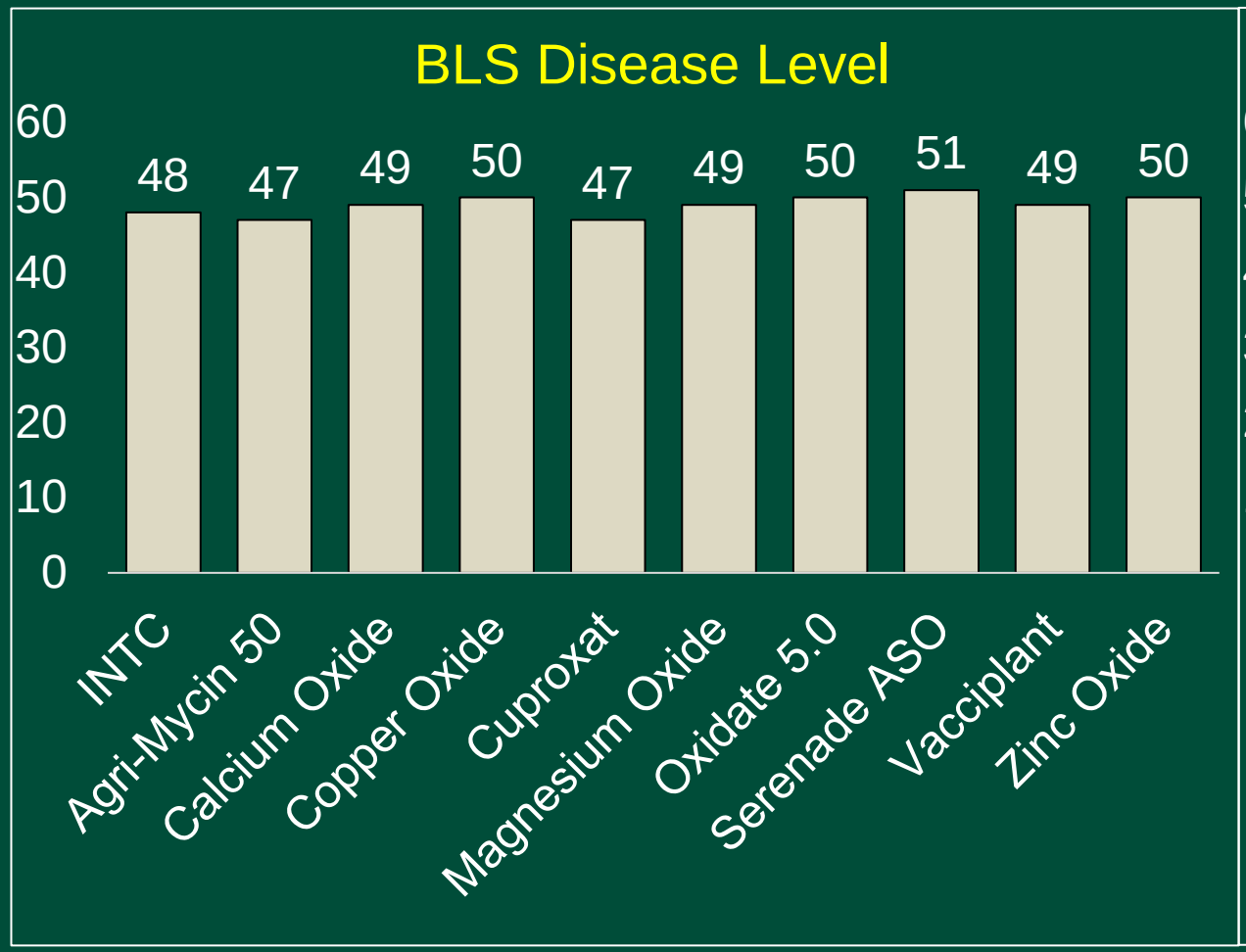
Gabe Dusek,
PhD Candidate

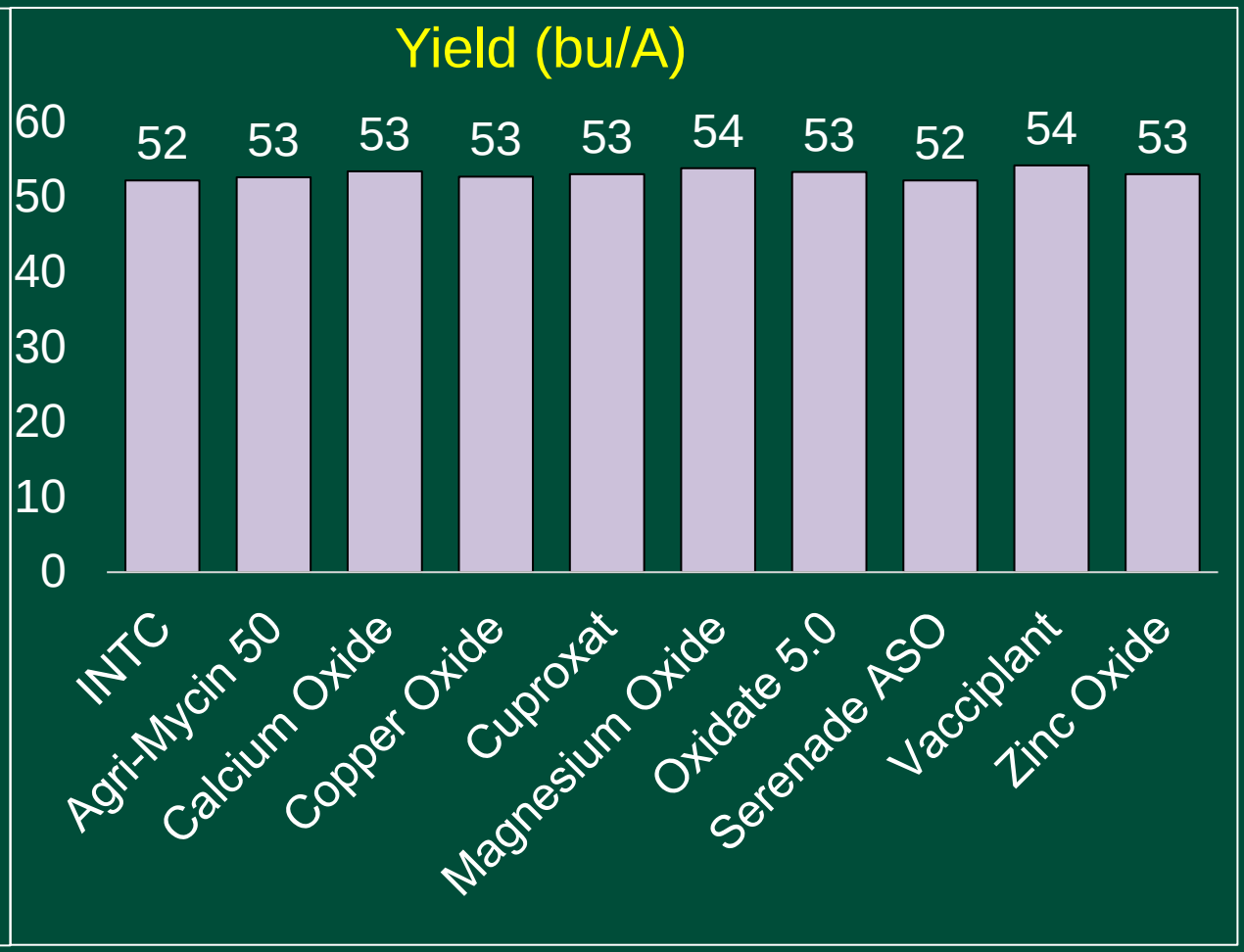
What About Other Plant Protection Products?

Trade Name	Active Ingredient
Agri-Mycin 50	Streptomycin Sulfate
Aviv	Bacillus subtilis strain IAB/BS03
Chitin	Chitin
Fulvic Acid	Fulvic Acid
Garlic Extract	Garlic Extract
Lifegard WG	Bacillus mycoides isolate J
Serifel	Bacillus amyloliquefaciens strain MBI 600
Spirulina	Spirulina Extract
Stargus	Bacillus amyloliquefaciens strain F727
Tannic Acid	Tannic Acid

Trade Name	Active Ingredient
42PHI	8-15-0+3.5(Cu)
Agri-Mycin 50	Streptomycin Sulfate
Calcium Oxide	Calcium Oxide
Copper Oxide	Copper Oxide
Cuproxat	Basic Copper Sulfate
Guarda	Thyme oil
Magnesium Oxide	Magnesium Oxide
Oxidate 5.0	Hydrogen Peroxide + Peroxyacetic Acid
PaceSetter	Extract of Reynoutria sachalinensis
Serenade ASO	Bacillus subtilis strain QST 713
Vacciplant	Laminarin SAR
Zinc Oxide	Zinc Oxide

Bacteriacide Trials – 2021 to 2022





All treatments similar levels to check

No statistical differences

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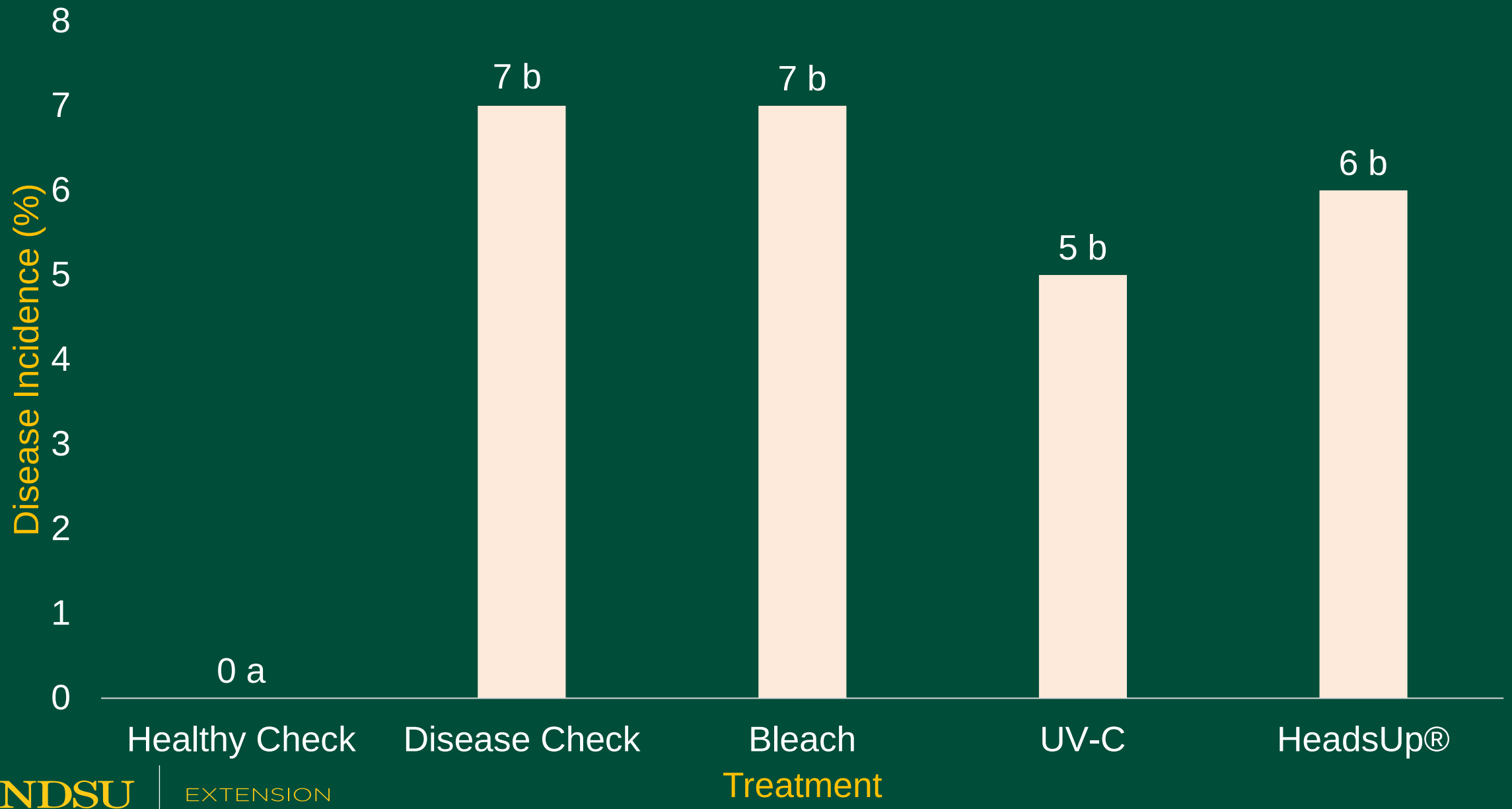
NDWC Funded

2024 BLS Seed Treatment Research

Three locations

- Healthy Check
- Disease Check
- Bleach
- UV-C
- HeadsUp®

Seed Treatment Efficacy on BLS Seed Lot



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Ergot and BLS Summary

- Susceptible differences among HRSW – nothing immune
- Focus fungicide timing for FHB…not ergot
- One reliable management tool for BLS

Fungicide Studies in ND Corn

Andrew Friskop – Cereal Crop Extension Pathologist

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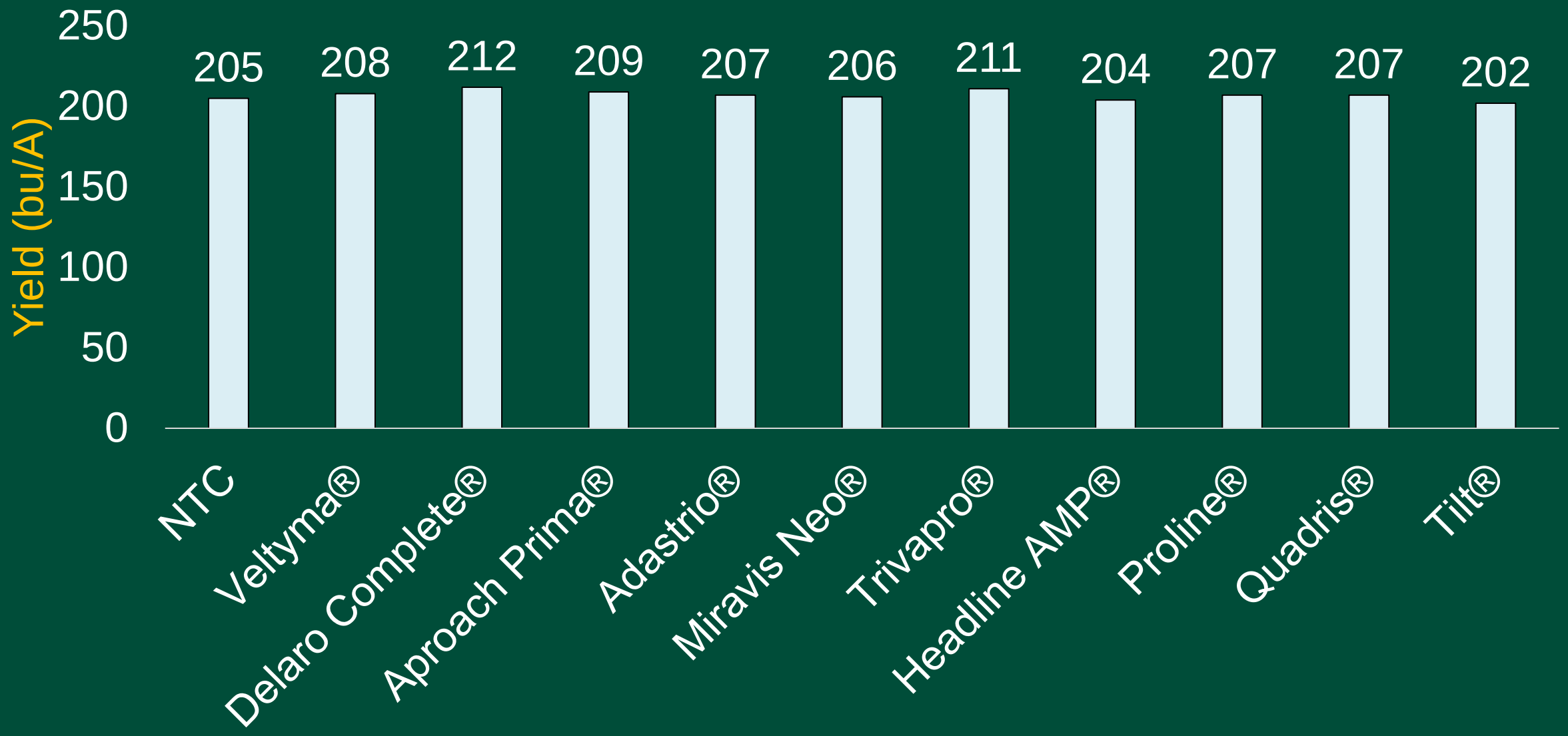
Field Trial Data Set - Corn Fungicides

- 2014-2015, 2019-2024
- Very low disease levels
- Common corn rust (not economic)
- Summarized data from 2023 and 2024
- Summarized data on VT and V8-V10

2023-2024 Corn Fungicide Trials

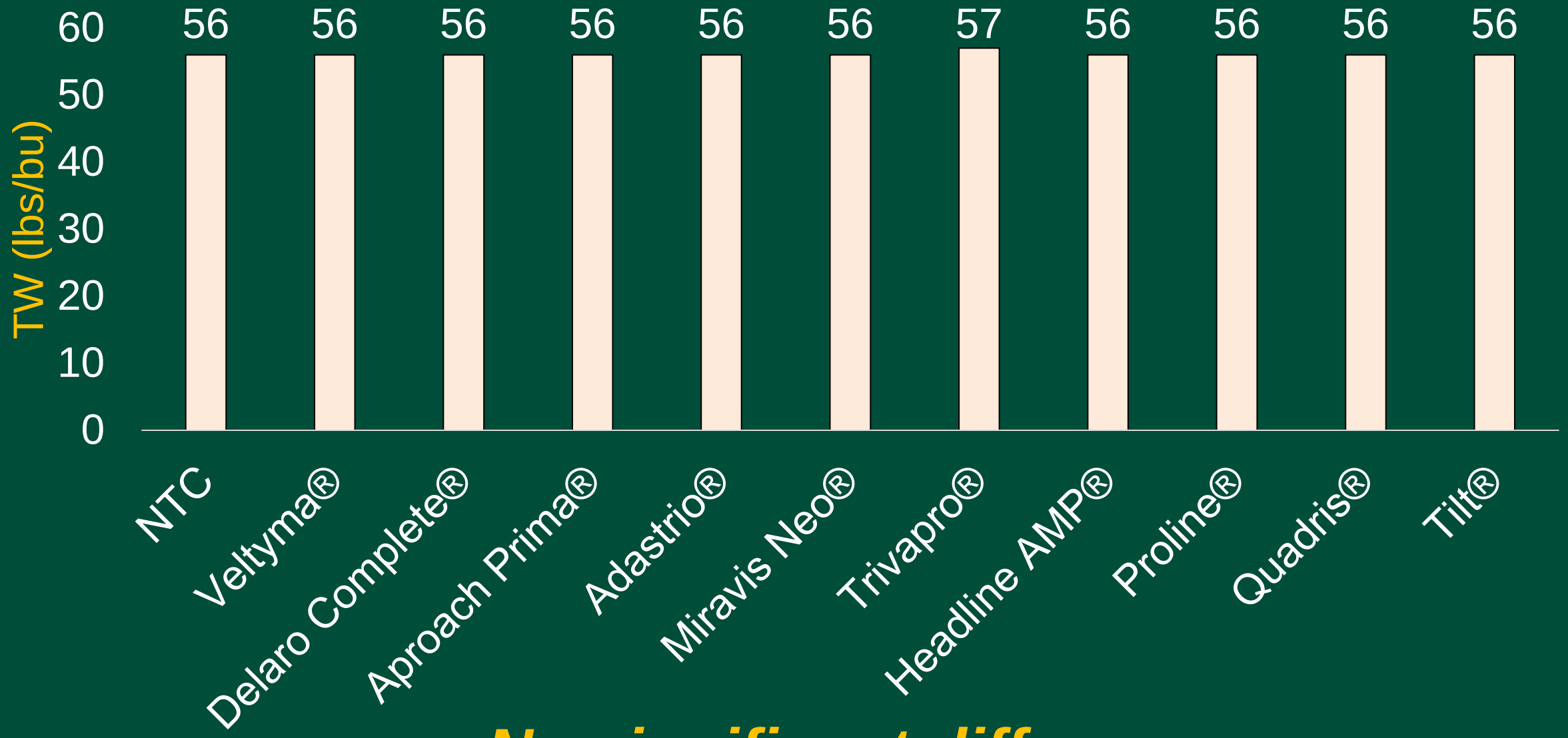
Treatment	Application Timing	Rate
Non-treated Control	-	-
Veltyma®	VT/R1	7 oz/A
Delaro Complete®	VT/R1	8 oz/A
Aproach Prima®	VT/R1	6.8 oz/A
Adastrio®	VT/R1	8 oz/A
Miravis Neo®	VT/R1	13.7 oz/A
Trivapro®	VT/R1	13.7 oz/A
Headline AMP®	VT/R1	10 oz/A
Proline®	VT/R1	5.7 oz/A
Quadris®	VT/R1	6 oz/A
Tilt®	VT/R1	4 oz/A

Summary Data – 2023-24 Corn Fungicide



No significant differences

Summary Data – 2023-24 Corn Fungicide



No significant differences

Yield Response Summaries from VT/R1 from 2014 to 2024 in ND

Yield Response – VT/R1 Fungicide 2014-2024

Fungicide Treatment	Average Bushel/Acre Response	Positive Response Observed

Yield Response – VT/R1 Fungicide 2014-2024

Fungicide Treatment	Average Bushel/Acre Response	Positive Response Observed
All Fungicides Tested	2.3	55%

Yield Response – VT/R1 Fungicide 2014-2024

Fungicide Treatment	Average Bushel/Acre Response	Positive Response Observed
All Fungicides Tested	2.3	55%
Single MOA	0.1	44%

Yield Response – VT/R1 Fungicide 2014-2024

Fungicide Treatment	Average Bushel/Acre Response	Positive Response Observed
All Fungicides Tested	2.3	55%
Single MOA	0.1	44%
Two MOA	3.2	58%

Yield Response – VT/R1 Fungicide 2014-2024

Fungicide Treatment	Average Bushel/Acre Response	Positive Response Observed
All Fungicides Tested	2.3	55%
Single MOA	0.1	44%
Two MOA	3.2	58%
Three MOA	2.0	55%

2024 NDCUC Funded Field Trials – Stalk Rot

- Three locations
  - Leonard
  - Arthur
  - Casselton (abandoned)
- Two hybrids
  - DKC36-48
  - NK8005V
- Four fungicide treatments

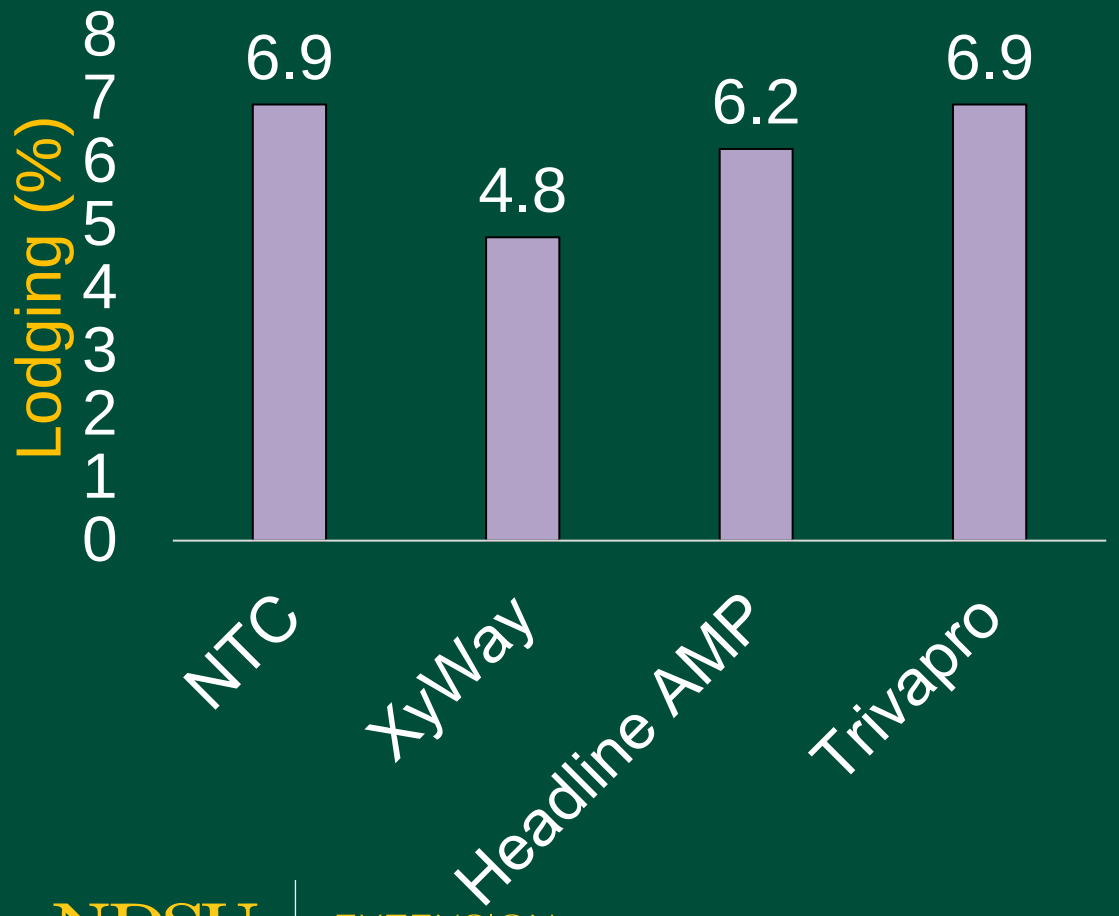
Treatment List

Treatment	Active Ingredient(s)	Application Timing	Rate
Non-treated Control	-	-	-
XyWay	Flutriafol	In-furrow	15.2 oz/A
Trivapro	Propiconazole + Azoxystrobin + Benzovindiflupyr	VT/R1	13.7 oz/A
Headline AMP	Pyraclostrobin + Metconazole	VT/R1	10 oz/A

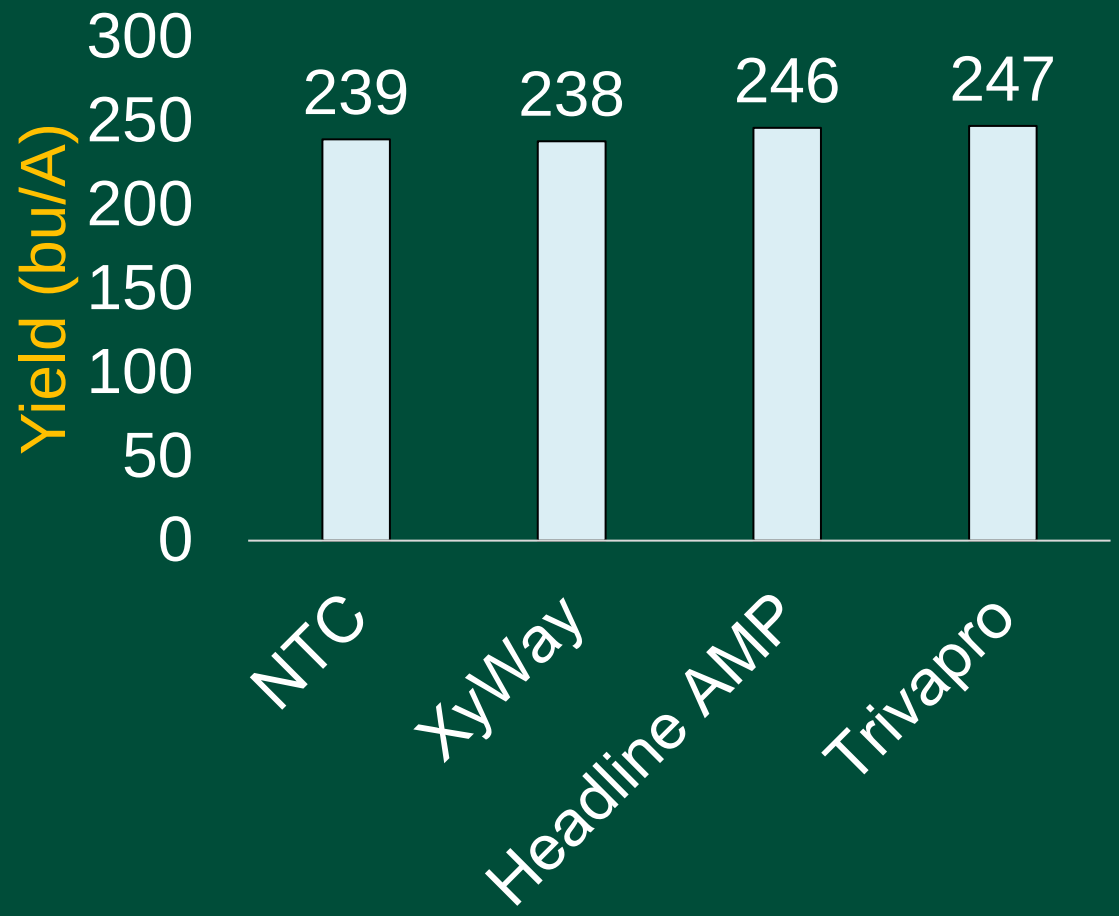
Summary Results – DKC36-48

Low levels of stalk integrity issues

No significant differences



No significant differences



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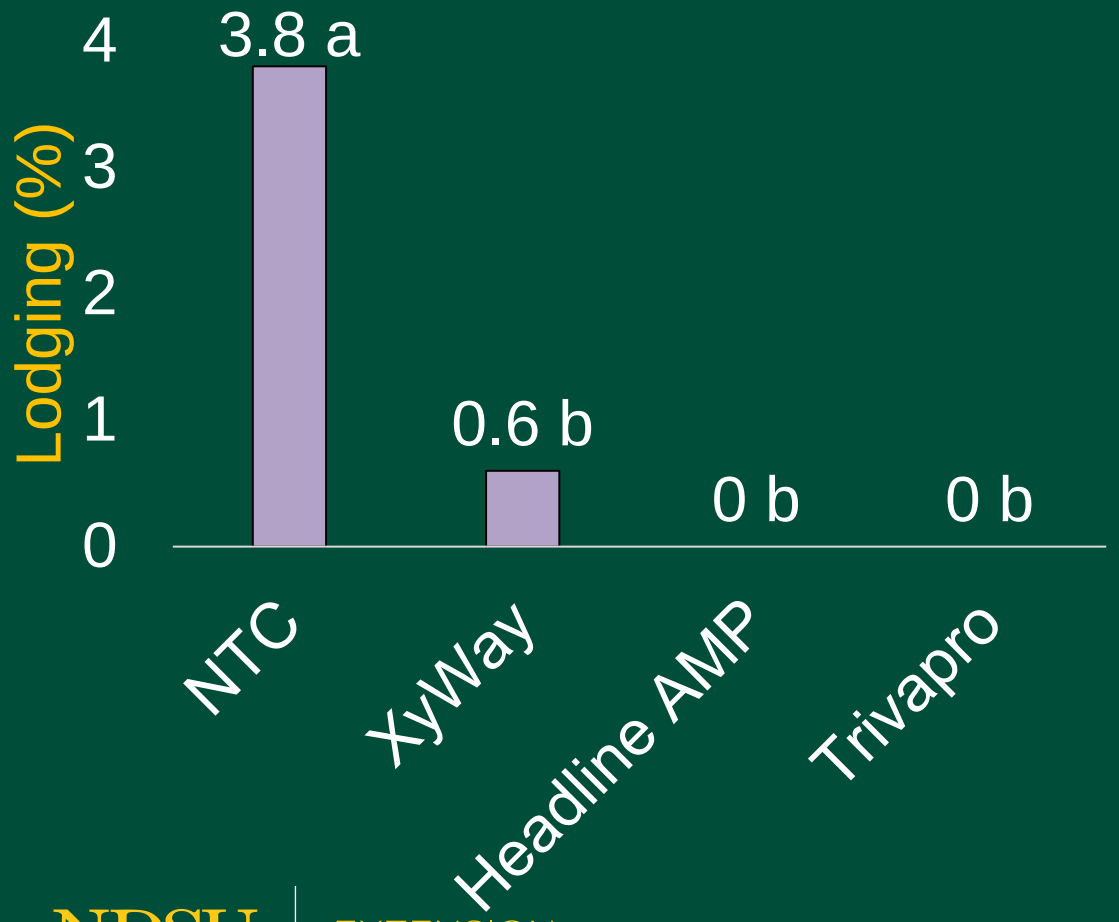
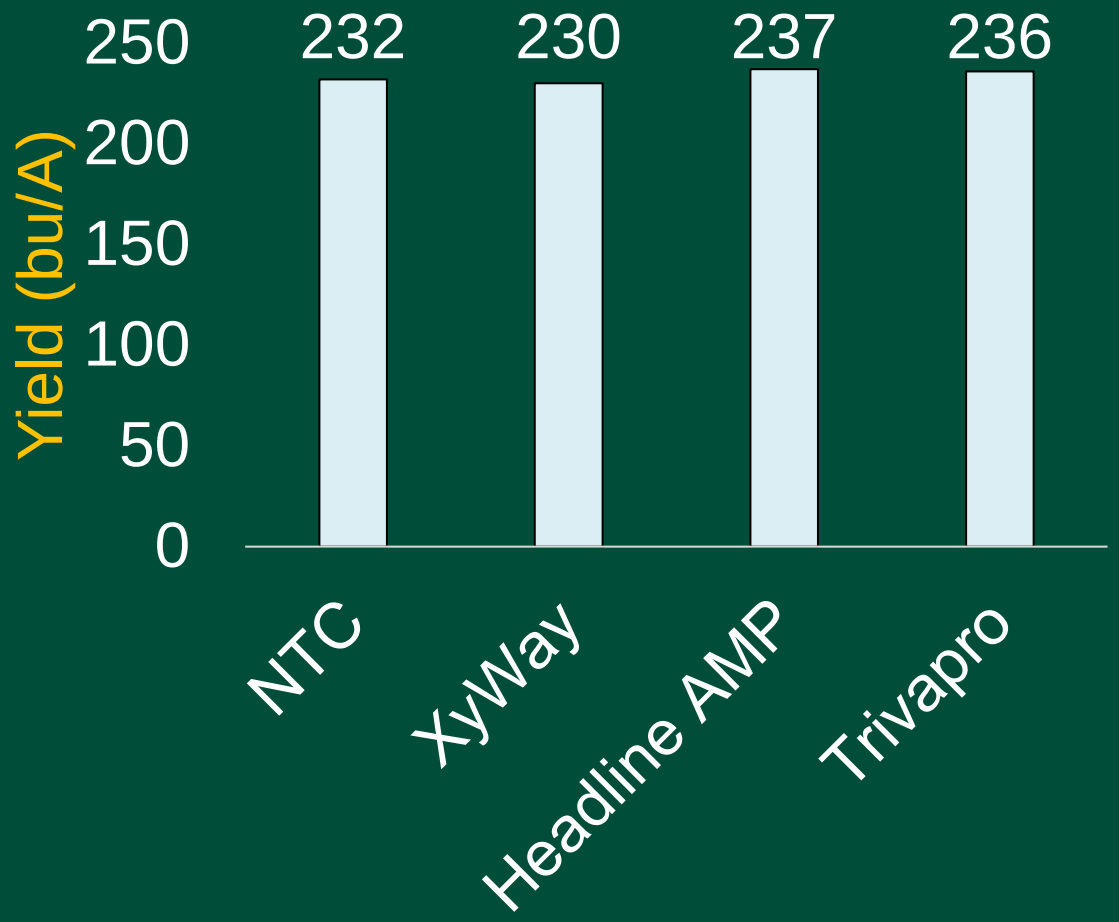
Summary Results – NK8005V

Low levels of stalk integrity issues

Significant differences



No significant differences



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Fungicide Use in Corn Summary

- Not enough fungal disease risk to justify application
- Positive yield responses 44-58% of the time (coin flip)
- Higher NCLB in 2024 and tar spot has been confirmed….could this change fungicide recommendations?

2022 to 2024 FHB Fungicide Data Summaries

Andrew Friskop – Cereal Crop Extension Pathologist

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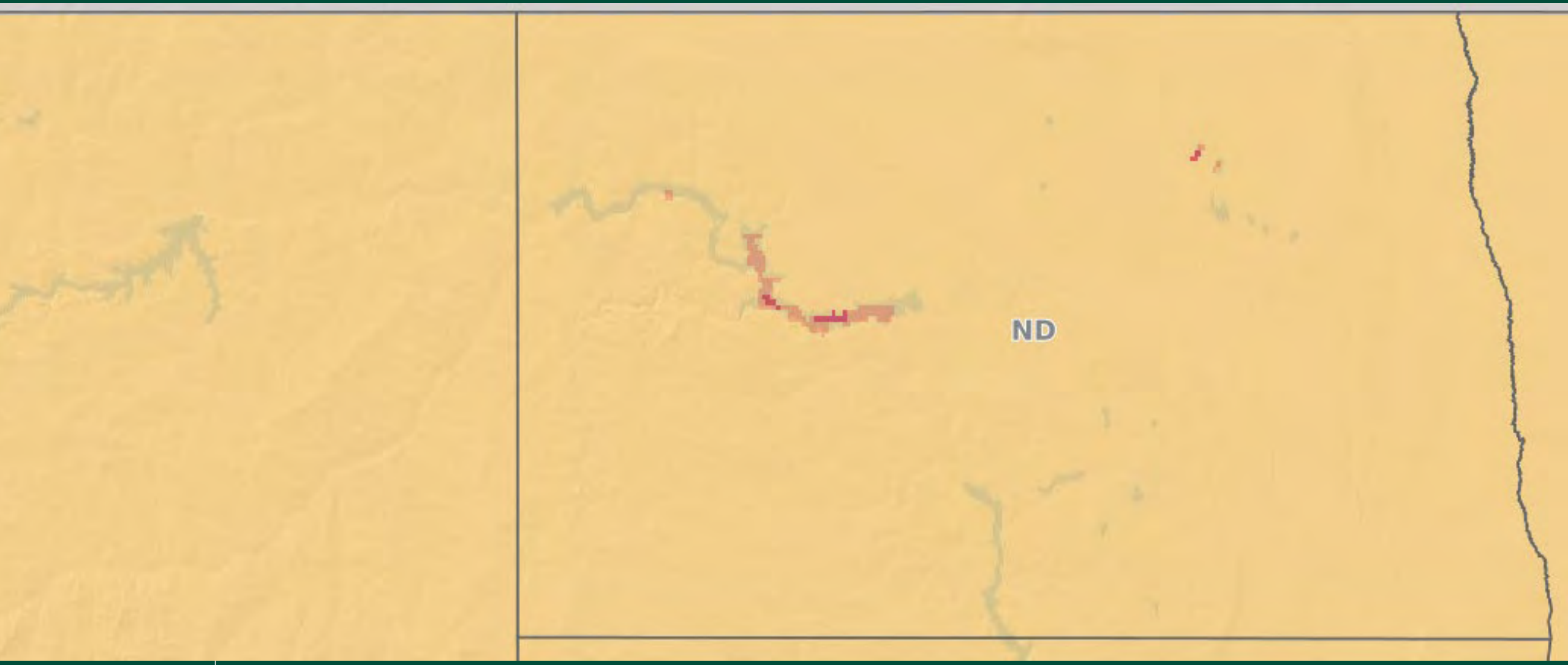
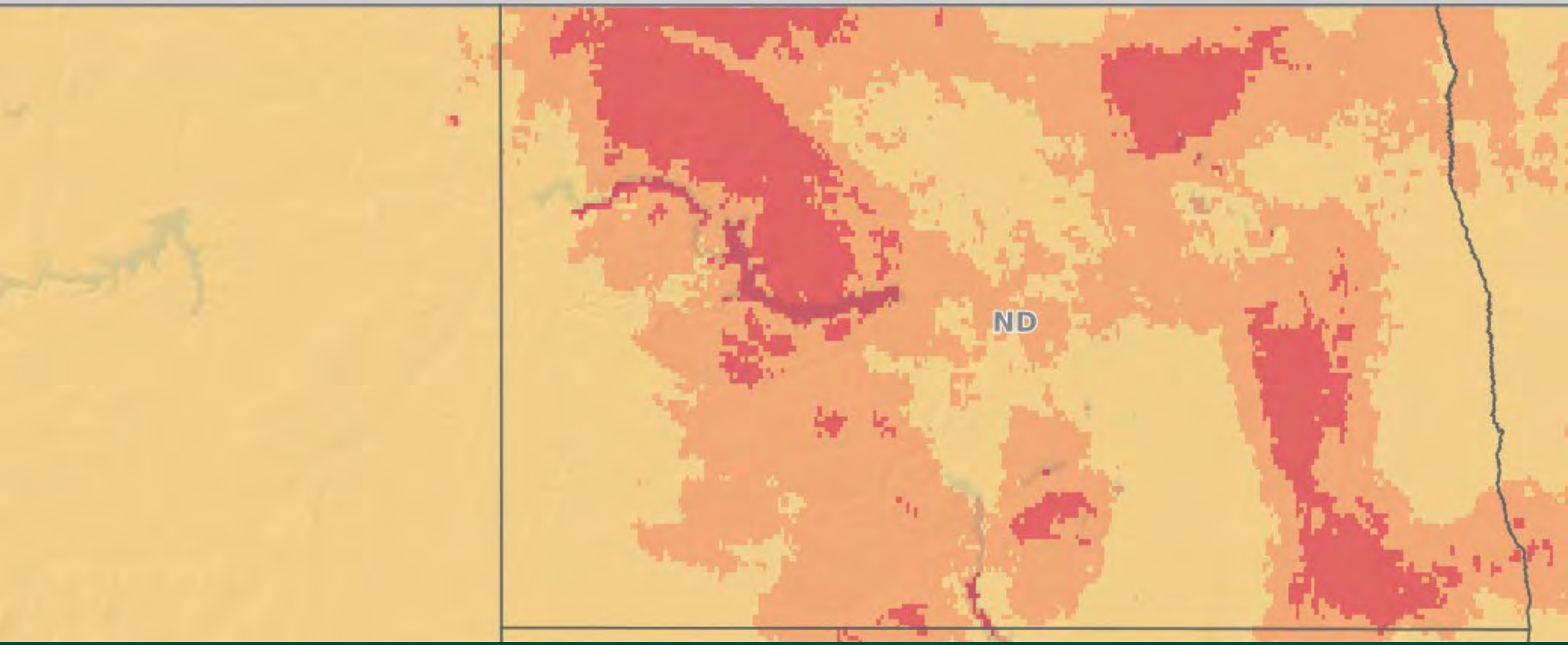
Fusarium Head Blight Risk in 2024

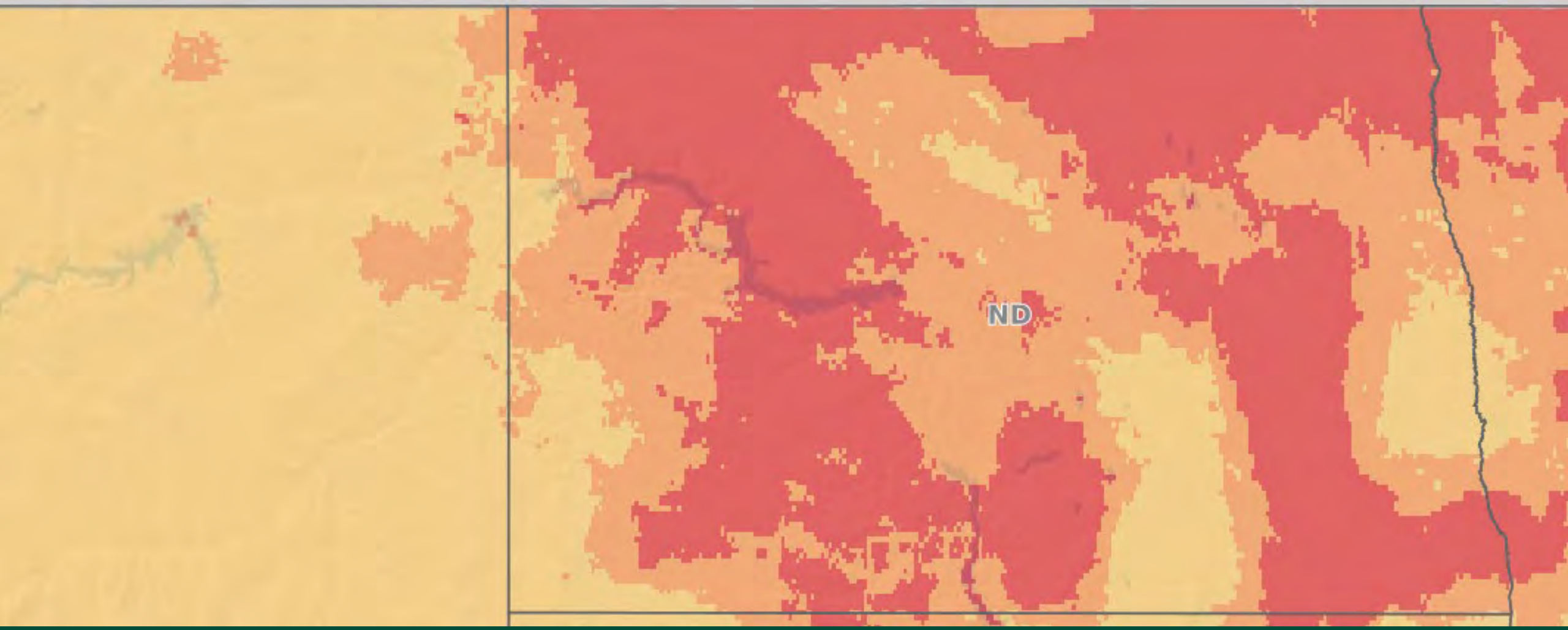
June 21, 2024 – Susceptible Varieties

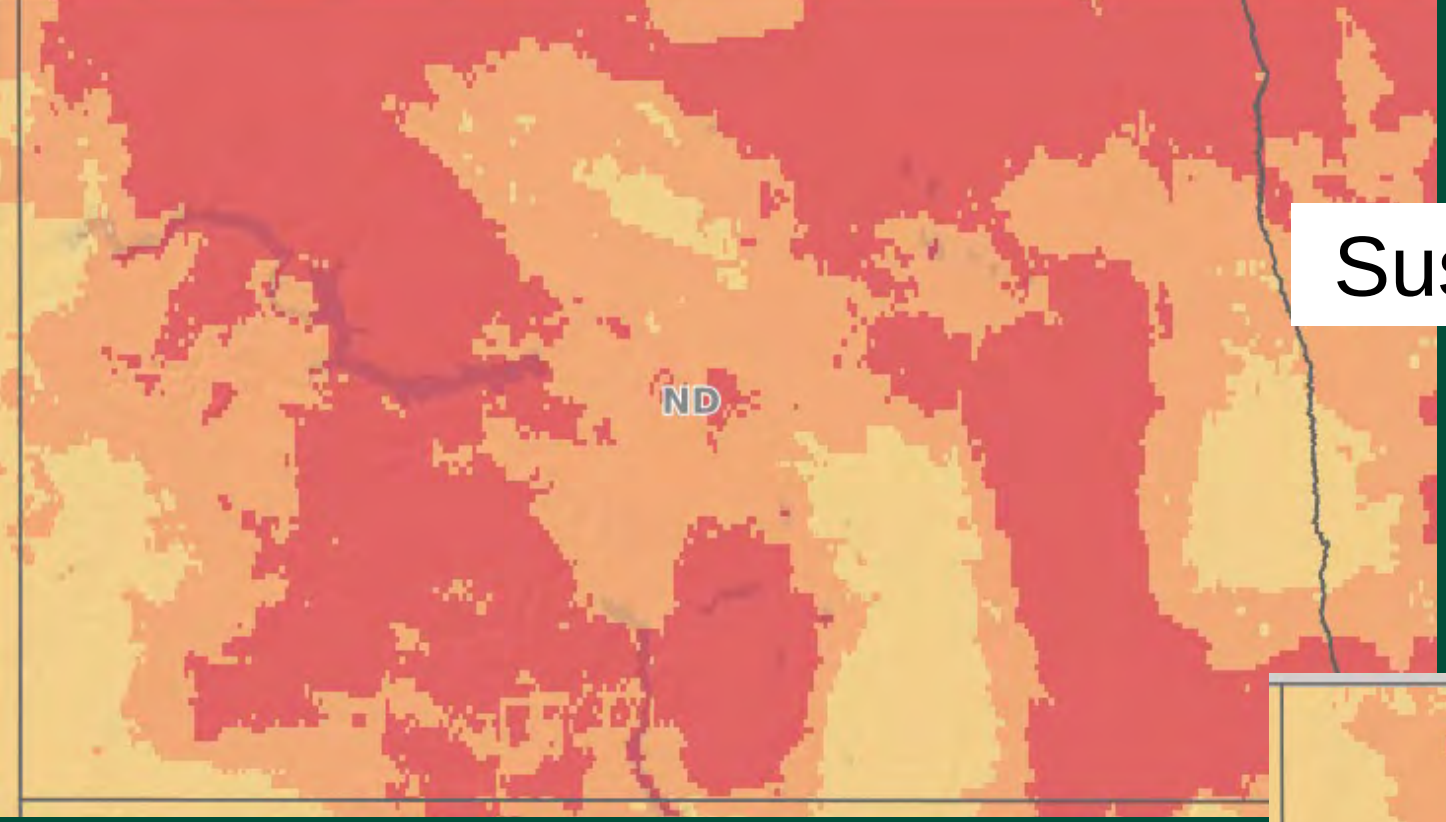


June 28, 2024 – Susceptible Varieties

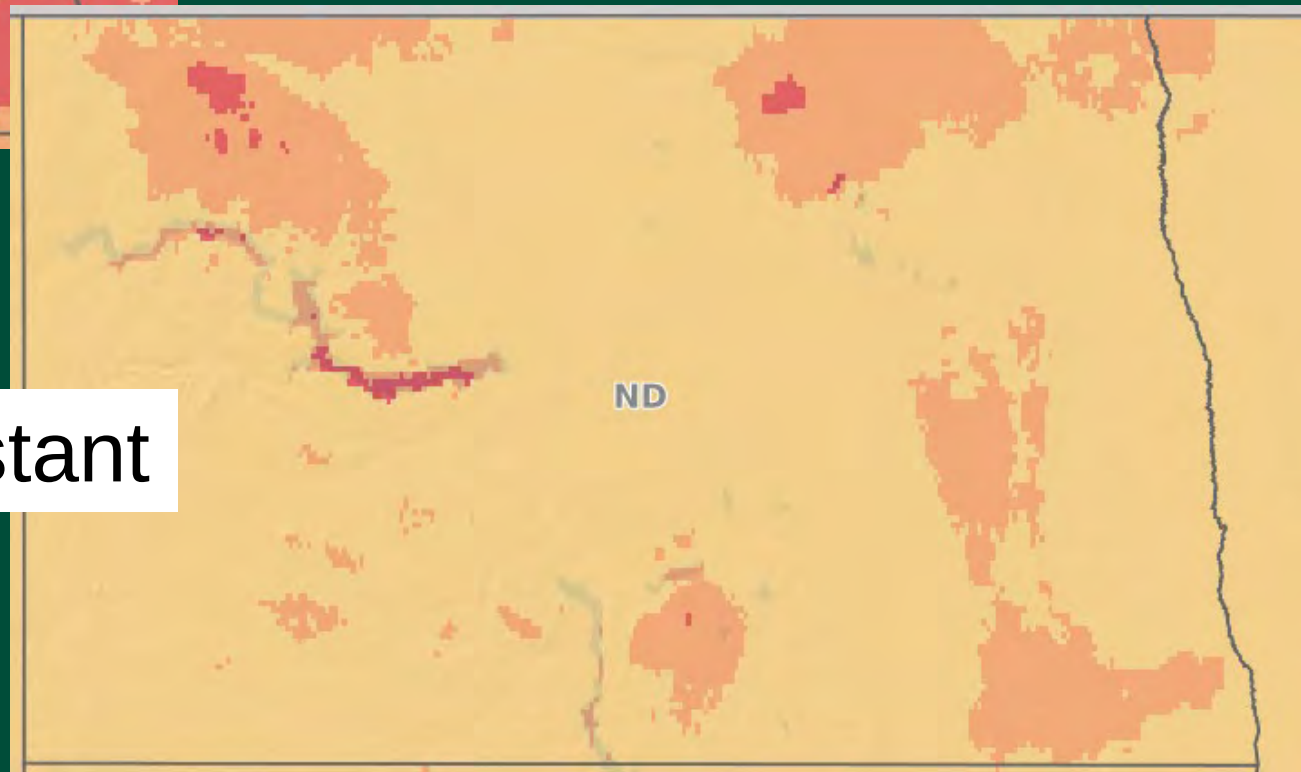


July 5, 2024 – Susceptible Varieties





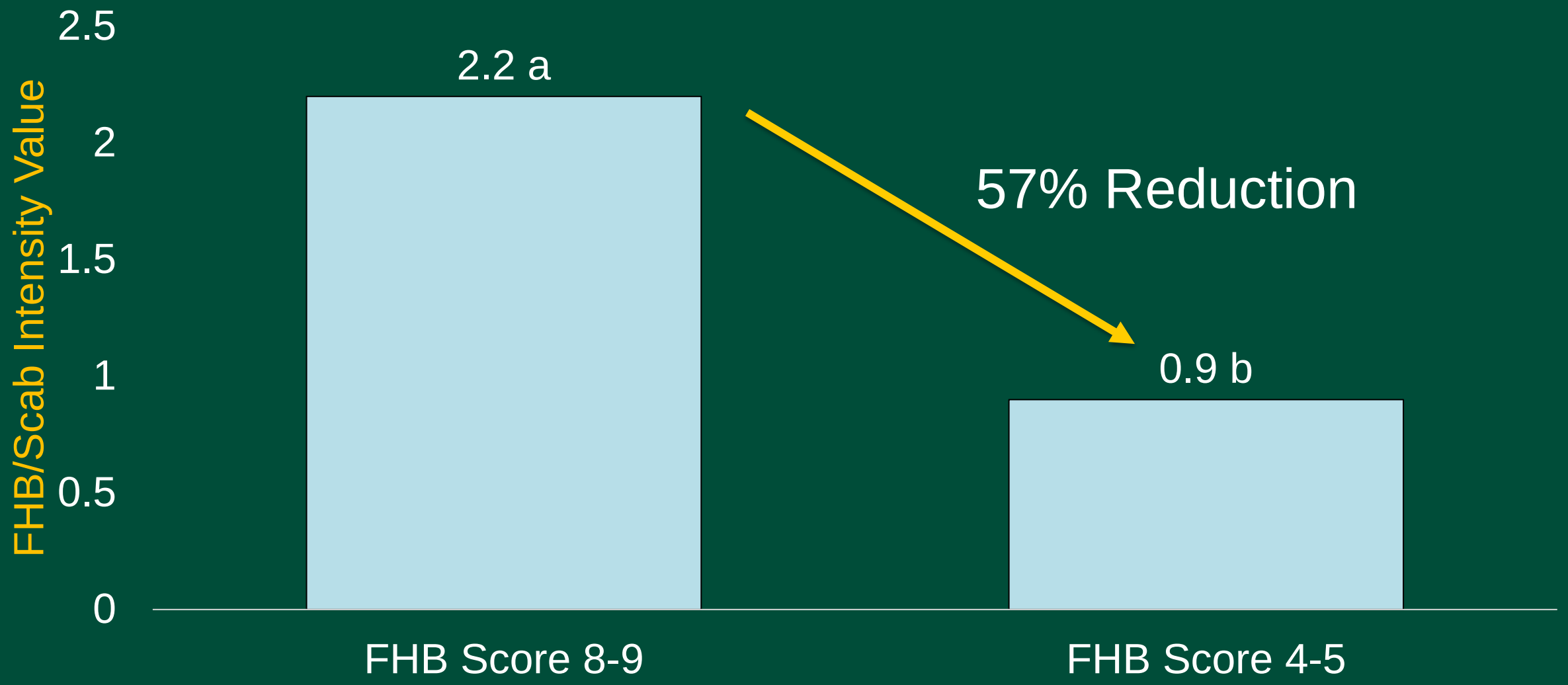
Susceptible



Moderately Resistant

2022-2024 – HRSW – Variety Resistance

**Data combined across five experiments*

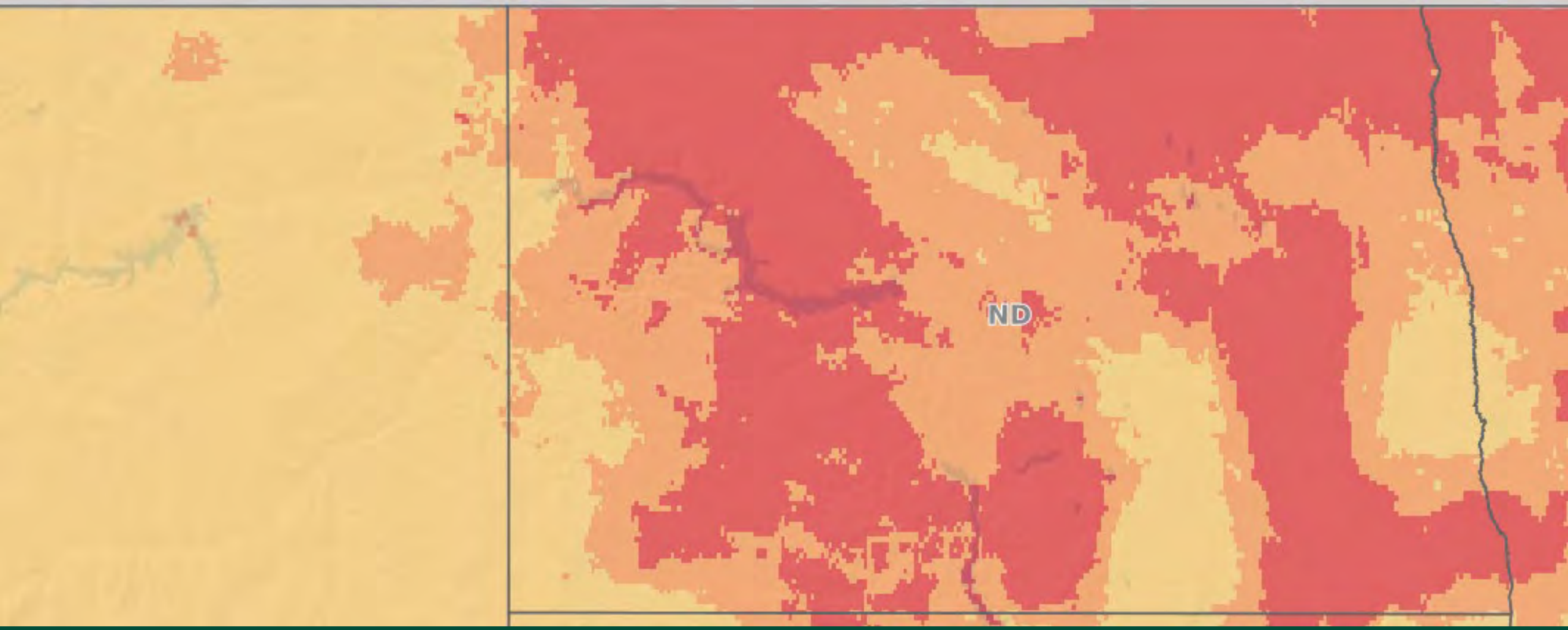


NDSU | EXTENSION

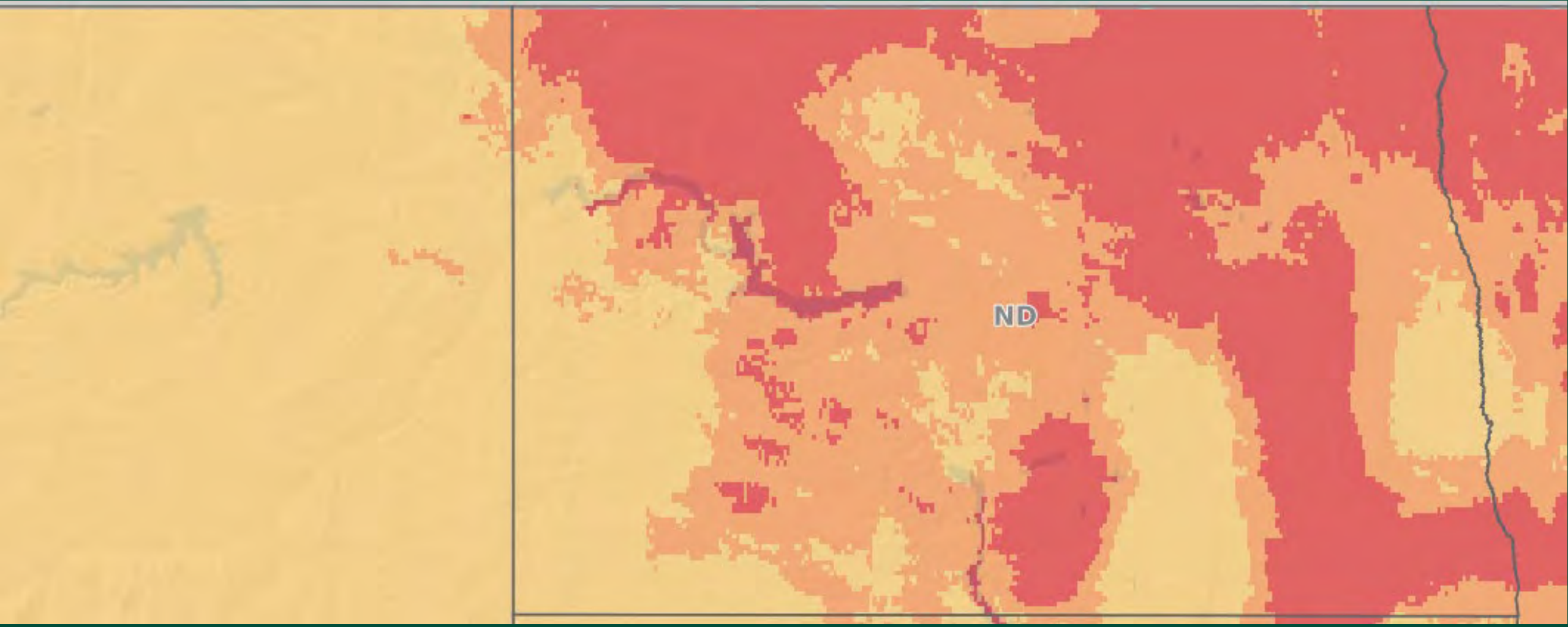
Funded by USWBSI

Funded by USWBSI

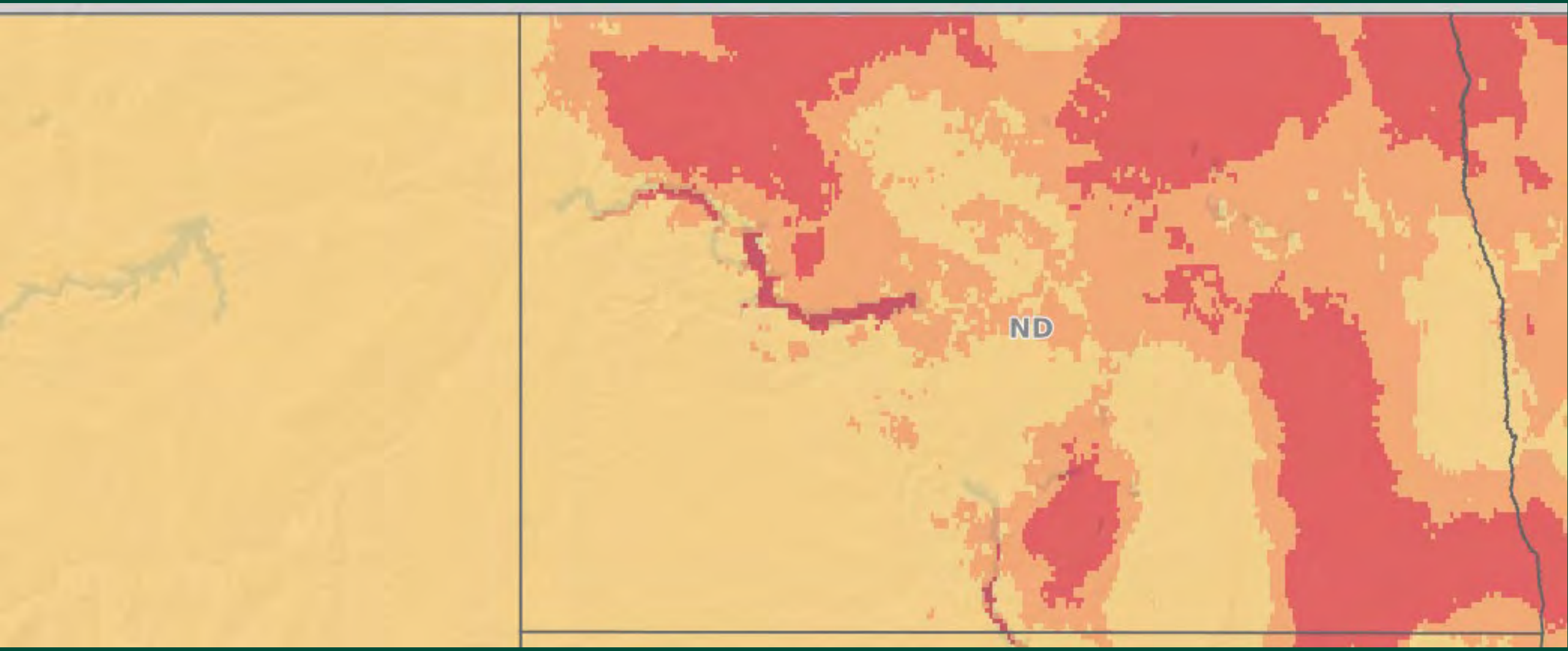
July 5, 2024 – Susceptible Varieties

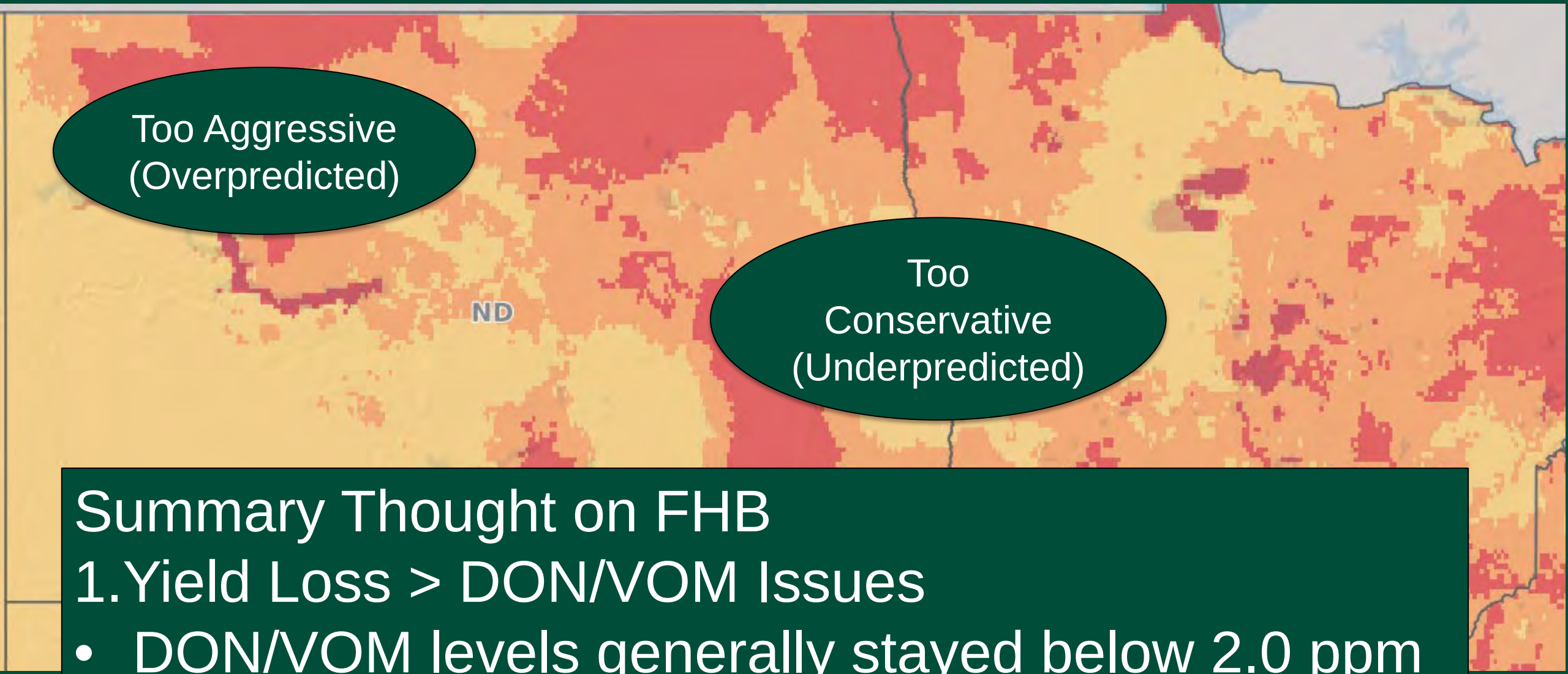


July 12, 2024 – Susceptible Varieties



July 19, 2024 – Susceptible Varieties





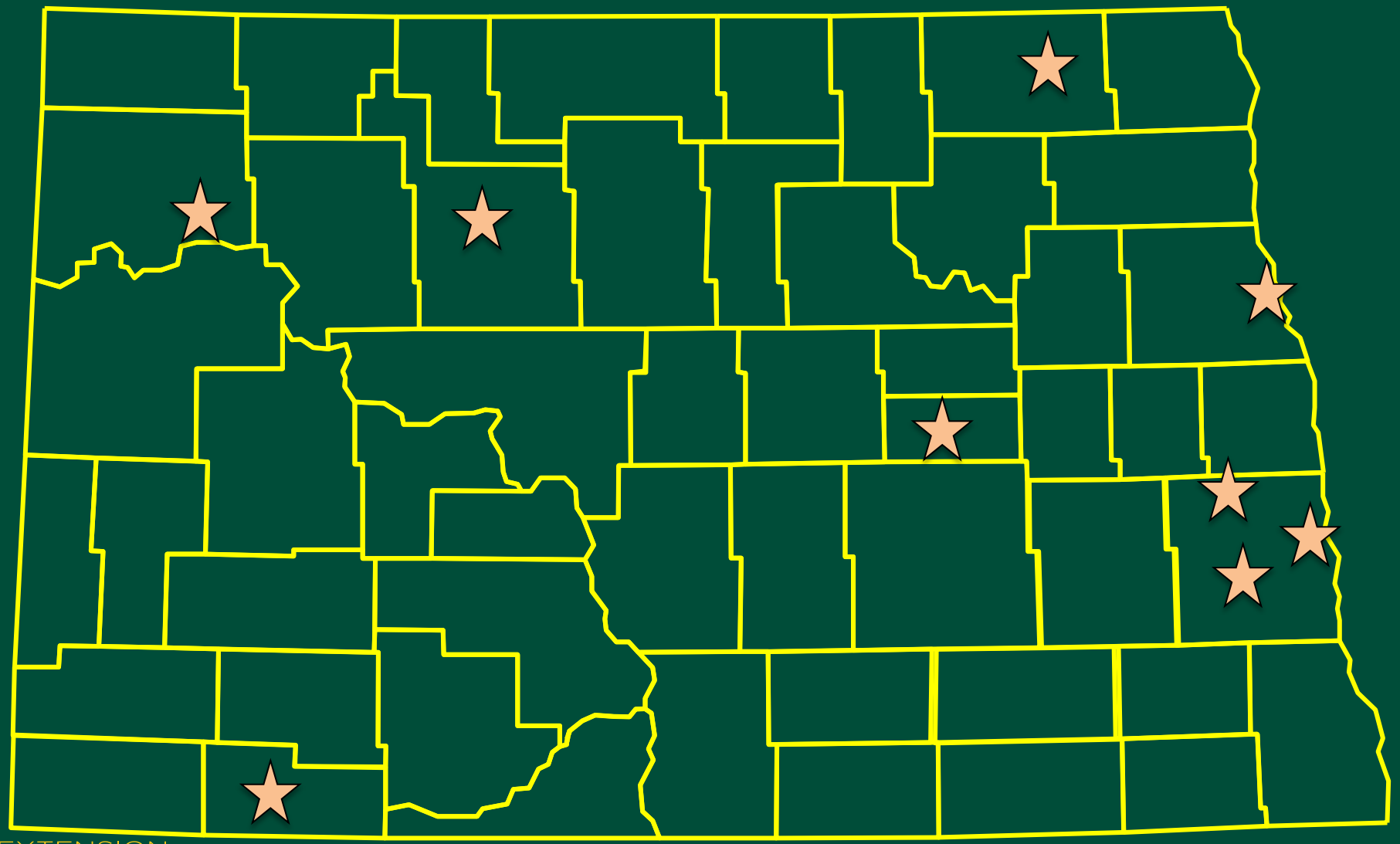
Summary Thought on FHB

1. Yield Loss > DON/VOM Issues

- DON/VOM levels generally stayed below 2.0 ppm
- May have lost 10 bushels in yield in the RRV

FHB Management Research

2022-24 USWBSI Fungicide Trial Locations



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Fungicide Efficacy and Timing

Fungicide Efficacy

Fungicide	Active Ingredient(s)	FHB Efficacy
Prosaro	Prothioconazole + Tebuconazole	Good
Miravis Ace	Pydiflumetofen + Propiconazole	Good
Proline	Prothioconazole	Good
Folicur, Generics	Tebuconazole	Fair
Prosaro Pro	Prothioconazole + Tebuconazole + Fluopyram	Good
Sphaerex	Metconazole + Prothioconazole	Good

Fair = ~20% Suppression

Good = ~55-60% Suppression

Fungicide efficacy is not additive for FHB!!

2022-24 Fungicide Data Legend – Small Grains

- MA = Miravis Ace @ 13.7 oz
- PRO = Prosaro @ 6.5 oz
- PROSPRO = Prosaro Pro @ 10.3 oz
- SPH = Sphaerex @ 7.3 oz
- TEB = Tebuconazole @ 4.0 oz

- HEAD = Full-head (Fks 10.5)
- FLWR = Early-flowering (Fks 10.51)
- LATE = 3 to 7 days after Fks 10.5 or Fks 10.51
- fb = Fks 10.5 or 10.51 followed by 3 to 7 days later

Fungicide Timing HRSW

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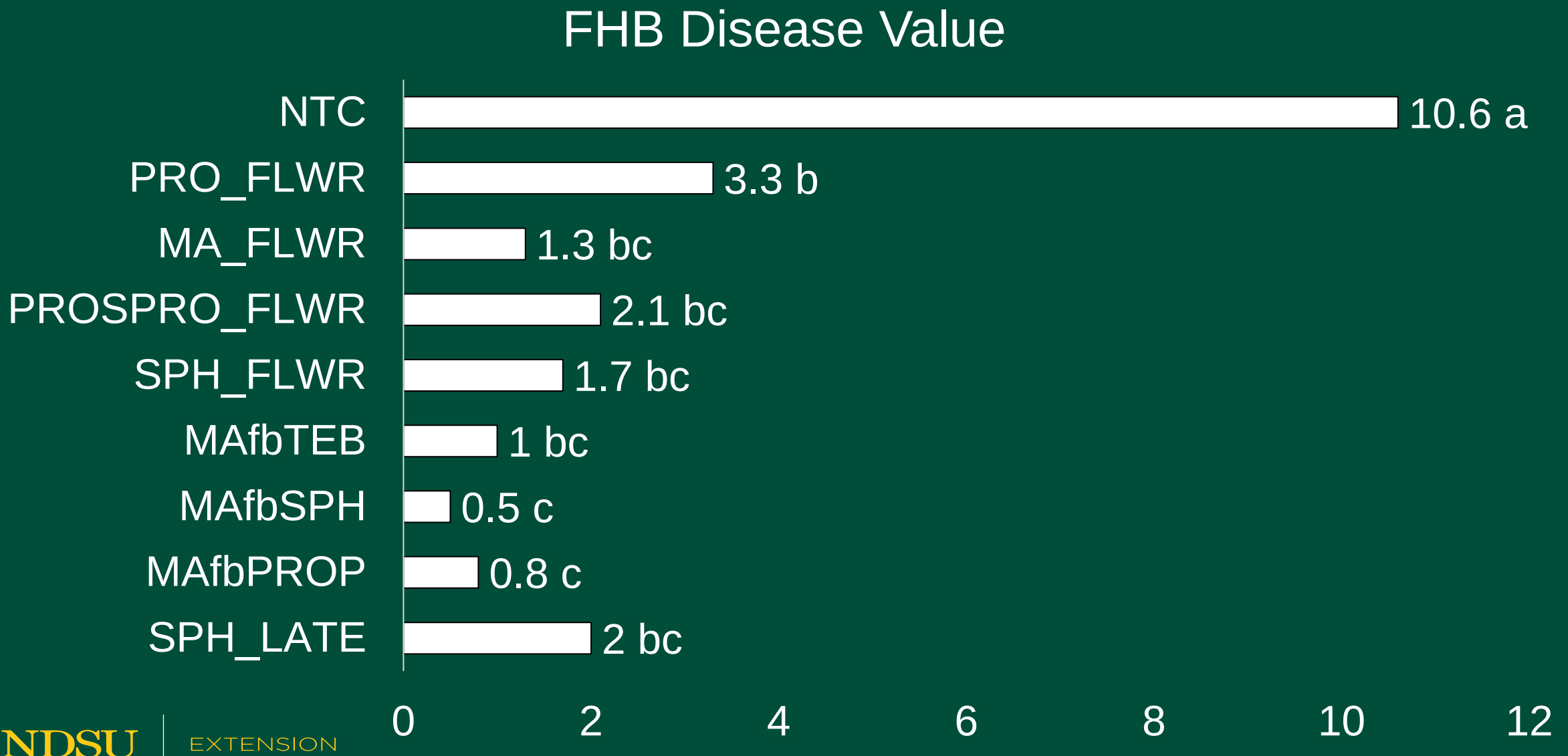
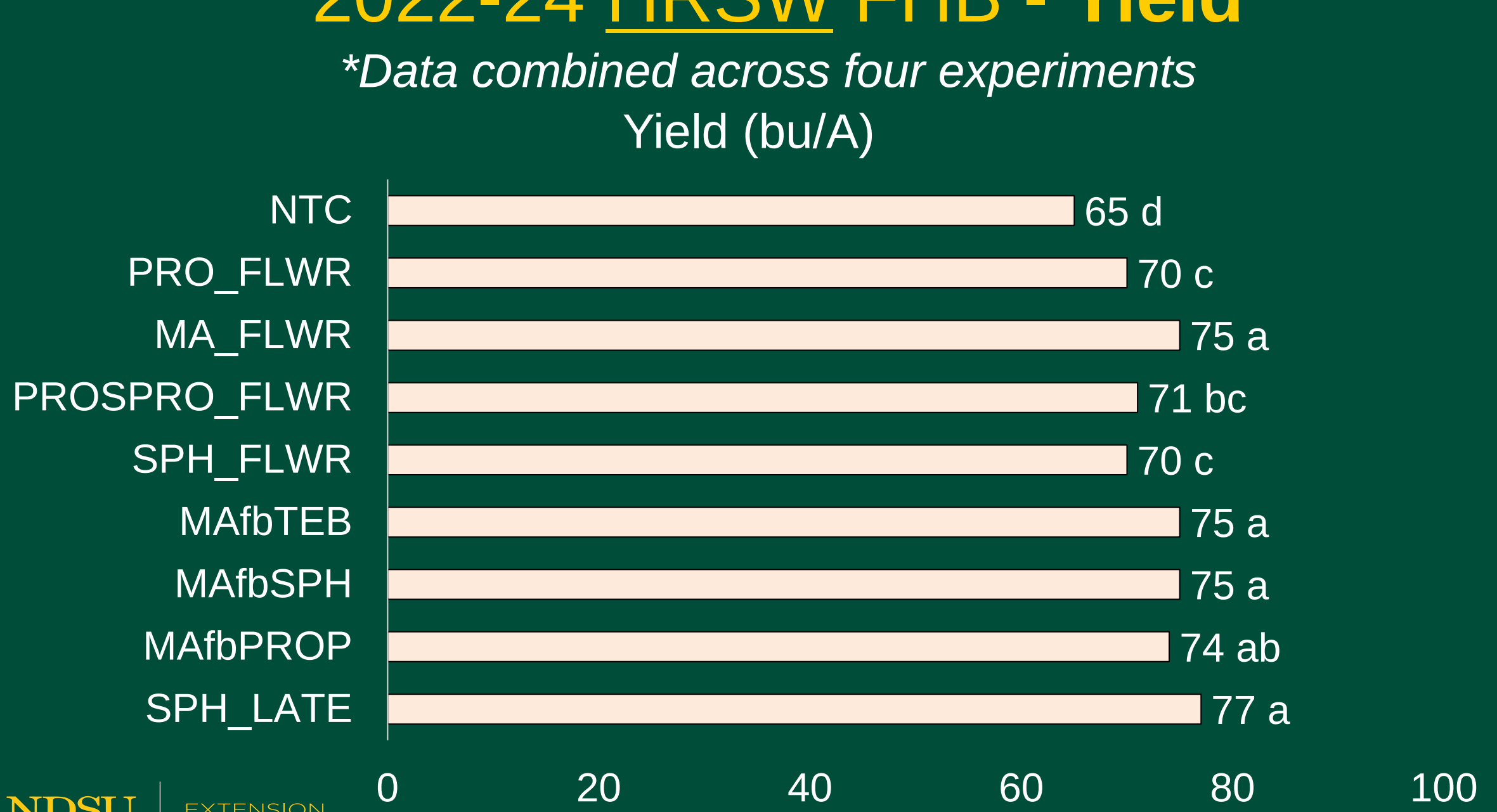
2022-24 HRSW FHB Disease Intensity

**Data combined across four experiments*



2022-24 HRSW FHB - **Yield**

**Data combined across four experiments*

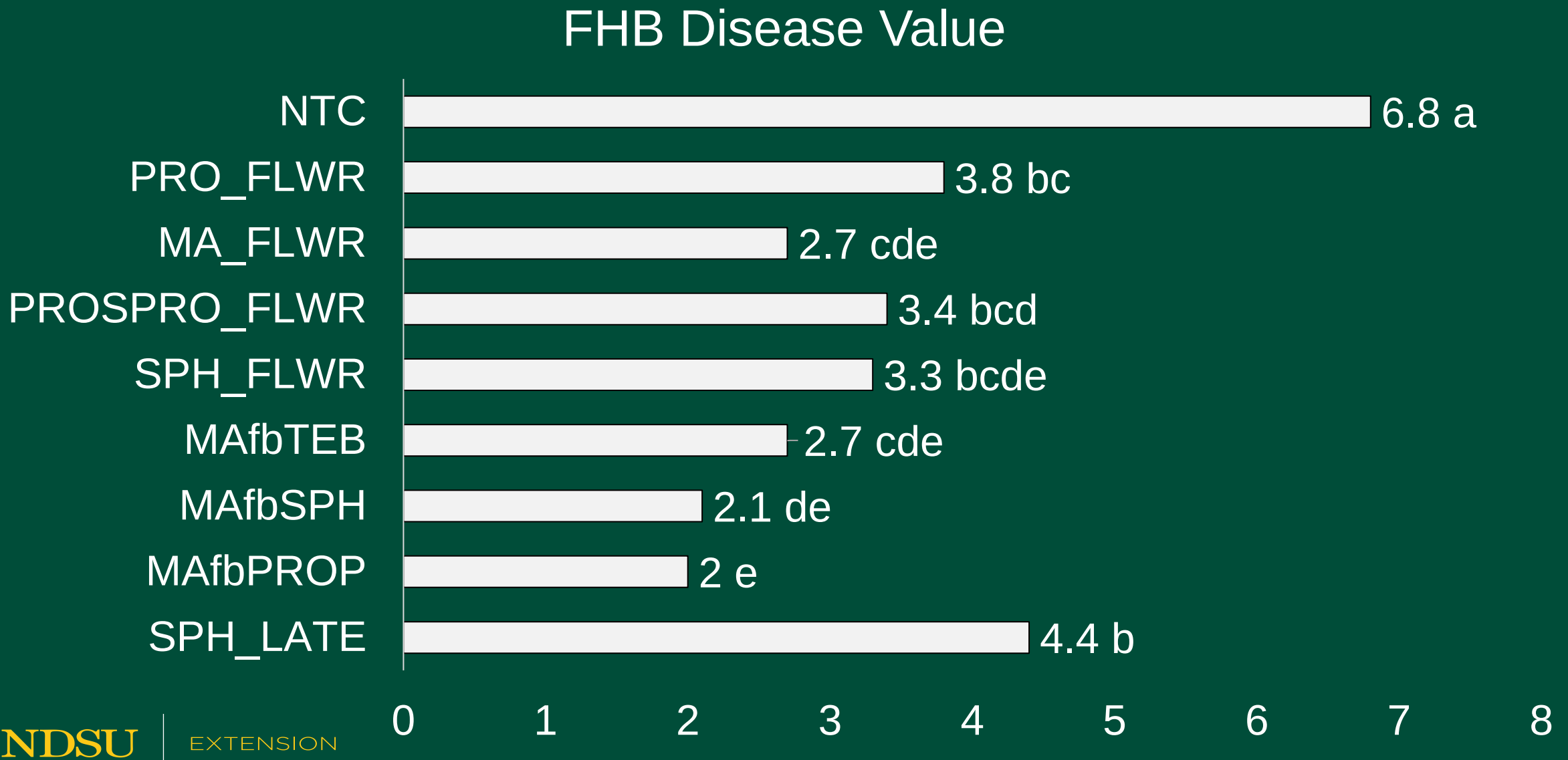


Fungicide Timing Durum

NDSU | EXTENSIO

2022-24 Durum FHB Disease Intensity

**Data combined across six experiments*



2022-24 Durum FHB - **Yield**

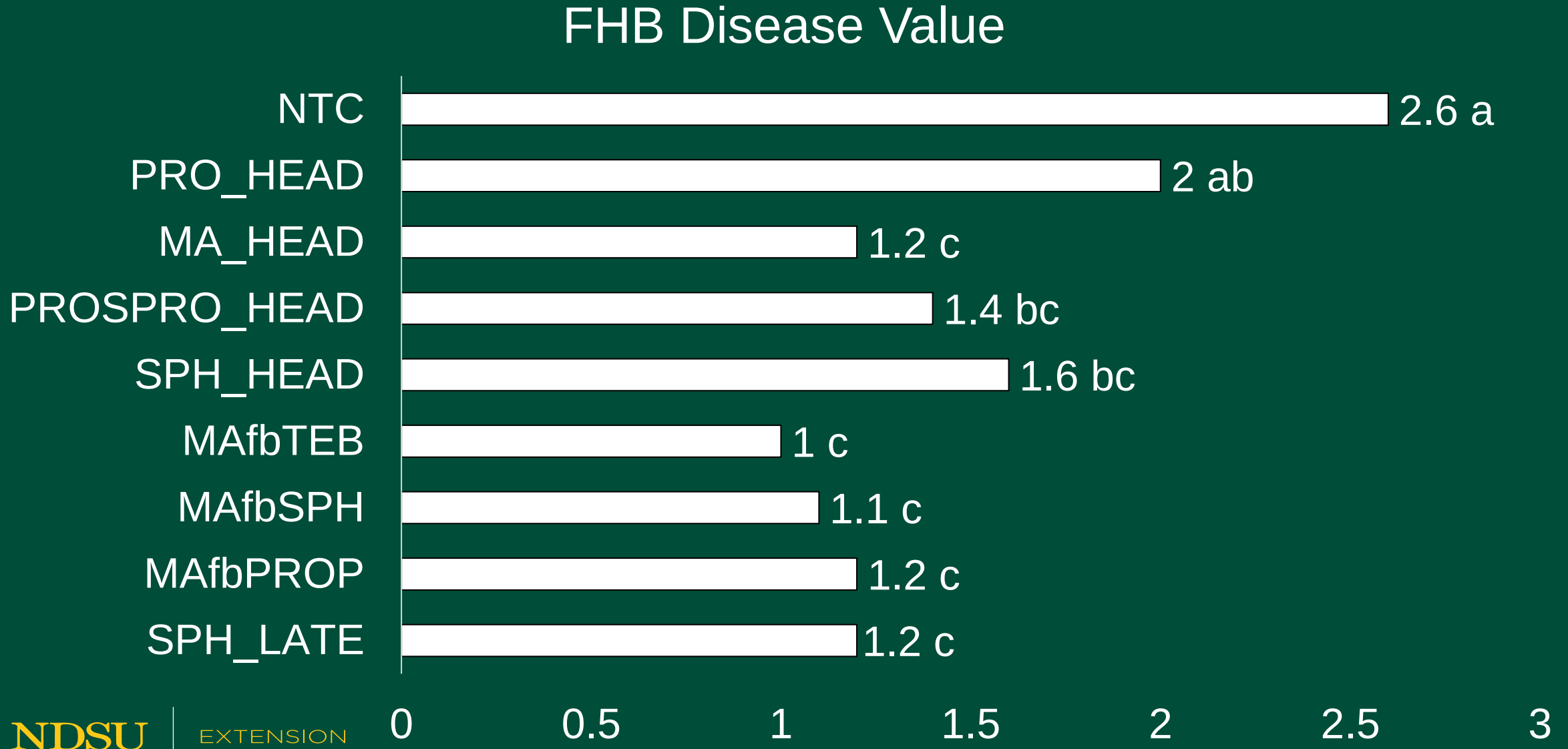
**Data combined across six experiments*

Fungicide Timing Barley

NDSU | EXTENSION

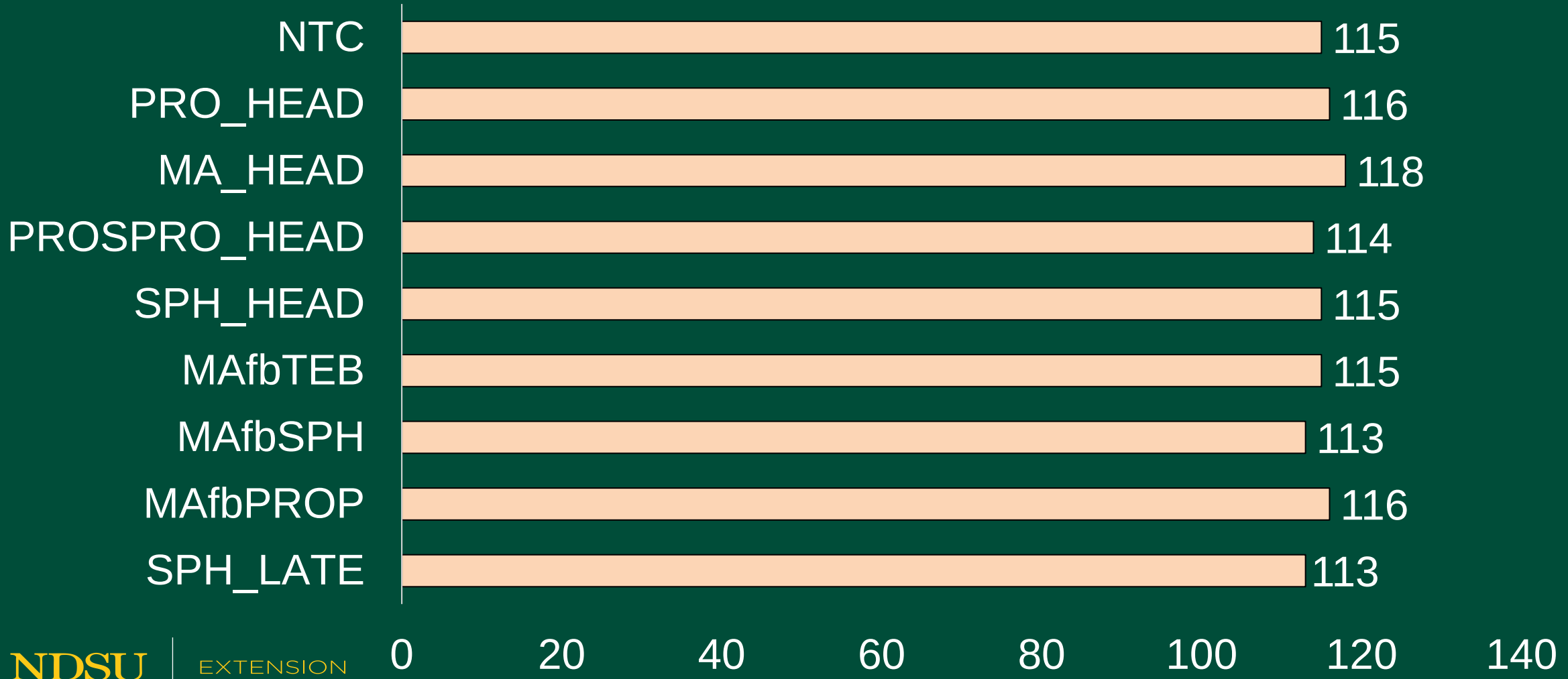
2022-24 Barley FHB Disease Intensity

**Data combined across five experiments*



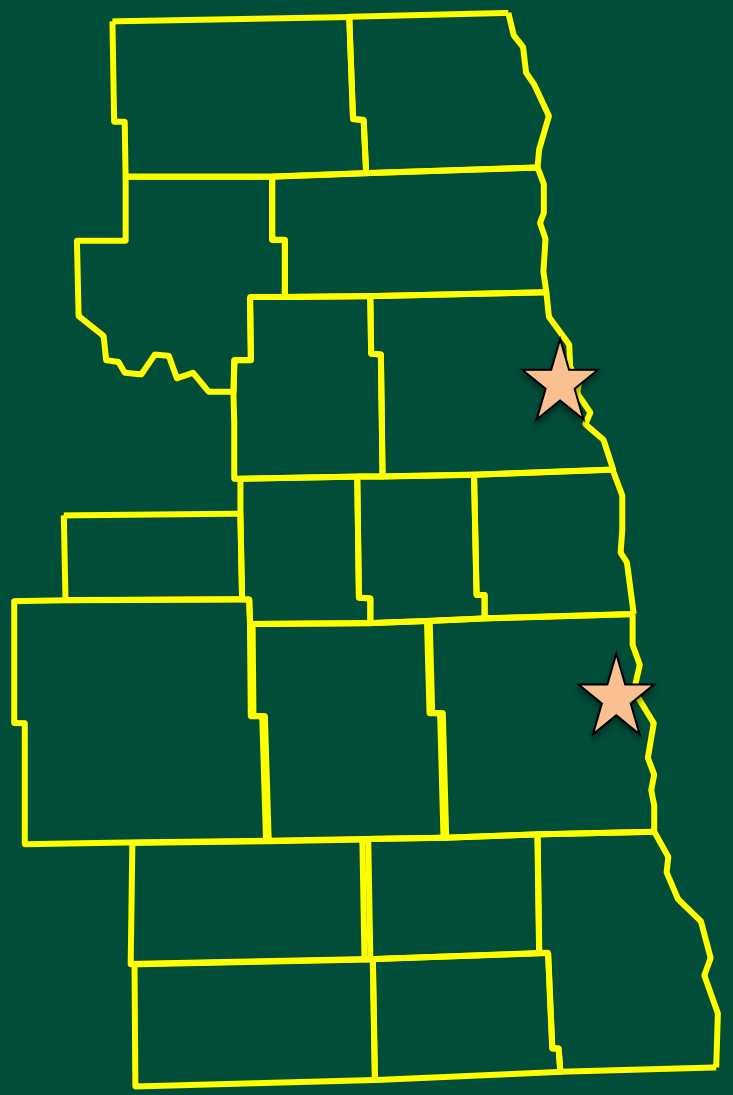
2022-24 Barley FHB - **Yield**

**Data combined across five experiments*



What about FHB Fungicides and Yield?

The higher the fungal disease risk + the more susceptible the variety = the greater the yield response from a FHB fungicide

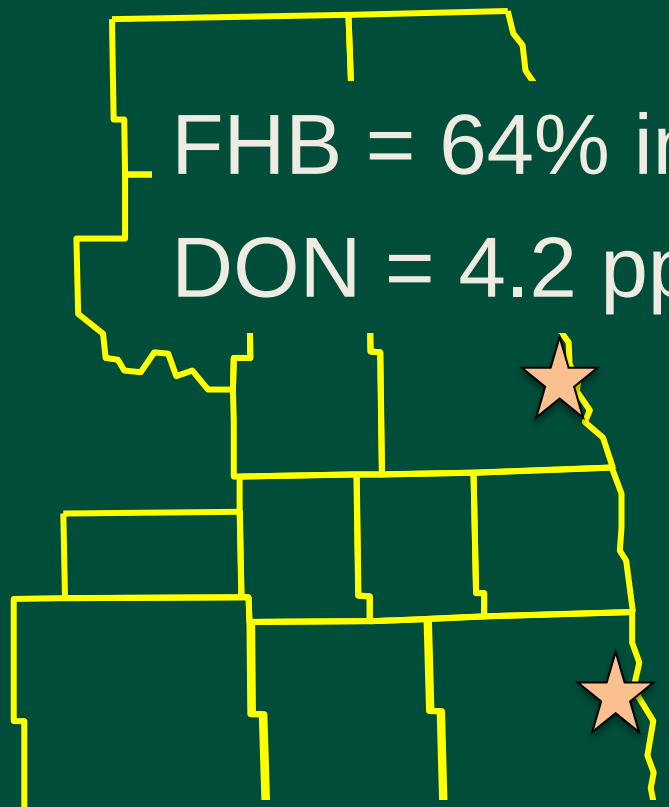


Four varieties

1. AP Murdock
2. WB9590
3. ND Stampede
4. ND Thresher

Two fungicide treatments

1. No fungicide
2. Propiconazole @ 3-4 leaf followed by Miravis Ace @ early flowering



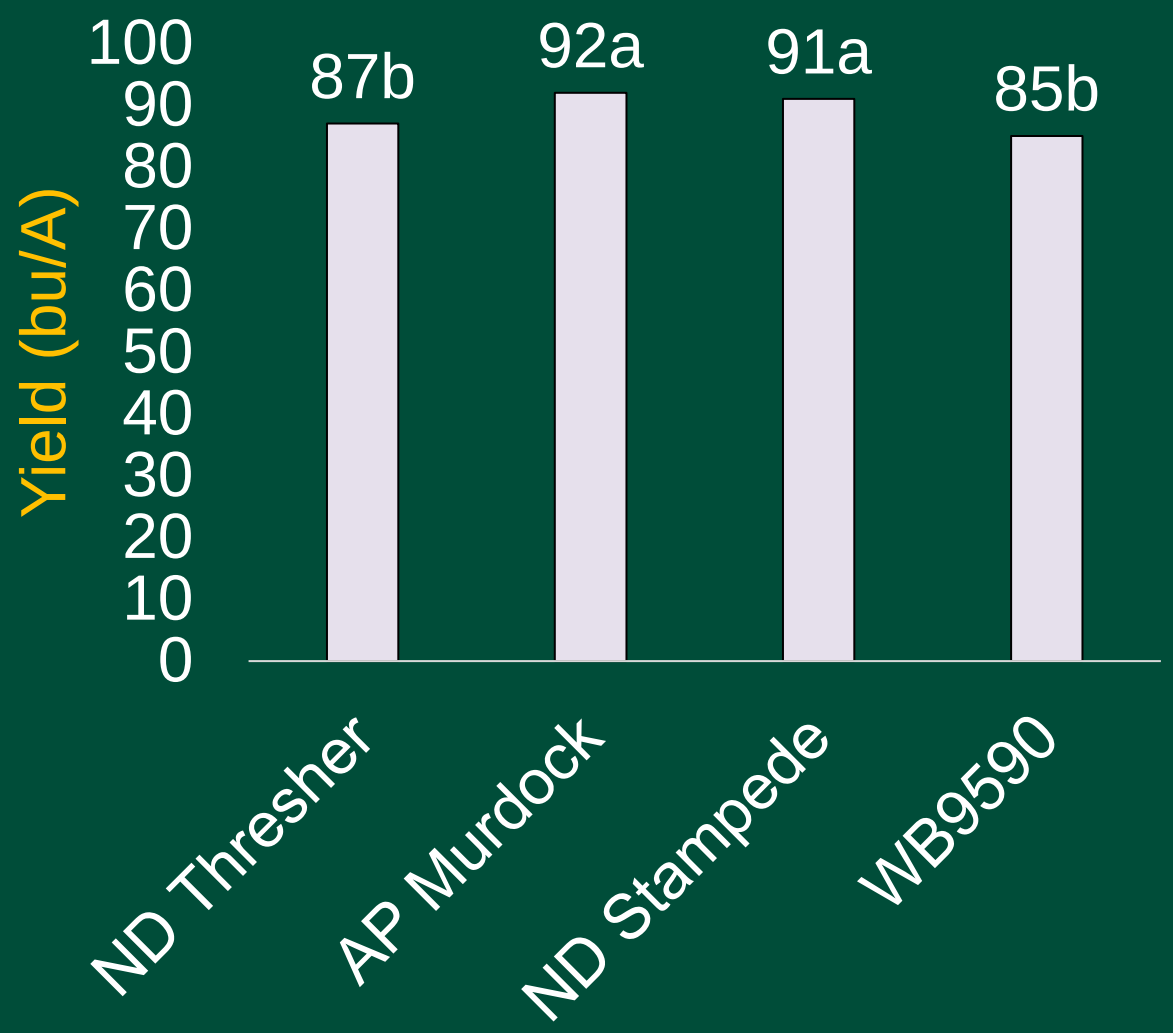
FHB = 64% incidence

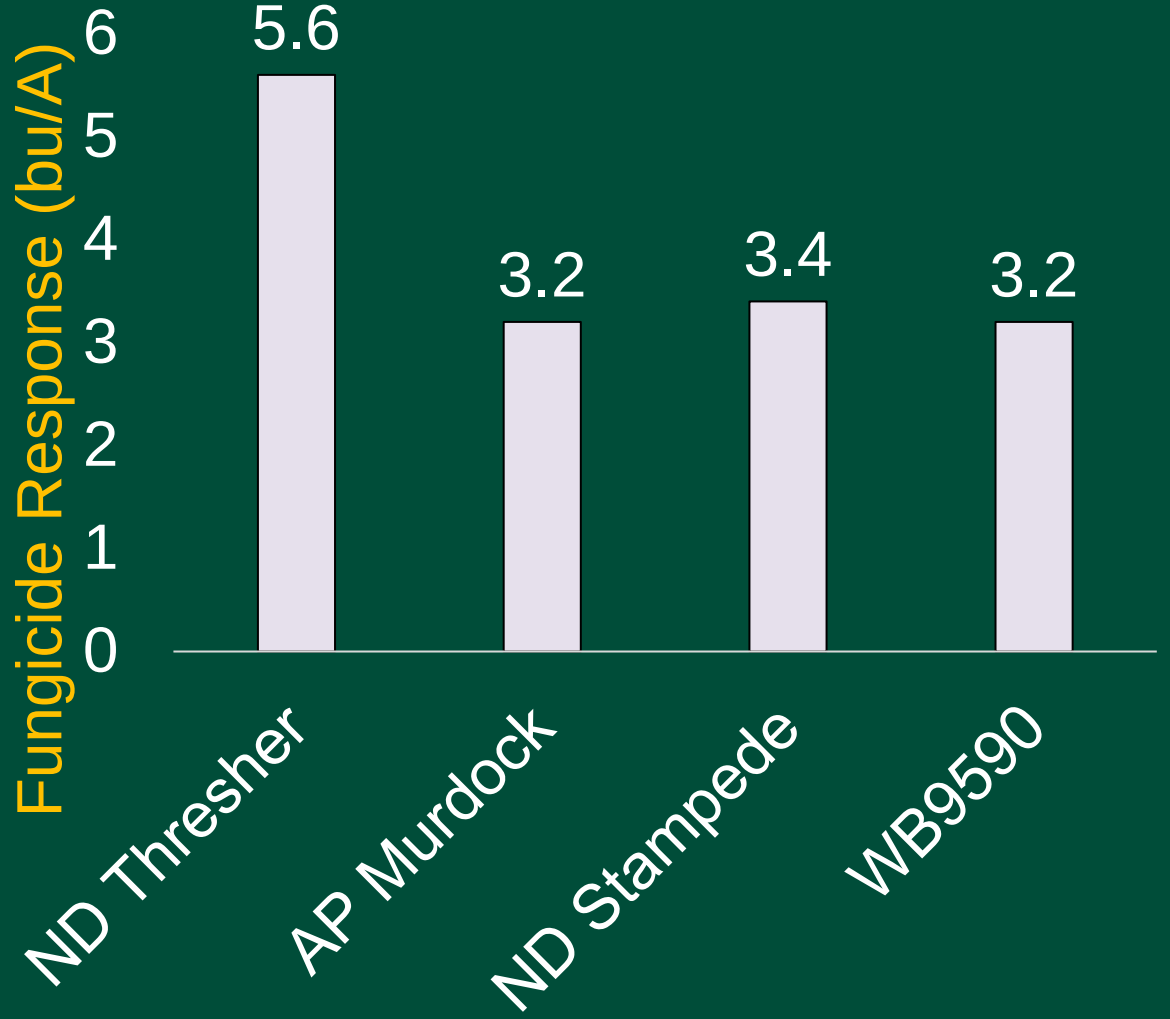
DON = 4.2 ppm (15.7 ppm high)

FHB = 11% incidence

DON = 0.2 ppm (0.5 ppm high)

Yield Results – **Fargo – Low FHB**





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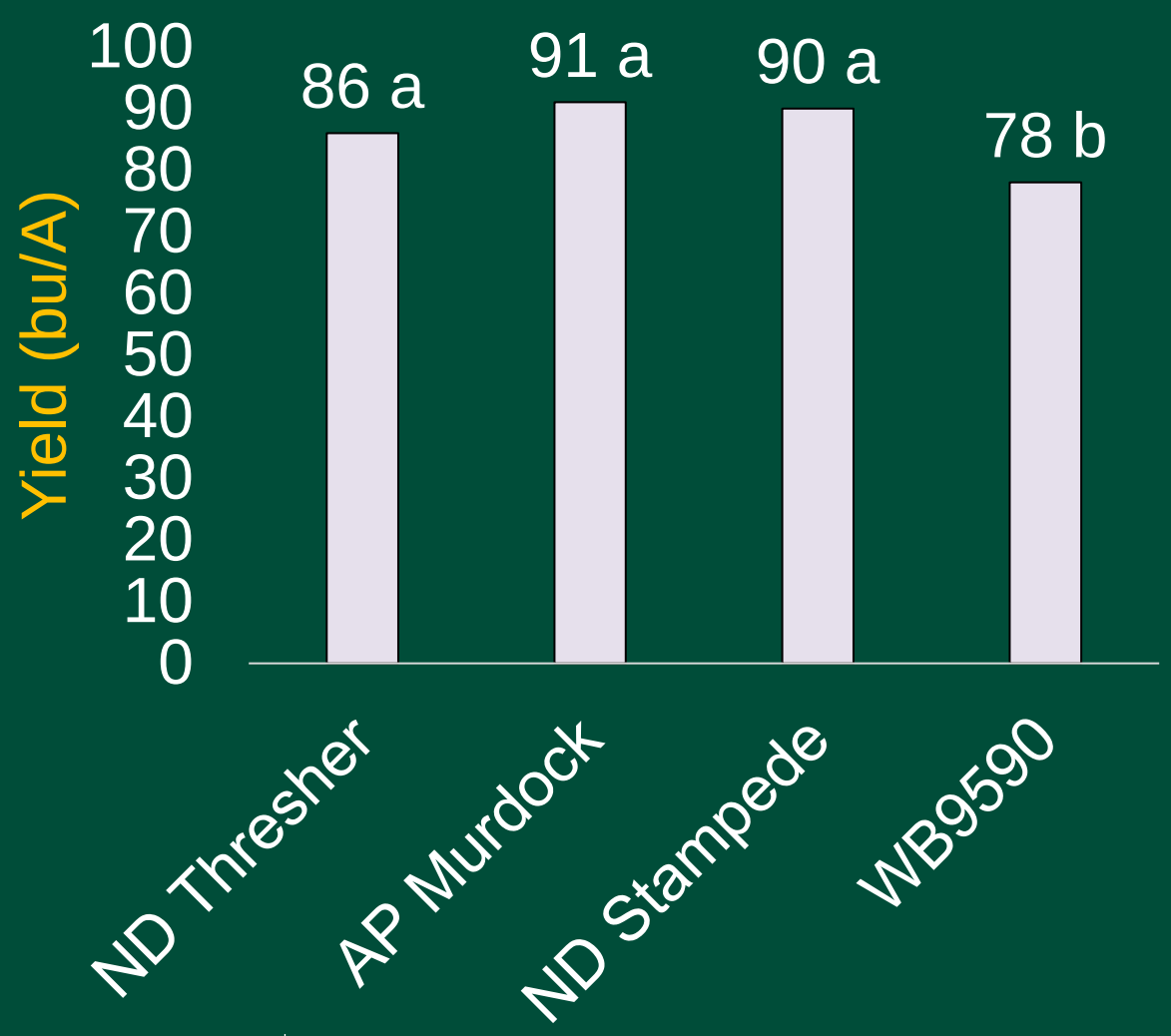
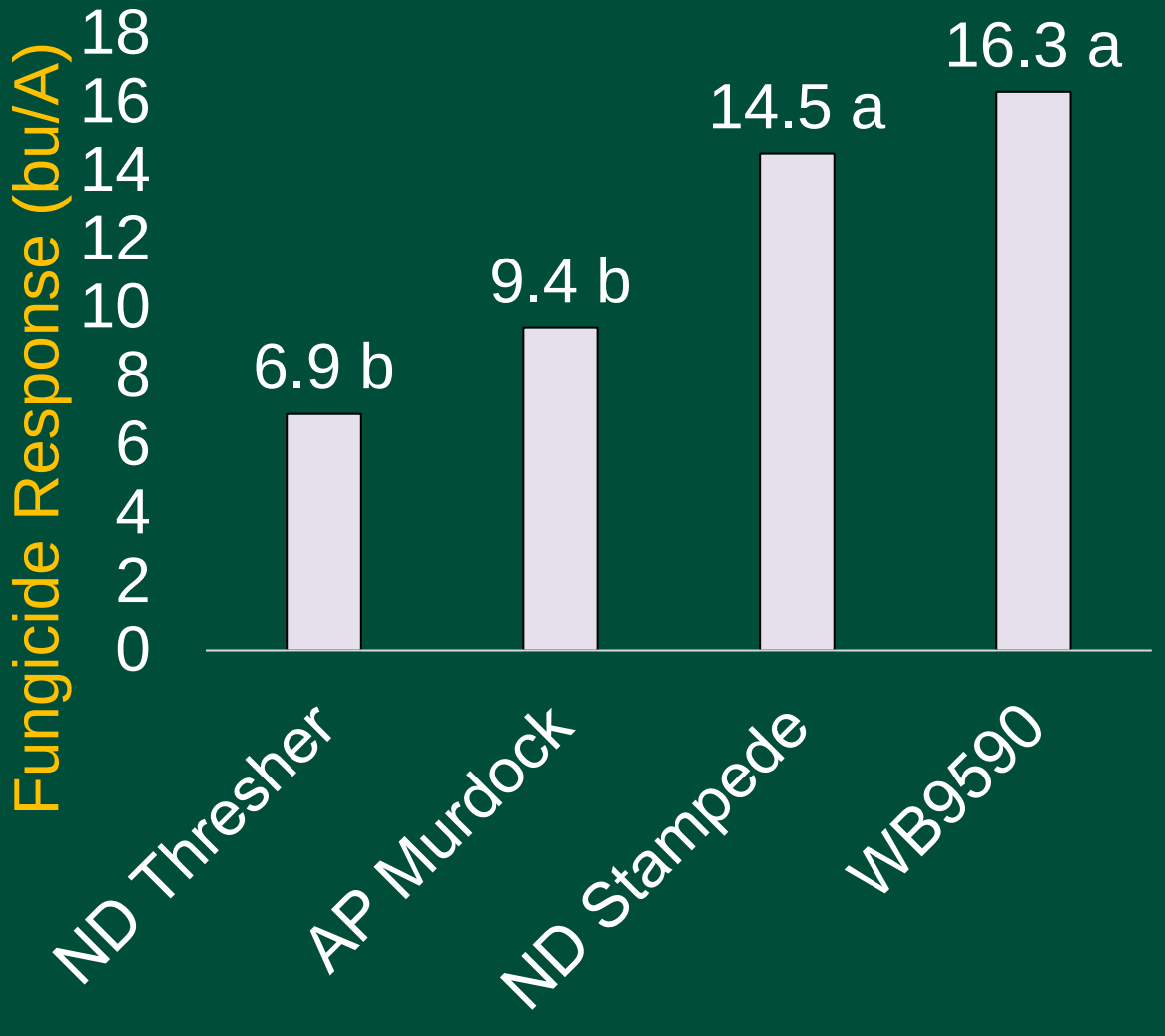
Yield Results – Thompson – Very High FHB





Tillering and Flag Leaf Fungicide Research - Wheat

Andrew Friskop – Cereal Crop Extension Pathologist

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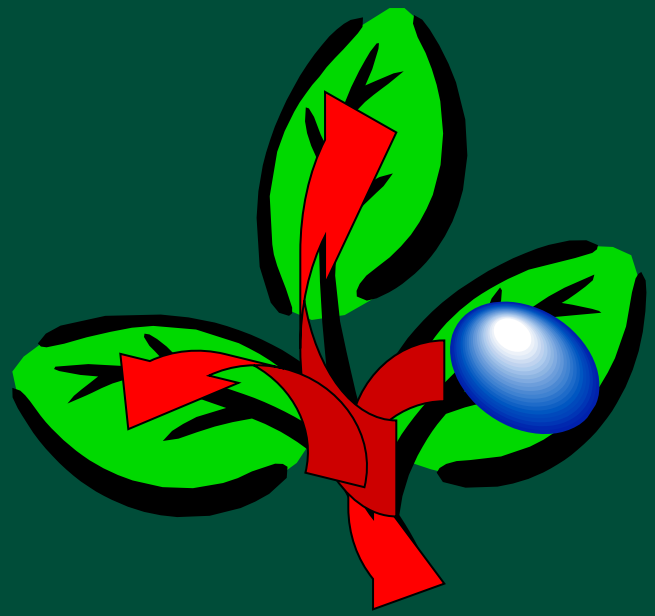
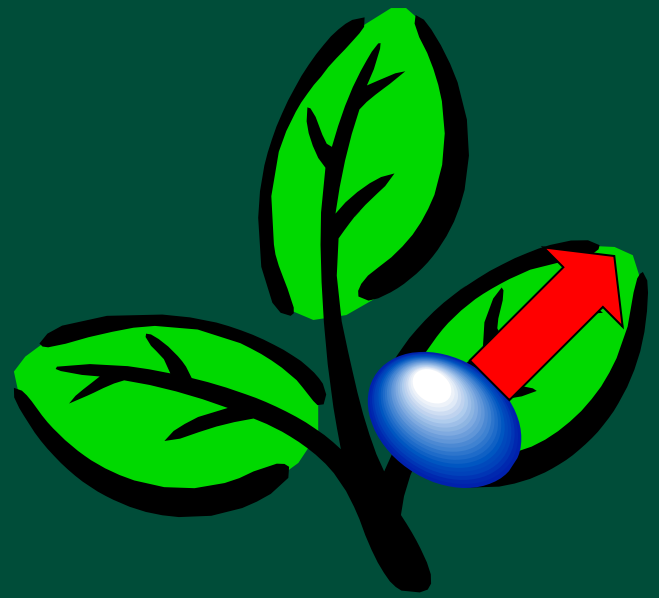
Fungicide Movement

Systemic
Herbicide

≠

Systemic
Fungicide





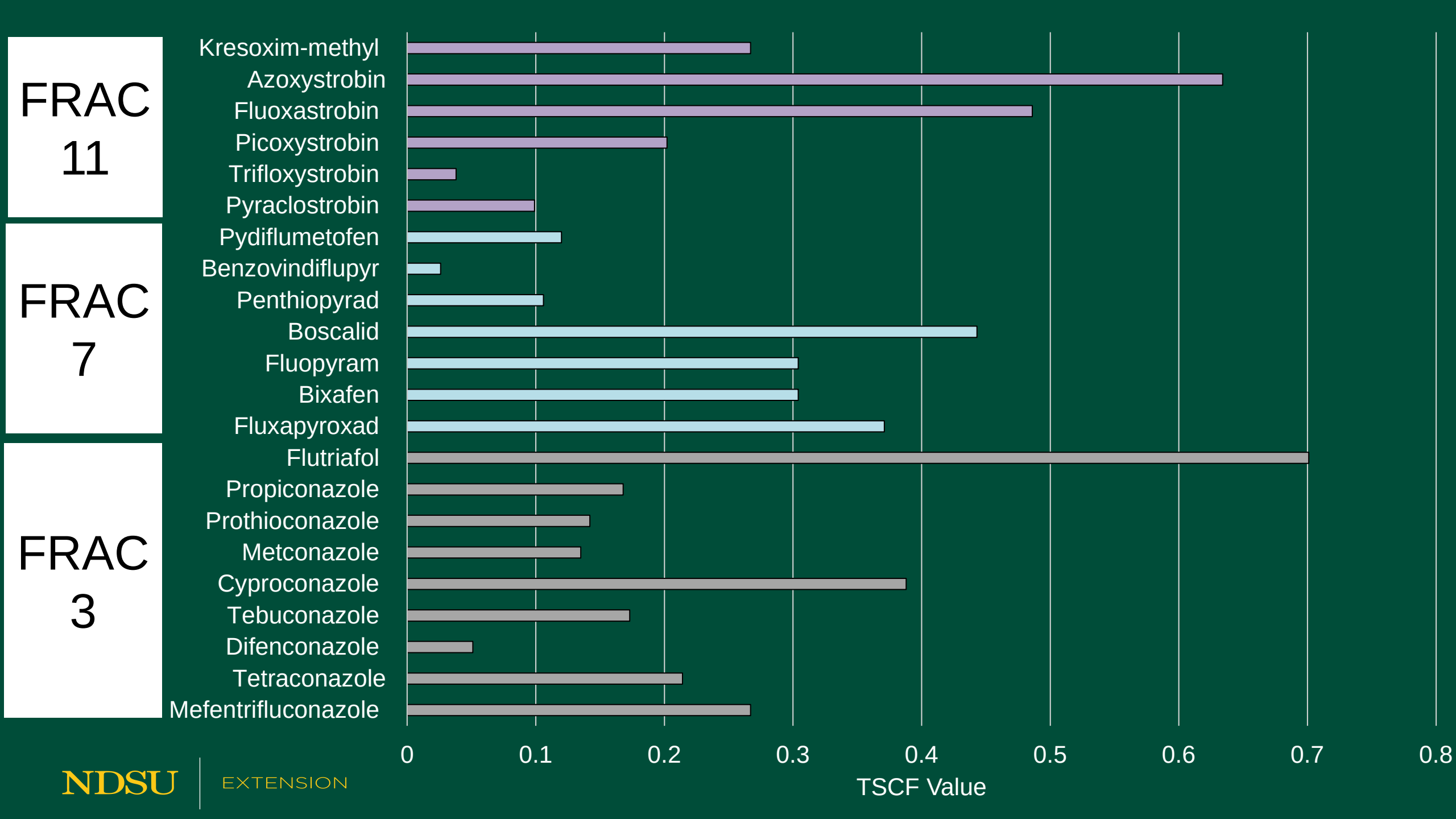
Phytomobility of Fungicides

Translocation Stream Concentration Factors

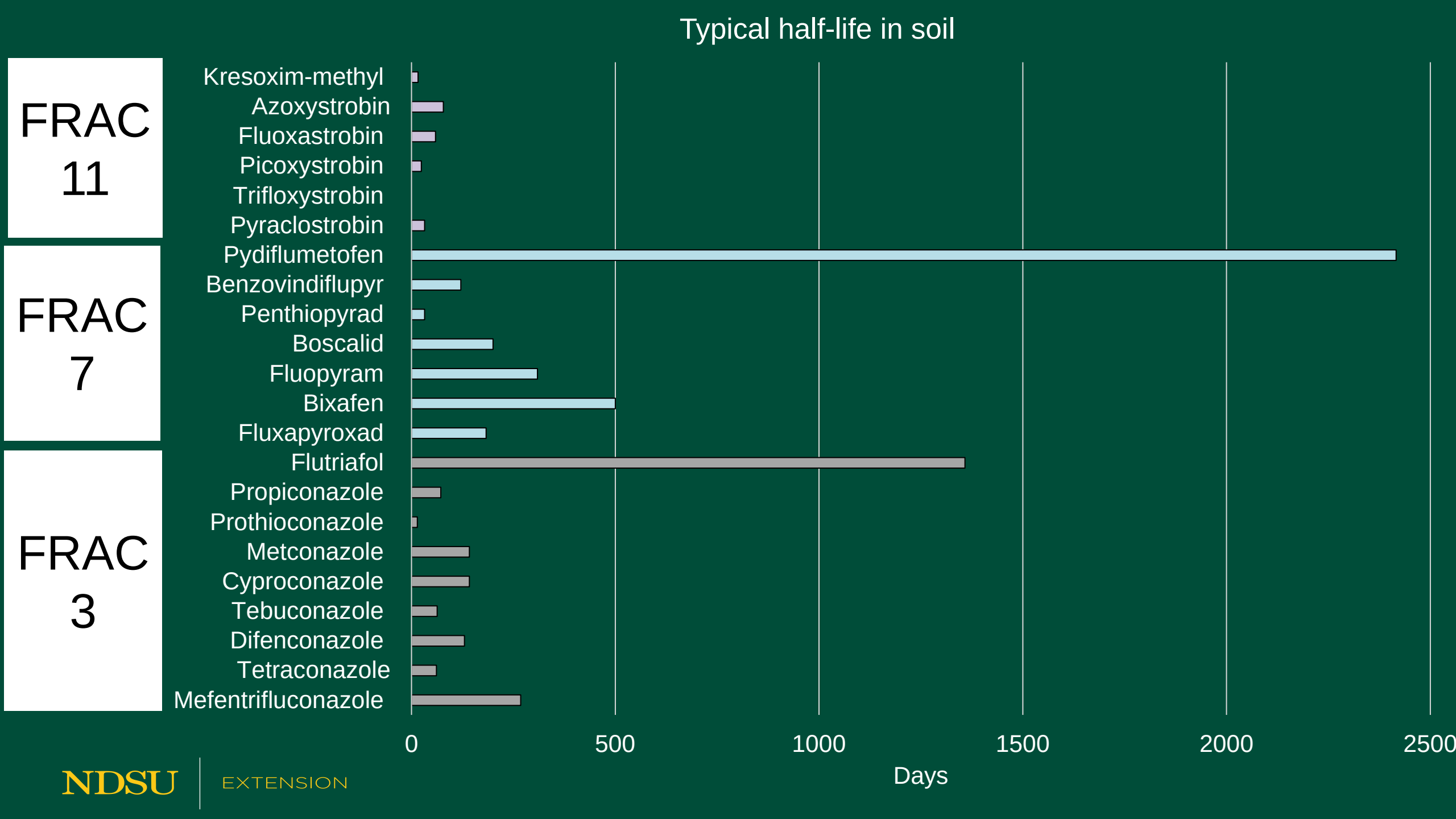
- Calculated using logP (lipophilicity) and polarity of a fungicide
- Briggs et al., 1982 (https://onlinelibrary.wiley.com/doi/10.1002/ps.2780130506)
- Value can be used as a measure of phytomobility
- Higher the value, the greater the phytomobility

Half-life

- Length of time for 50% of a fungicide to breakdown to secondary components



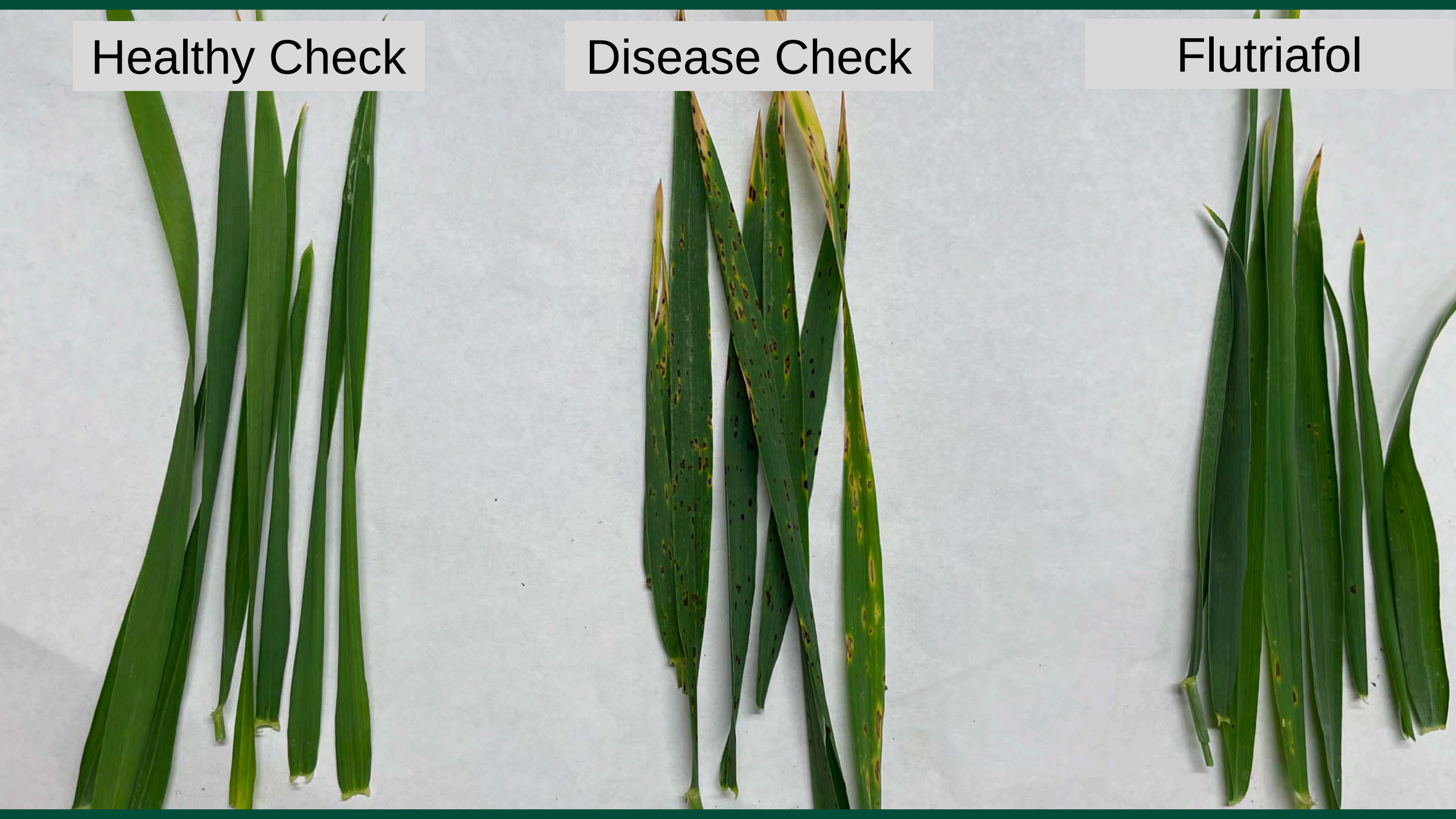
NDSU | EXTENSION



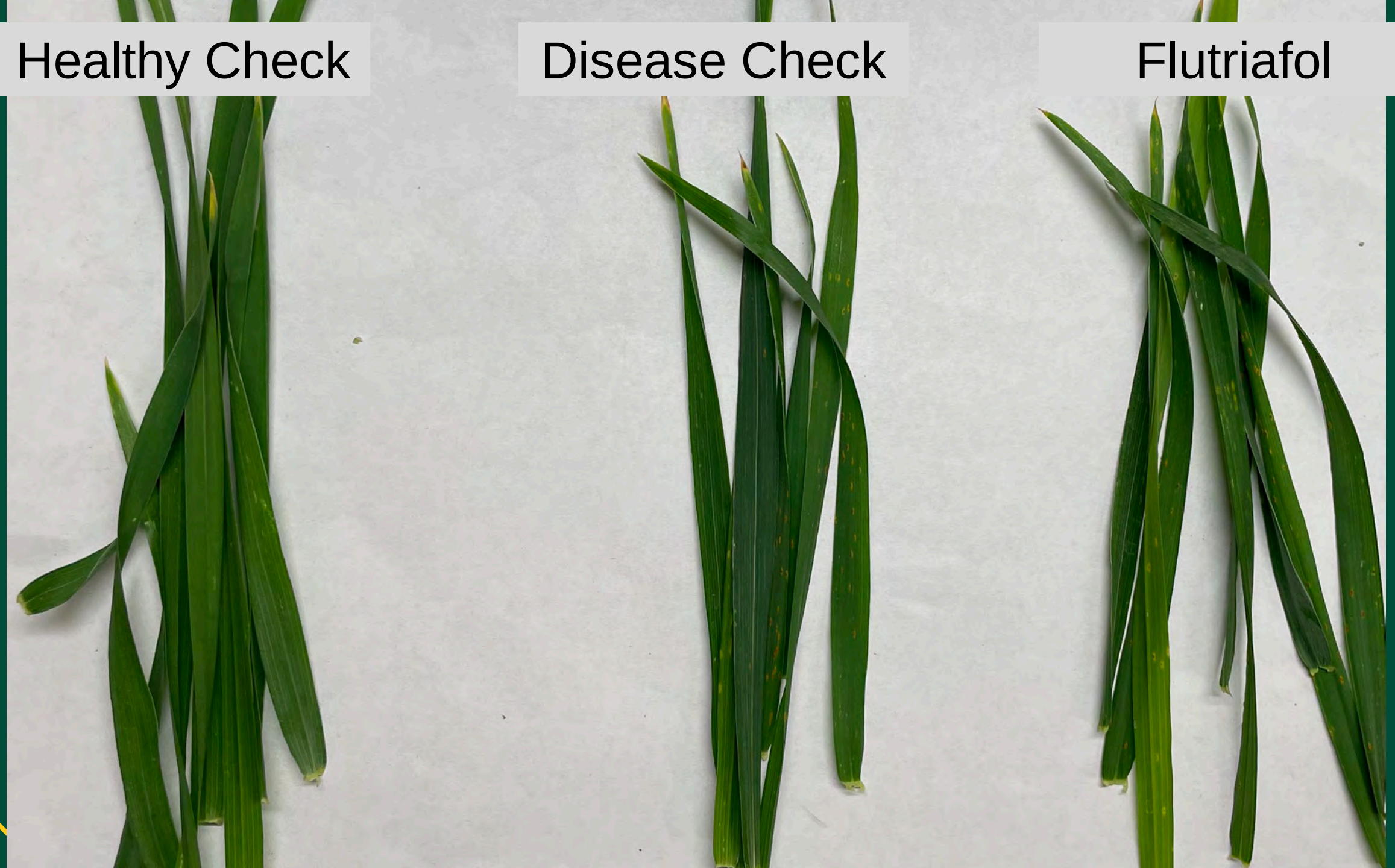
NDSU | EXTENSION

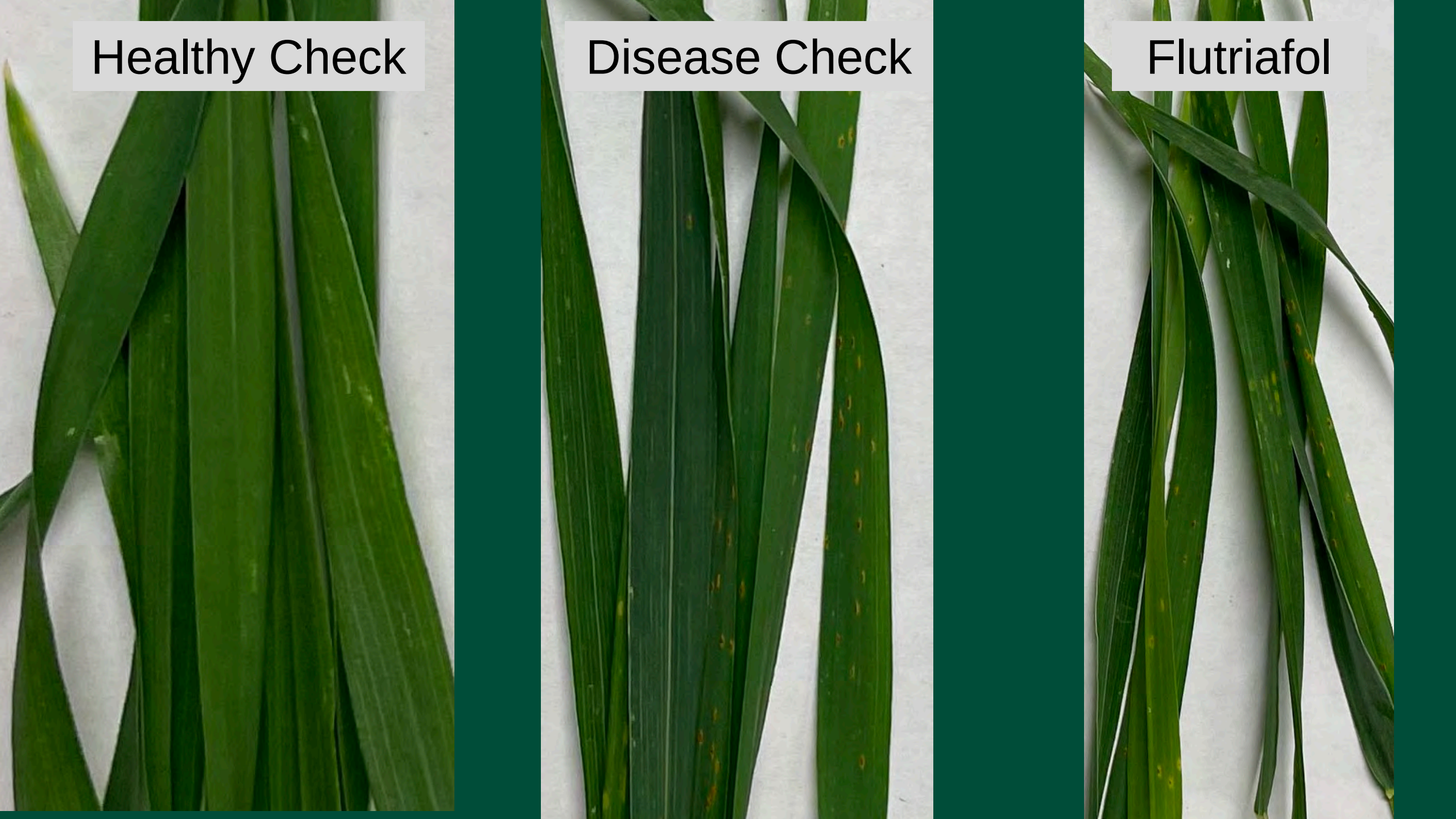
Controlled Greenhouse Study

- Flutriafol (fungicide with highest TSCF Value)
- Fungicide applied at 2-3 leaf
- Tan spot pathogen or leaf rust pathogen inoculated 14 days later


Healthy Check
Disease Check
Flutriafol


Healthy Check
Disease Check
Flutriafol


Healthy Check
Disease Check
Flutriafol


Healthy Check
Disease Check
Flutriafol

Fungicides at Tillering (Herbicide Pass)

1. Protect available leaves from residue borne diseases such as tan spot and Stagonospora nodorum blotch
2. Several very good to excellent options
3. Potentially reduce disease stress during stage when spike size is determined
4. Be cautious about tank mixes of formulations

Wheat Fungicide Efficacy - CPN

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		Active ingredient (%)	Product/Trade name	Rate/A (fl oz)	Powdery mildew	Stagonospora nodorum blotch	Septoria tritici blotch	Tan spot	Stripe rust	Leaf rust	Stem rust
Strobilurins	11	Picoxystrobin 22.5%	Aproach SC	6.0 - 12.0	G[1]	VG	VG[2]	VG	E[3]	VG	VG
		Pyraclostrobin 23.6%	Headline SC	6.0 - 9.0	G	VG	VG[2]	E	E[3]	E	G
		Azoxystrobin 22.9%	Quadris 2.08 SC, multiple generics[5]	4.0 - 12.0[6]	G	VG	VG	E	E	E	VG
Triazoles	3	Tebuconazole 38.7%	Folicur 3.6 F, multiple generics[5]	4.0	NL	NL	NL	NL	E	E	E
		Prothioconazole 41.0%	Proline 480 SC	5.0 - 5.7	--	VG	VG	VG	VG	VG	VG
		Prothioconazole 19.0%	Prosaro 421 SC	6.5 - 8.2	G	VG	VG	VG	E	E	E
		Tebuconazole 19.0%									
		Propiconazole 41.8%	Tilt 3.6 EC, multiple generics[5]	4.0	VG	VG	VG	VG	VG	VG	VG
		Metconazole 10.91%	Sphaerex	4.0 - 7.3	VG	VG	VG	VG	E	E	E
		Prothioconazole 18.19%									
Mixed modes of action[8]	3	Tebuconazole 22.6%	Absolute Maxx SC	5.0	G	VG	VG	VG	VG	E	VG
	11	Trifloxystrobin 22.6%									
	3	Cyproconazole 7.17%	Aproach Prima SC	3.4 - 6.8	VG	VG	VG	VG	E	VG	U
	11	Picoxystrobin 17.94%									
	3	Prothioconazole 16.0%	Delaro 325 SC	8.0	G	VG	VG	VG	VG	VG	VG
	11	Trifloxystrobin 13.7%									
	7	Pydiflumetofen 13.7%	Miravis Ace SE	13.7	VG	VG	VG	VG	VG	VG	VG
	3	Propiconazole 11.4%									
	7	Fluxapyroxad 2.8%	Nexicor EC	7.0 - 13.0	VG	VG	E	E	E	E	VG
	11	Pyraclostrobin 18.7%									
	3	Propiconazole 11.7%									
	7	Fluxapyroxad 14.3%	Priaxor	4.0 - 8.0	G	VG	VG	E	VG	VG	G
	11	Pyraclostrobin 28.6%									
	3	Prothioconazole 17.39%	Prosaro Pro SC	10.3 - 13.6	G	VG	VG	VG	E	E	E
	3	Tebuconazole 8.7%									
	7	Fluopyram 8.7%									
	3	Propiconazole 11.7%	Quilt Xcel 2.2 SE, multiple generics[5]	10.5 - 14.0[7]	VG	VG	VG	VG	E	E	VG
	11	Azoxystrobin 13.5%									
	3	Prothioconazole 10.8%	Stratego YLD[9]	4.0	G	VG	VG	VG	VG	VG	VG
	11	Trifloxystrobin 32.3%									
	7	Benzovindiflupyr 2.9%	Trivapro SE	9.4 - 13.7	VG	VG	VG	VG	E	E	VG
	3	Propiconazole 11.9%									
	11	Azoxystrobin 10.5%									
	3	Flutriafol 18.63%	Topguard EQ	4.0 - 7.0	VG	NL	VG	VG	E	E	VG
	11	Azoxystrobin 25.30%									

[1] Efficacy categories: NL=Not Labeled; NR=Not Recommended; P=Poor; F=Fair; G=Good; VG=Very Good; E=Excellent; U = Insufficient data to make statement about efficacy of this product.

Foliar Fungicide Timing Data 2008 to 2024

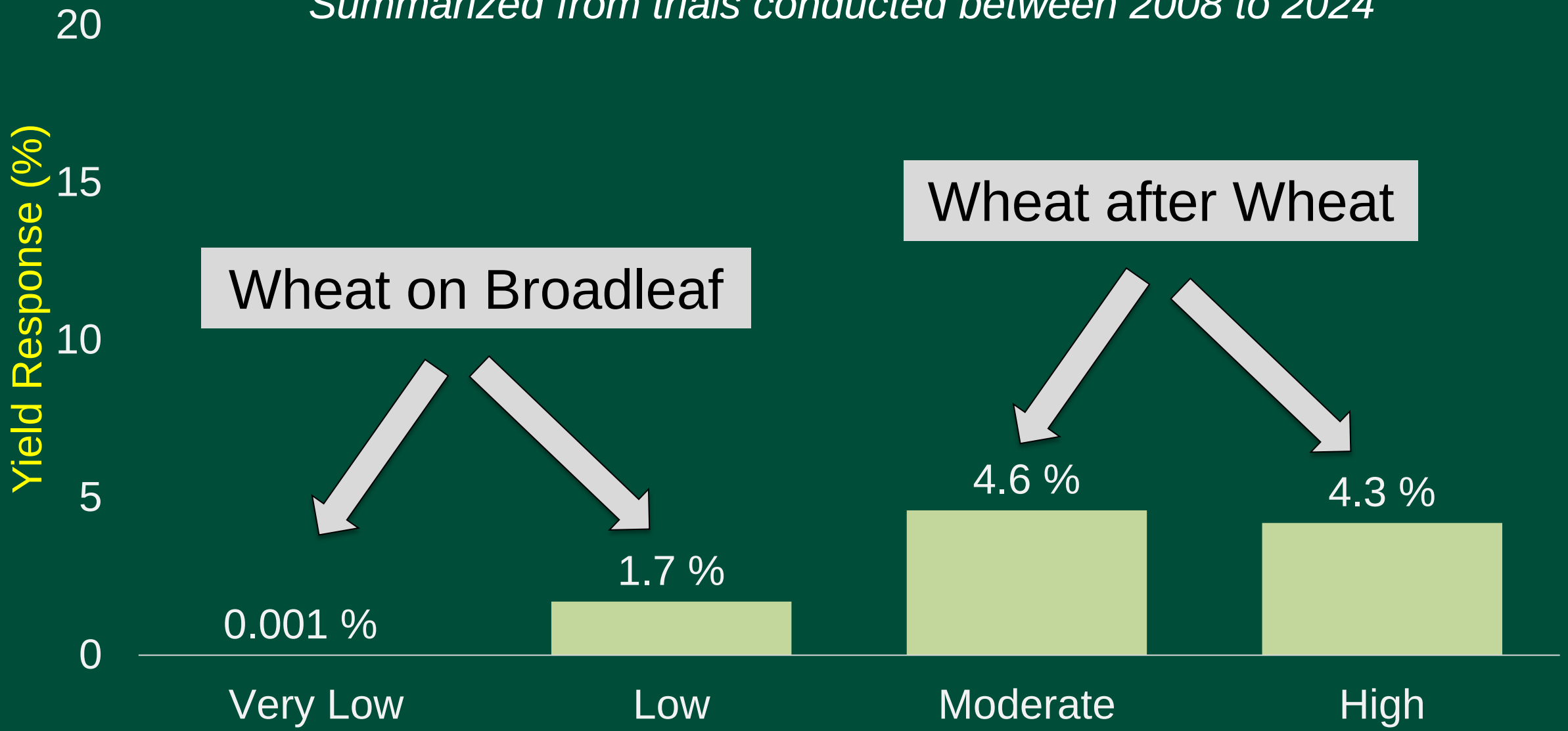
- 400 replicated fungicide means
- Fungicides rated very good to excellent
- Two timings: Tillering or Flag Leaf
- Four “disease risk” categories (situational data)
- Determined % yield response

Disease Risk Categories

Factors	Very Low	Low	Moderate	High
Variety	Moderately Resistant	Moderately Resistant	Susceptible	Susceptible
Previous Crop	Broadleaf	Broadleaf	Wheat	Wheat
Tillage	Conventional	Conventional	Conventional	Minimal
Dew Periods	Infrequent dews	Sporadic dews	Frequent dews	Frequent dews
Rainfall	Below average	Below Average	Average	Above Average
Disease Onset	Low Levels at Soft Dough Stage	Lower Canopy at Flowering Stages	Lower Canopy at Boot Stage	Detected at Jointing
Disease Severity	0-1%	1-10%	10-20%	>20%

Early-Season Fungicide – Yield Response

Summarized from trials conducted between 2008 to 2024



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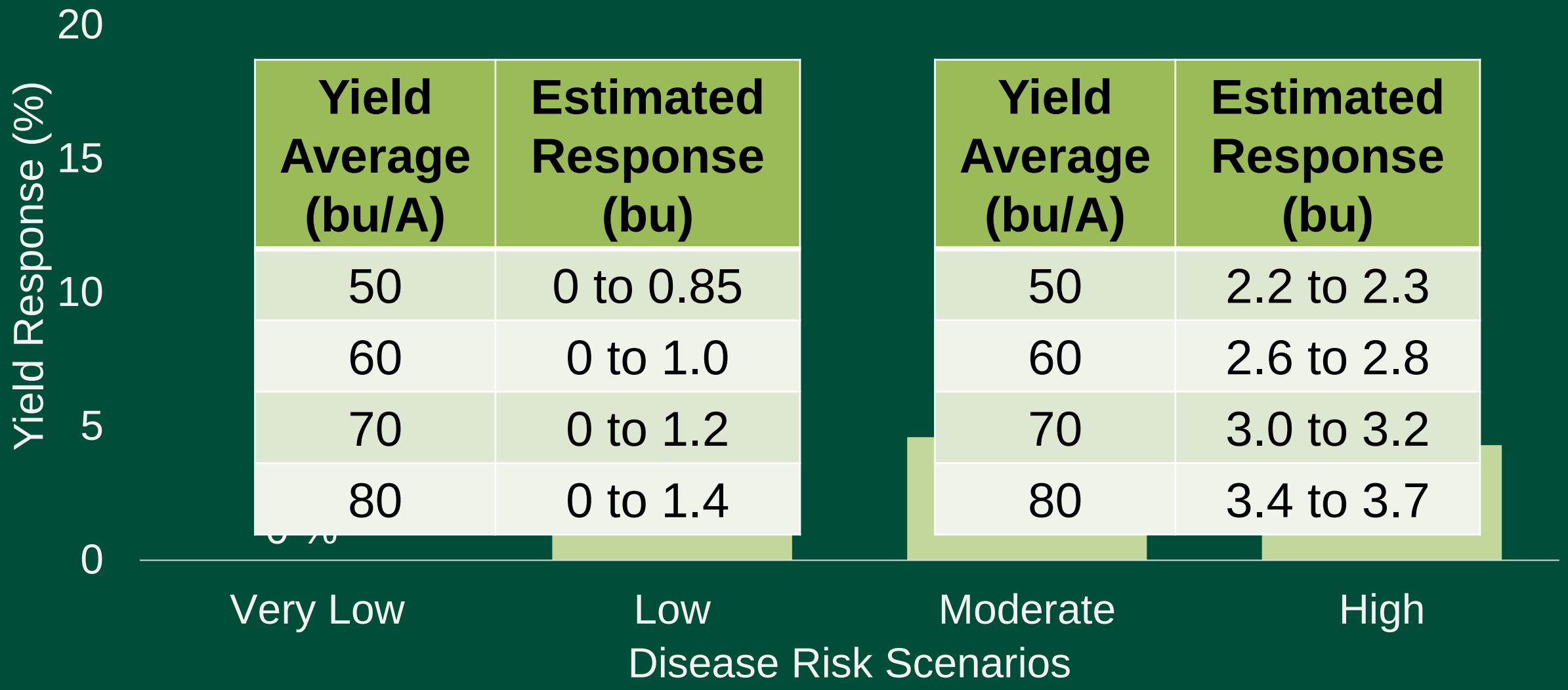
Summarized Yield Response – Tillering



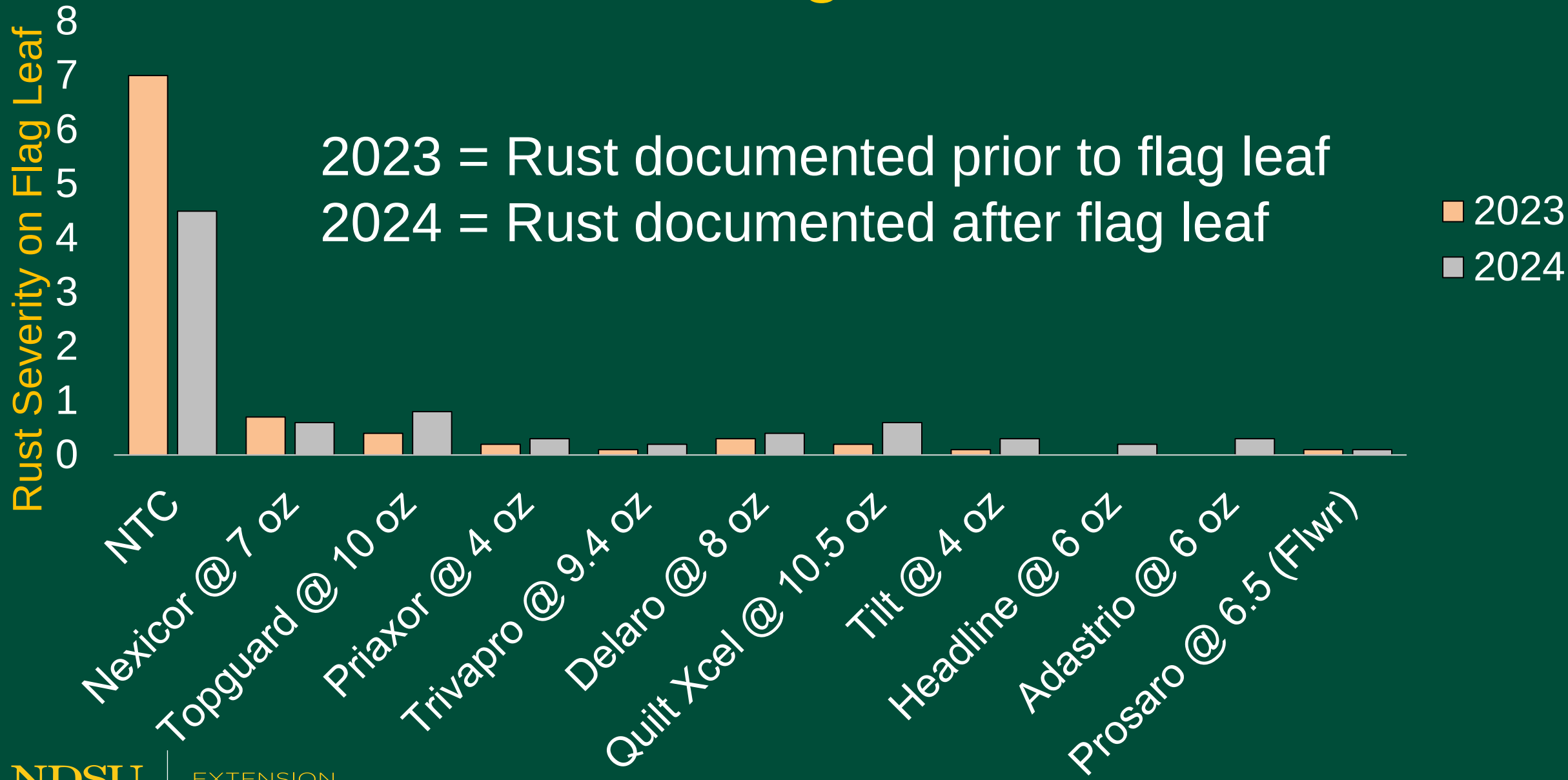
Yield Average (bu/A)	Estimated Response (bu)
50	0 to 0.85
60	0 to 1.0
70	0 to 1.2
80	0 to 1.4

Yield Average (bu/A)	Estimated Response (bu)
50	2.2 to 2.3
60	2.6 to 2.8
70	3.0 to 3.2
80	3.4 to 3.7

Fungicides at Flag Leaf

1. Several very good to excellent products
2. Protect flag leaf from rust diseases and late flushes of fungal leaf spots
3. Yield response

Uniform Leaf Rust Fungicide Trials - ‘Faller’



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Uniform Leaf Rust Fungicide Trials - ‘Faller’

Average Yield Response:

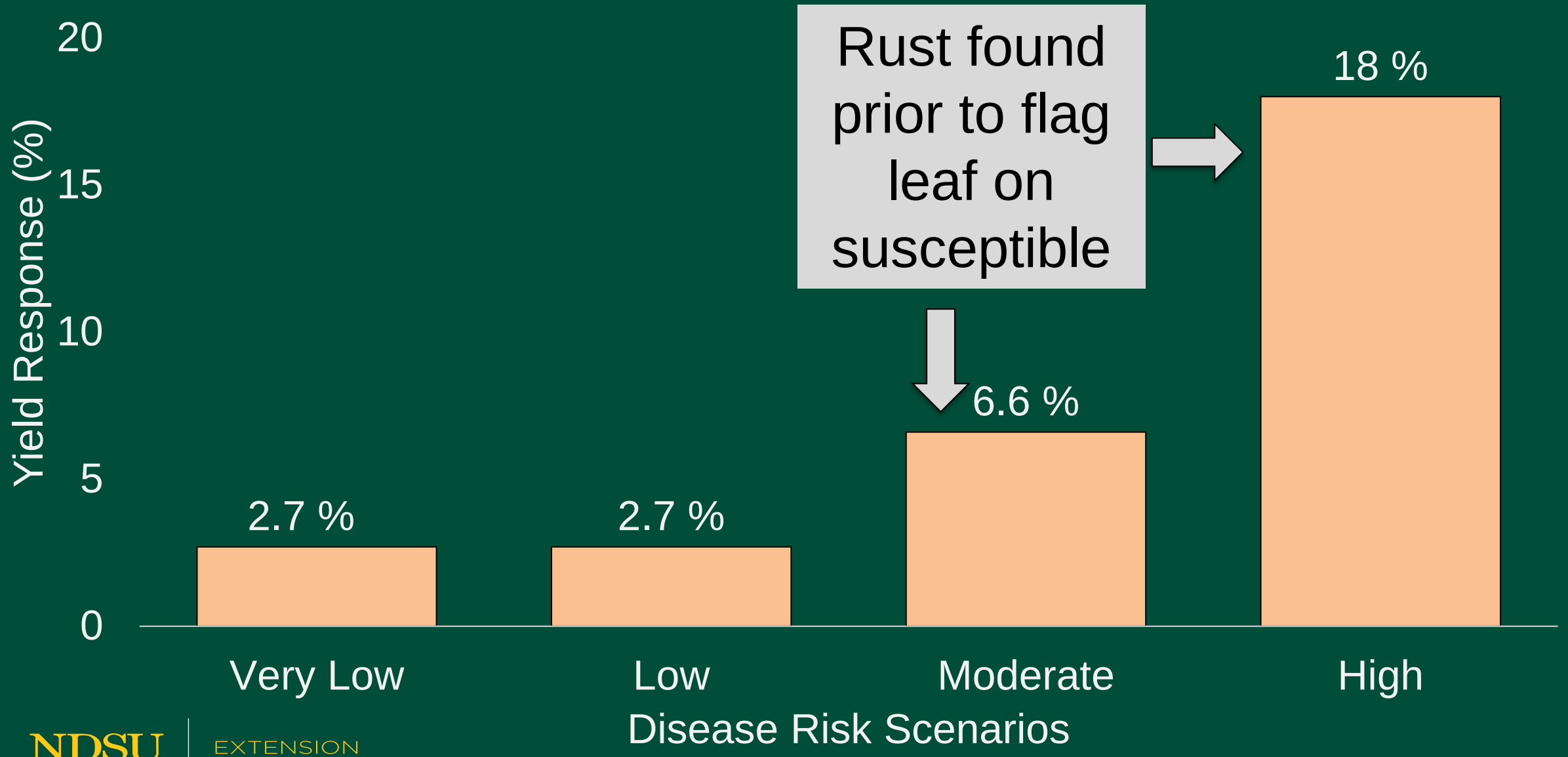
2023 = 12.5 bu/A (rust found prior to flag leaf)

2024 = 2.7 bu/A (rust found after flag leaf)

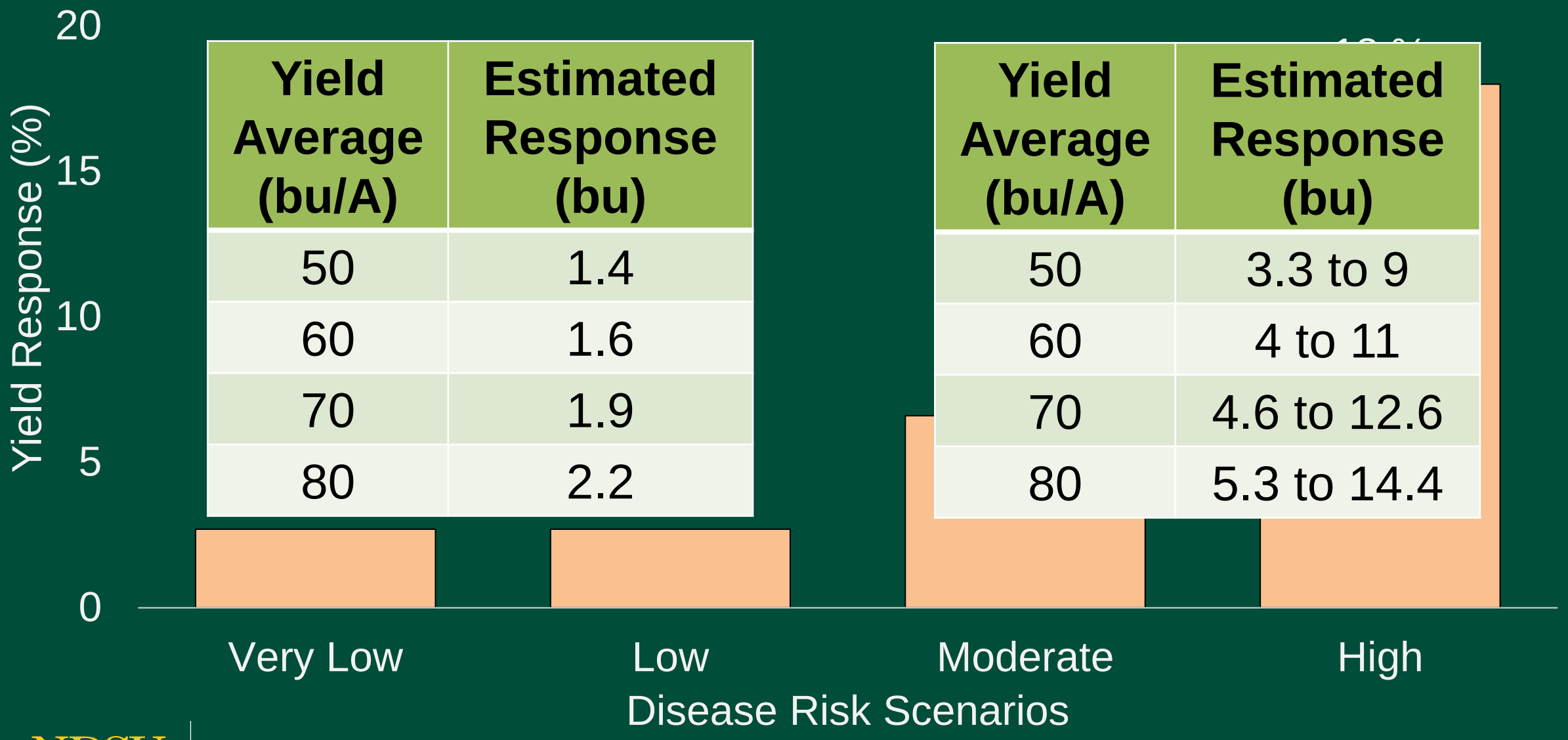
Foliar Fungicide Timing Data 2008 to 2024

- 400 replicated fungicide means
- Fungicides rated very good to excellent
- Two timings: Tillering or Flag Leaf
- Four “disease risk” categories (situational data)
- Determined % yield response

Summarized Yield Response – Flag Leaf



Summarized Yield Response – Flag Leaf

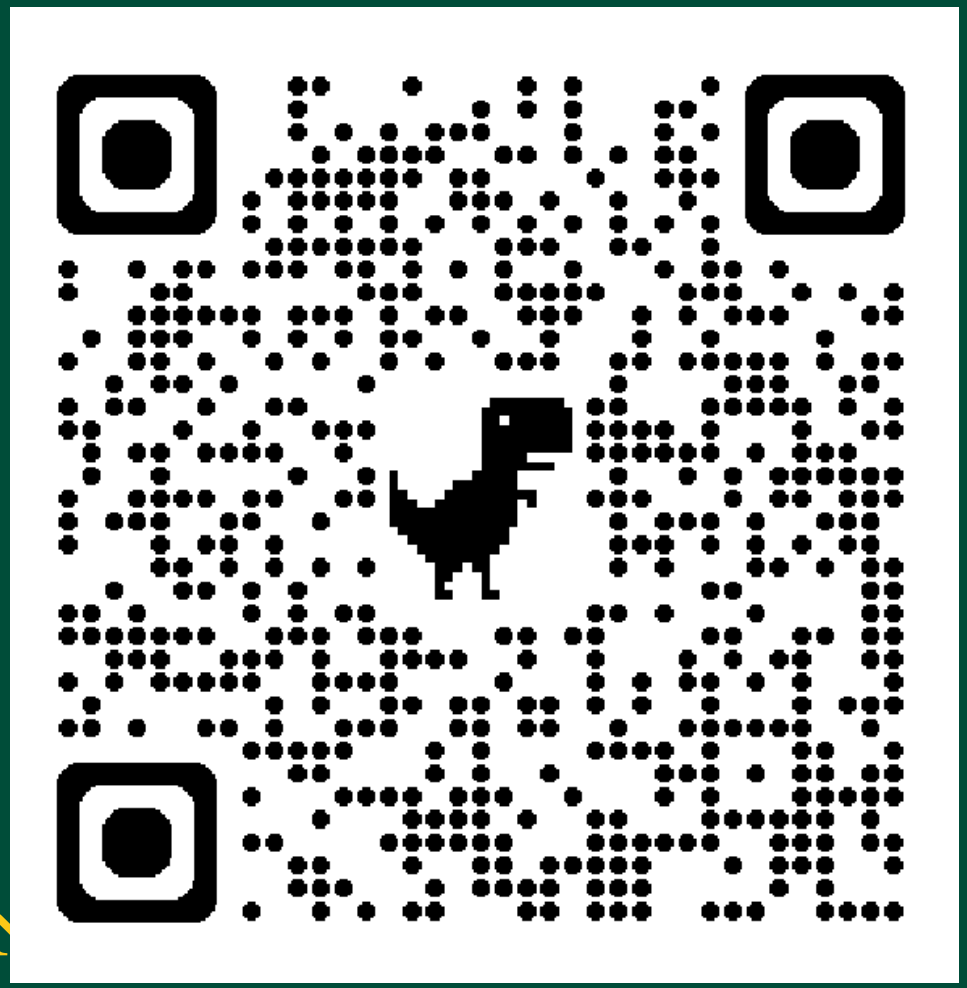


Yield Average (bu/A)	Estimated Response (bu)
50	1.4
60	1.6
70	1.9
80	2.2

Yield Average (bu/A)	Estimated Response (bu)
50	3.3 to 9
60	4 to 11
70	4.6 to 12.6
80	5.3 to 14.4

Questions and Thanks

360 Website – Small Grain and Corn Disease Information



Cereal Crop Extension Pathology Team

Jessica Scherer (Research Manager)

Bryan Hansen (Research Specialist)

Gabe Dusek (PhD Candidate)

NORTH DAKOTA WHEAT COMMISSION

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