

IMPROVING SOYBEAN WHITE MOLD CONTROL: INTEGRATED MANAGEMENT AND BREEDING FOR RESISTANCE

Richard "Wade" Webster, Megan McCaghey, Brian Mueller, John Gaska, Daren S. Mueller, Martin I. Chilvers, Shawn Conley, Damon L. Smith



White Mold (*Sclerotinia sclerotiorum*)

- Fungal plant pathogen
- Infects over 400 plants
 - Including many weed species
- Characteristic white fluff ball
- Persists in the soil as sclerotia
 - Can survive up to 8 years



Disease Cycle



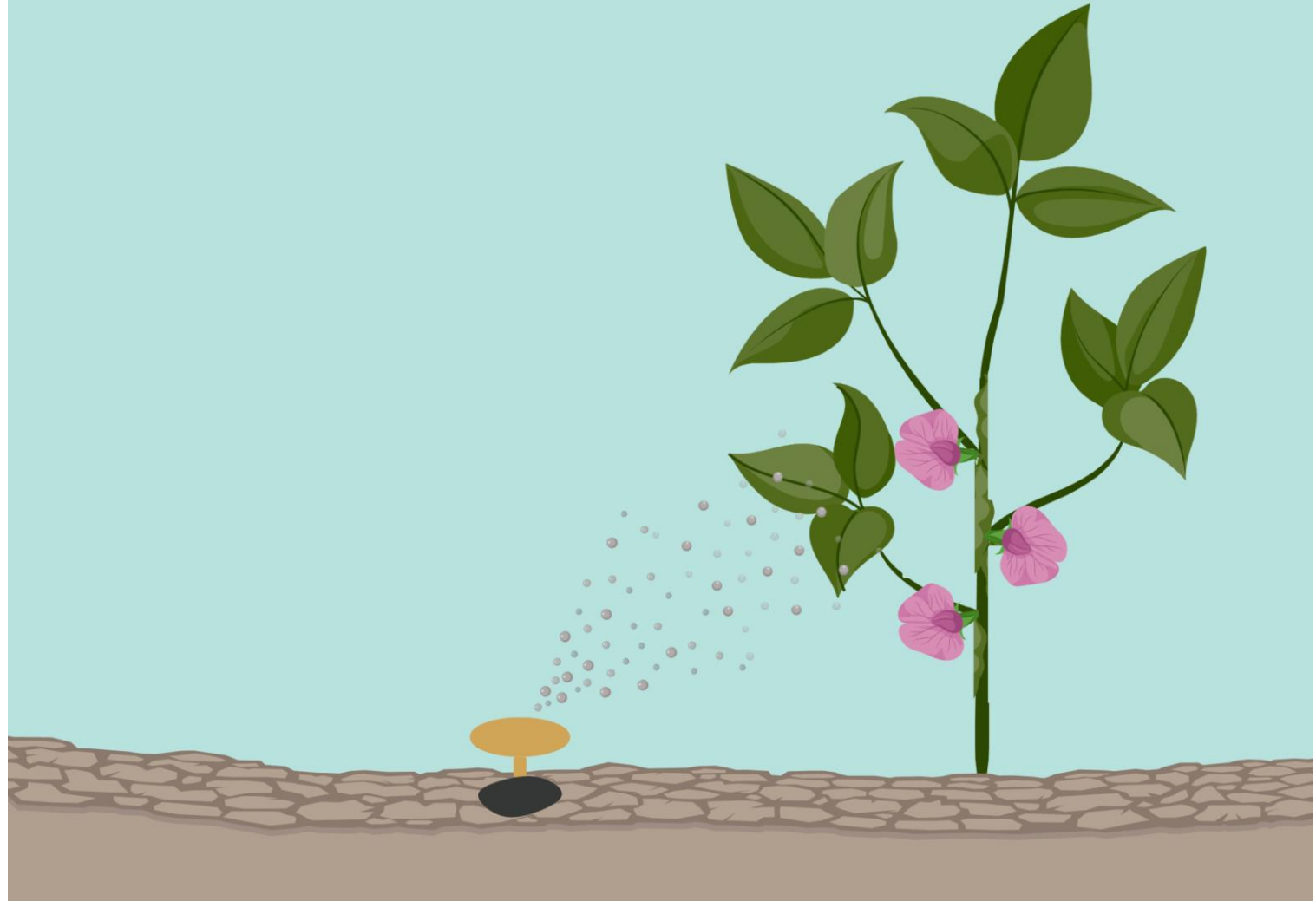
Vegetative Growth Stages



Disease Cycle



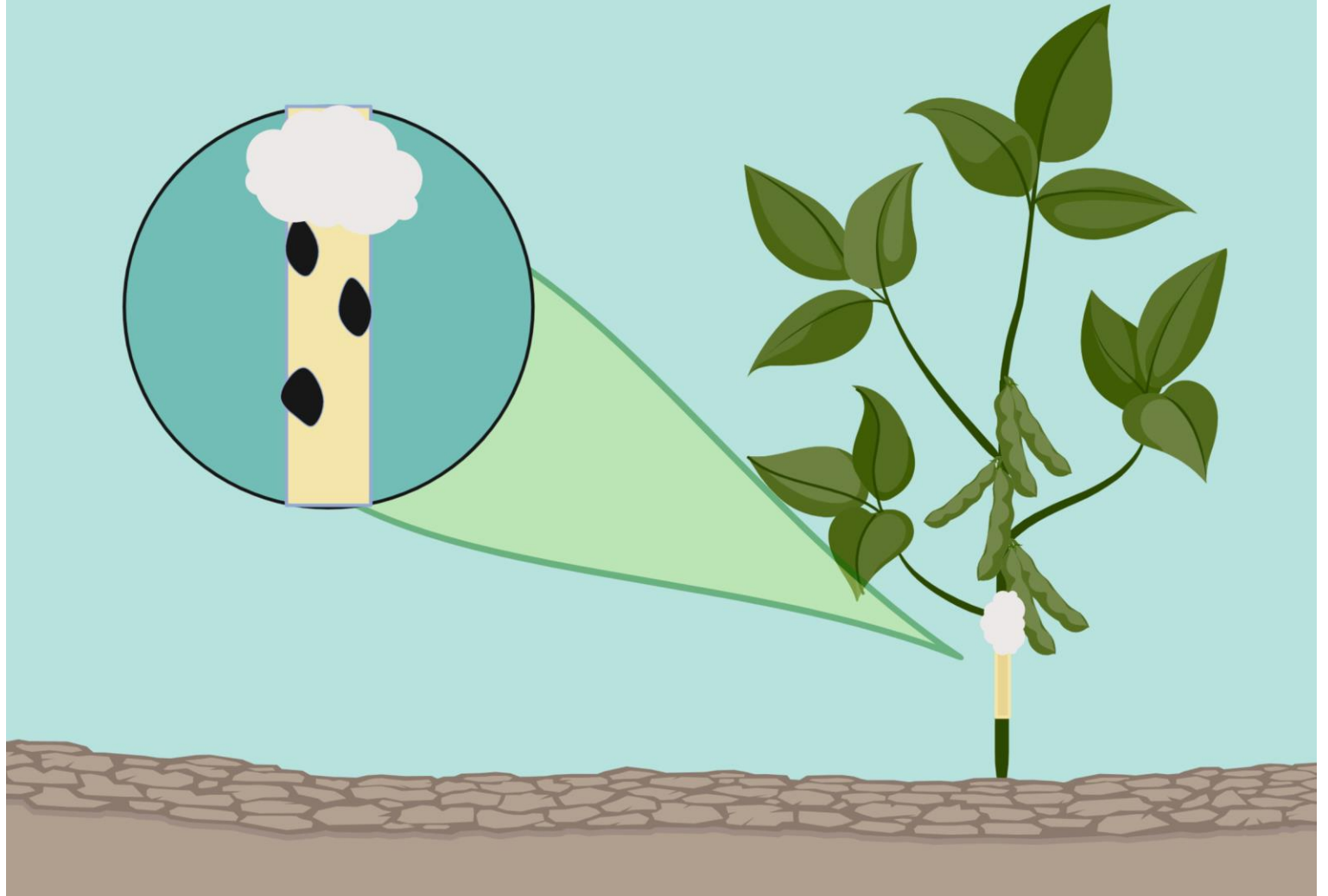
R1-R3 Growth Stages



Disease Cycle



R5-R8 Growth Stages



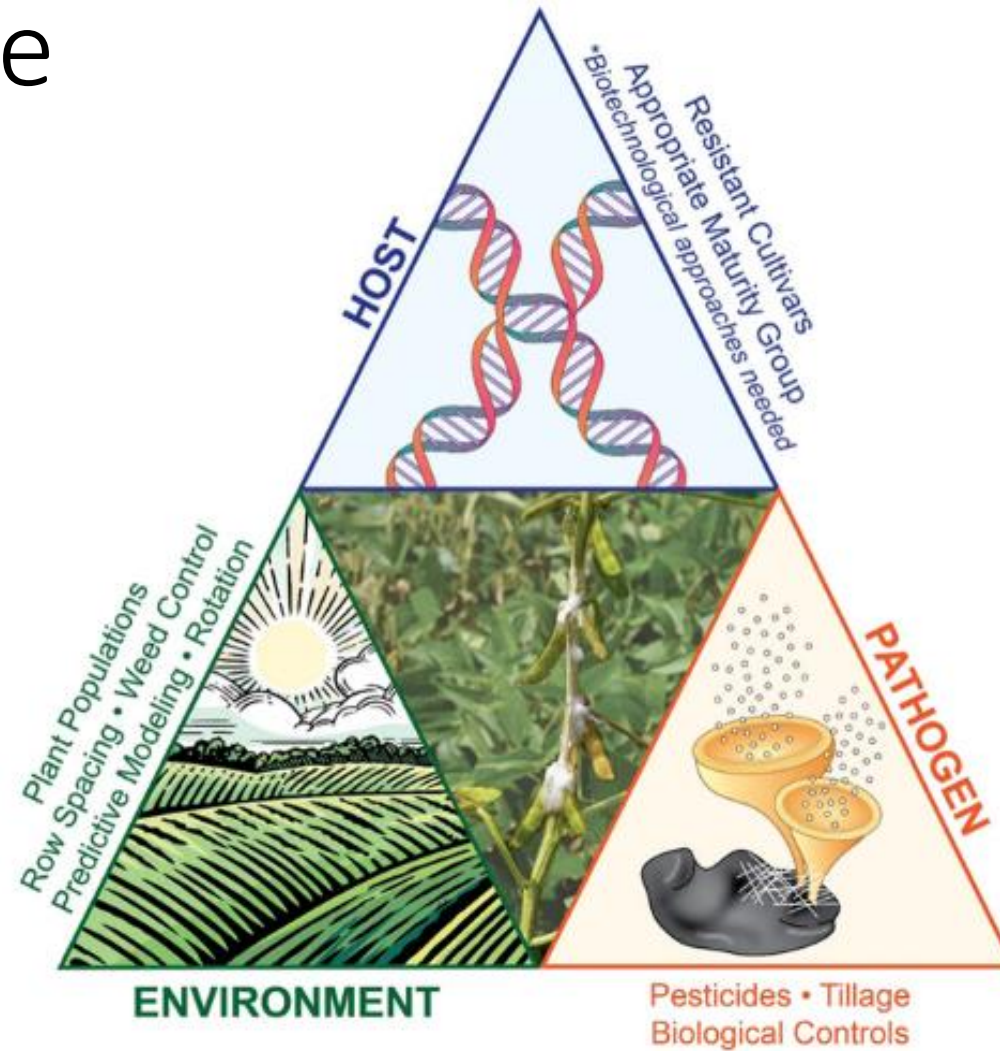
Impact of White Mold on Soybean Production



- Yield losses can reach up to 40 million bushels per year (Allen et al. 2017)
 - Over **400 million dollars** (\$10.10/bu)
- Every 10% increase in white mold incidence at R7, yield is reduced 2-5 bu/ac.
- Reduced seed quality as well as introducing sclerotia into grain (Danielson and Nelson 2004)



Disease Triangle



Willbur et al. 2019



Objectives

1. Improve management of white mold by determining the greatest methods for reducing disease pressure
2. Develop soybean lines with high white mold resistance while also retaining favorable agronomic traits



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What is Used Now to Control White Mold?

- **Row Spacing**
 - **Wide rows (30 inches) result in lower white mold incidence** (Grau & Radke 1984)
 - **Less conducive environment for apothecial germination** (Fall et al. 2018)
- Planting Population
- Fungicide



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- Row Space
 - Wide rows (30 inches) result in lower white mold incidence (Grau & Radke 1984)
 - Less conducive environment for apothecial germination (Fall et al. 2018)
- **Planting Population**
 - **Higher populations lead to dense stands** (Lee et al. 2005)
 - **More conducive for white mold**
- Fungicide



What is Used Now to Control White Mold?

- Row Space
 - Wide rows (30 inches) result in lower white mold incidence (Grau & Radke 1984)
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- Planting Population
 - Higher populations lead to dense stands (Lee et al. 2005)
 - More conducive for white mold
- **Fungicide**
 - **Greatest control when applied around flowering (R1-R3) (Willbur et al. 2019)**



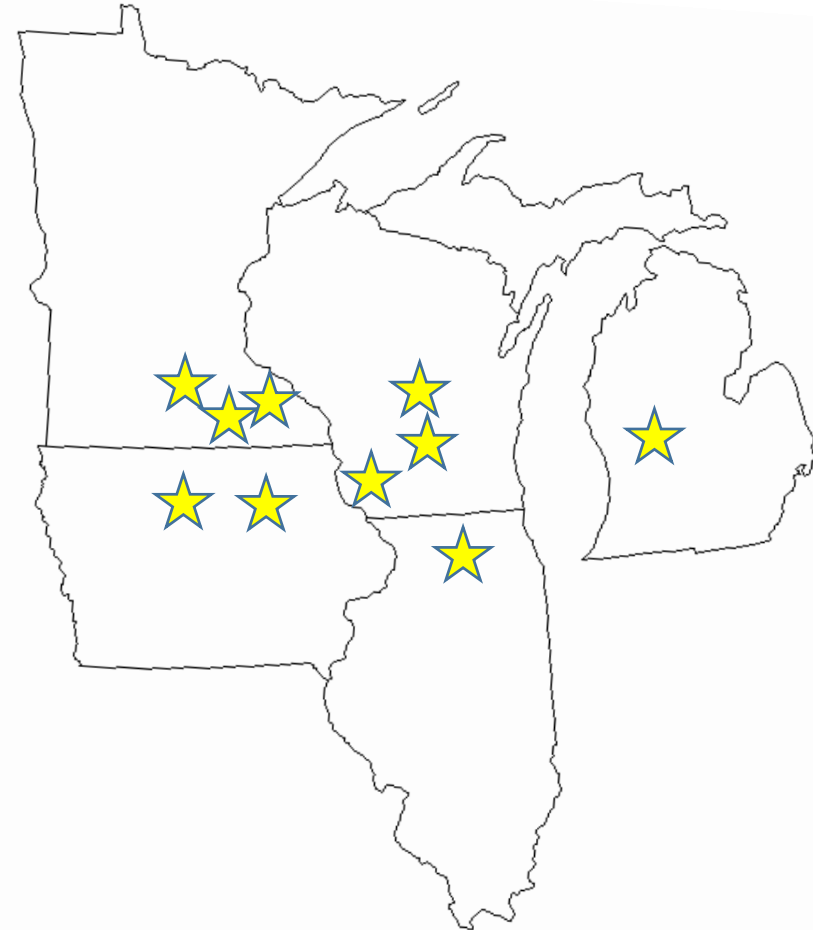
The Big Question

- Between row spacing, planting population, and fungicide applications, how do they interact and what has the greatest impact on reducing white mold incidence?



What did we do?

- Trials were located across the Upper Midwest from 2017-2019
 - A total of 19 site years (n=1484)
- Susceptible commercial cultivar
- Row Spacing (15" vs. 30")
- Planting Populations (110,000 seeds to 200,000 seeds/a)
- Fungicide Applications (standard Approach, Sporecaster prediction model, Non-treated)



DIX in Disease Environment



Row	**
Pop	ns
Fung	**
Row*Pop	ns
Row*Fung	ns
Pop*Fung	ns
Row*Pop*Fung	ns

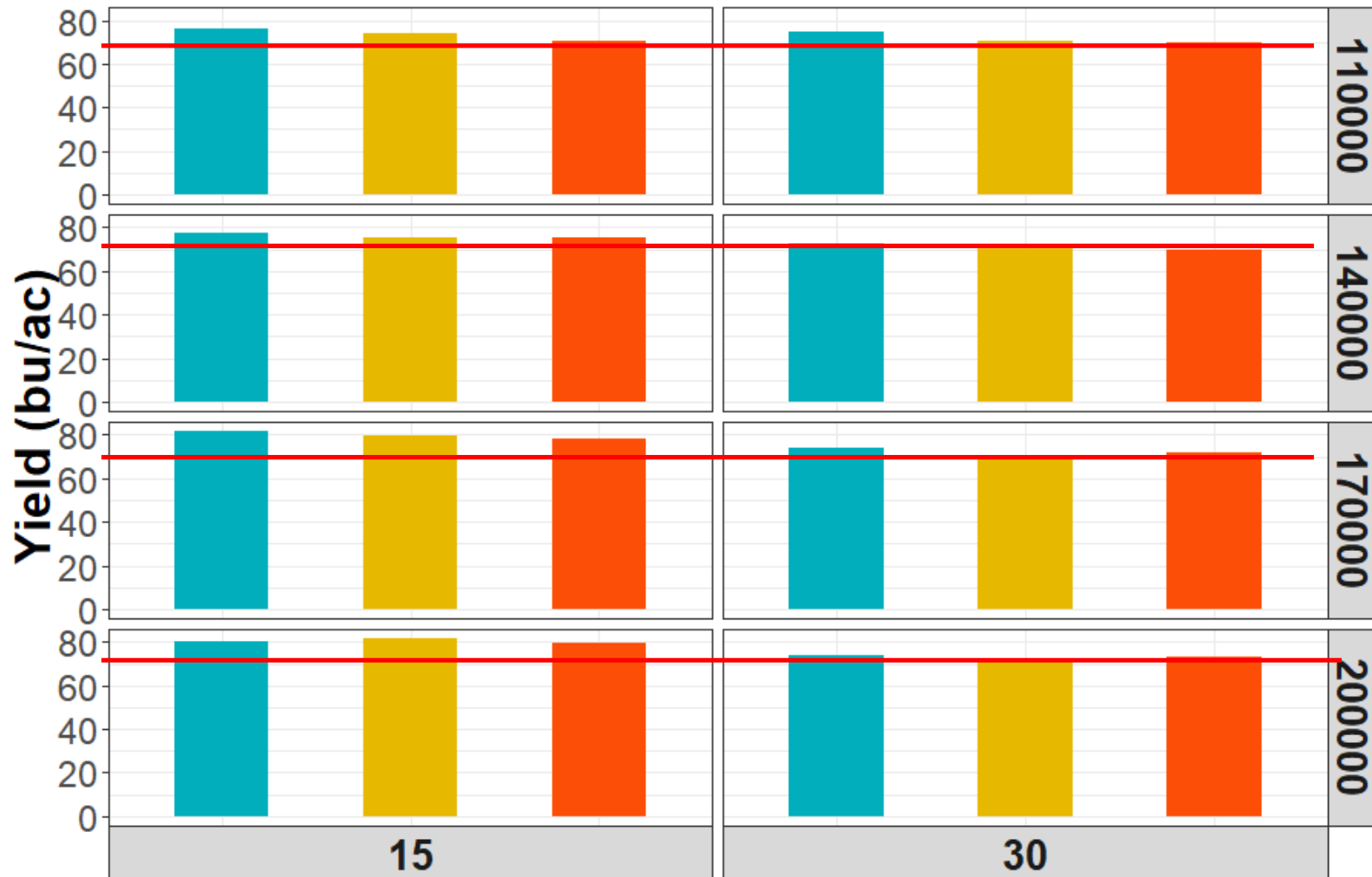
* = $p < 0.05$

** = $P < 0.005$

ns= no significant difference



Yield in Disease Environment



Fung ■ Standard Approach ■ Sporecaster ■ Non-Treated

Row	**
Pop	**
Fung	**
Row*Pop	**
Row*Fung	ns
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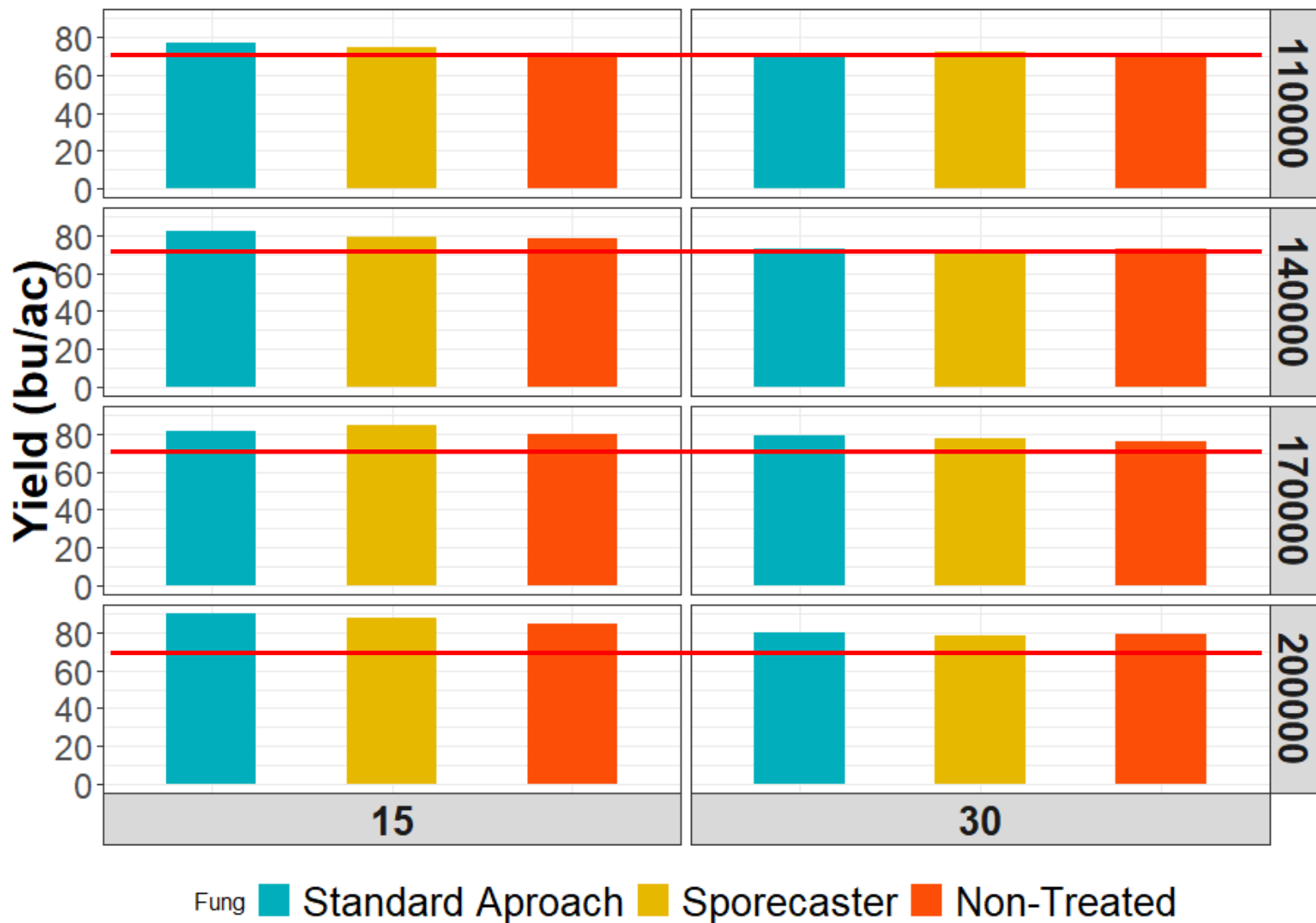
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Yield in No Disease Environment



Row	**
Pop	**
Fung	*
Row*Pop	ns
Row*Fung	ns
Pop*Fung	ns
Row*Pop*Fung	ns

* = $p < 0.05$

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Summary

- Wide row spacing → decreased disease
 - Planting Population is also important
- Long term control of white mold is critical!

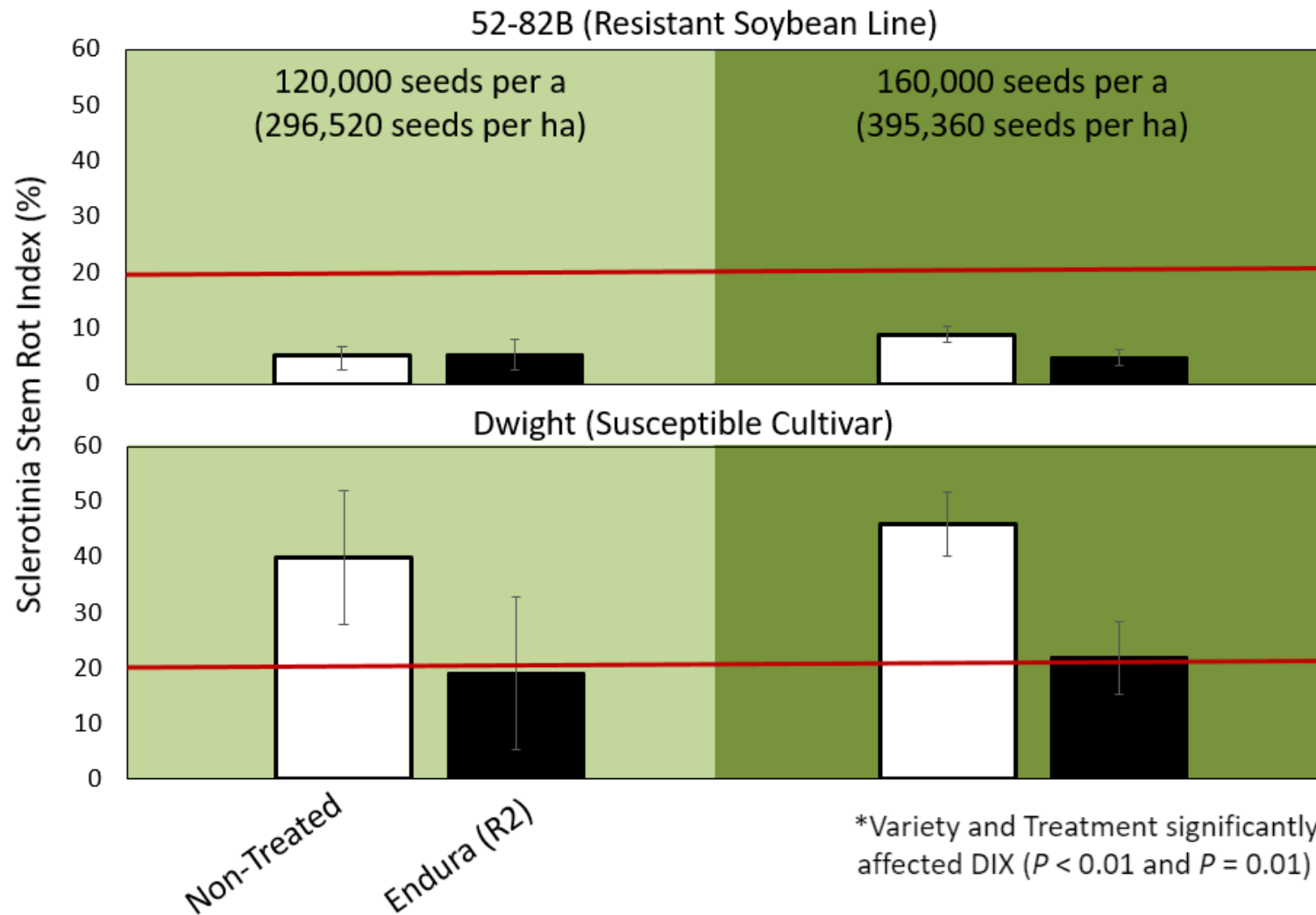


Objectives

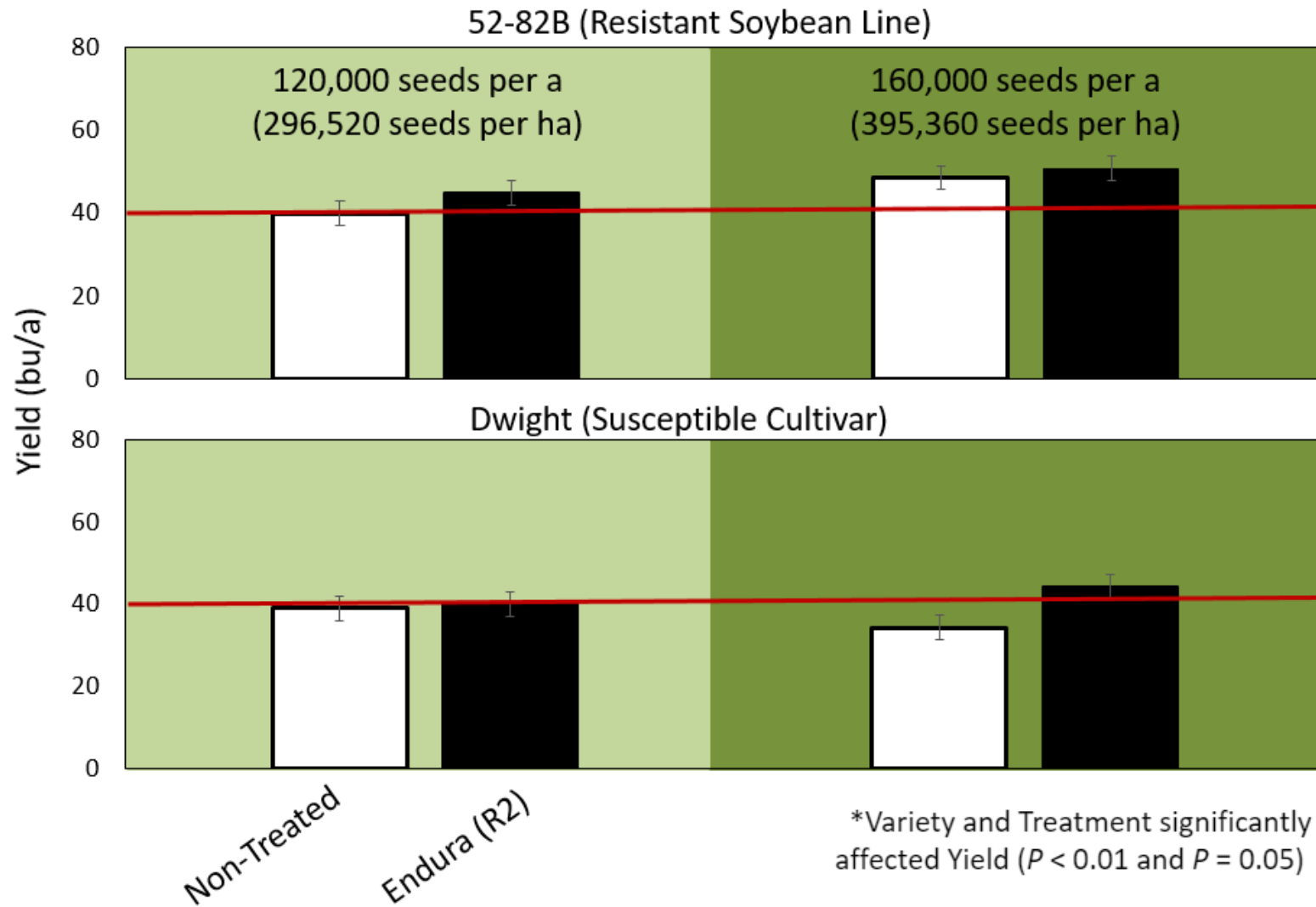
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2017 Germplasm x Fungicide Trial - DIX



2017 Germplasm x Fungicide Trial - Yield

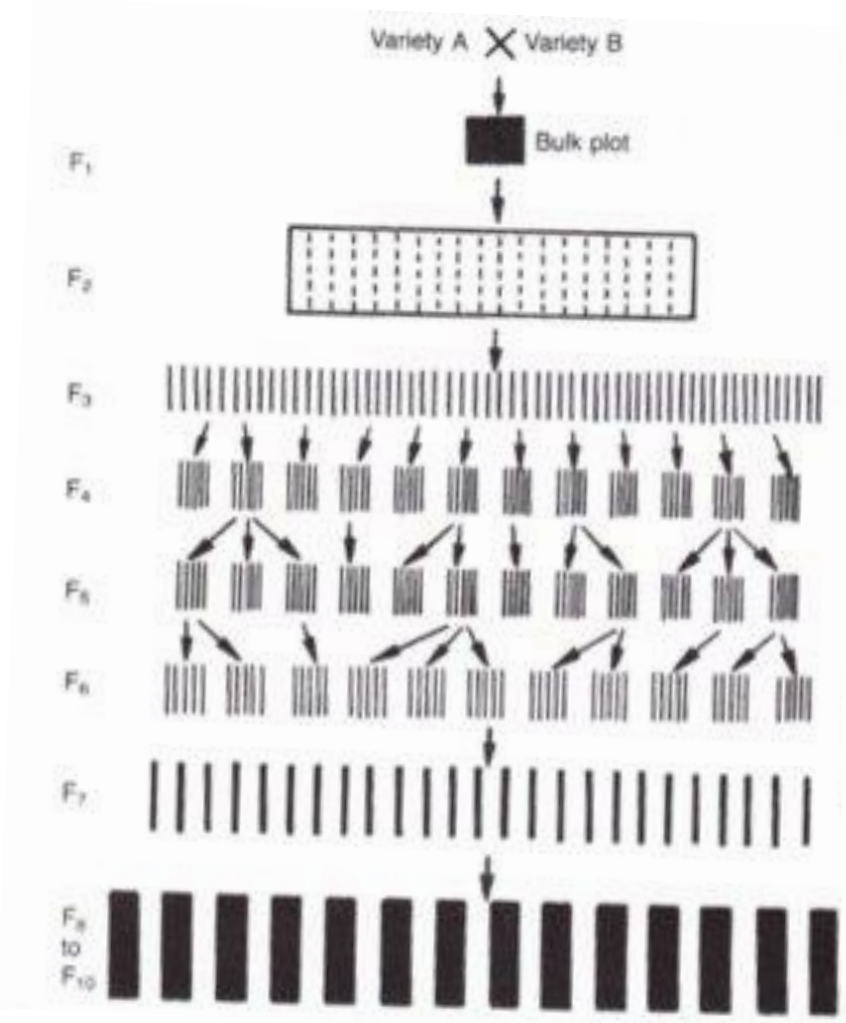


How Does Soybean Breeding Work?

- Self-pollinated crop
- Must be crossed in summer months



Progression of Generations



Groups of Breeding Lines

- Group 1
 - Crossing from 2016
- Group 2
 - Crosses from 2018



Breeding Schemes

- 2016 Crosses

Parent	White Mold Resistance	Standability
51-23	+	+
SSR51-70	+	-
52-82B	+	+



Breeding Schemes

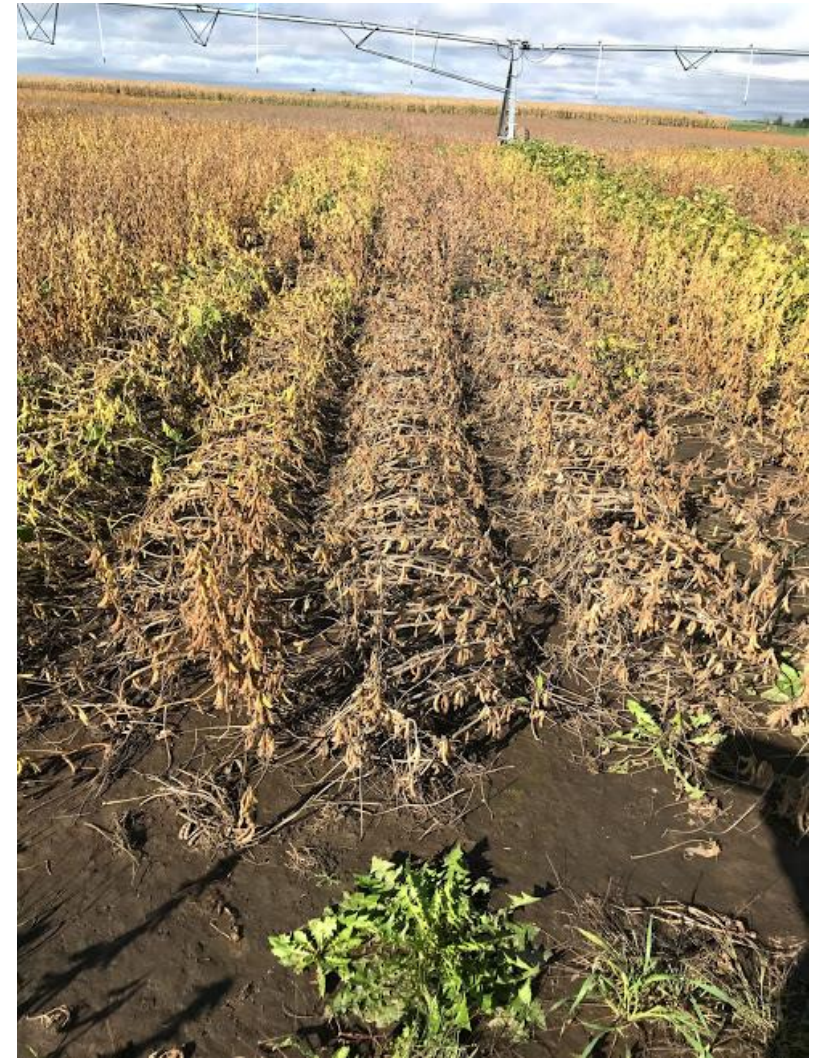
- 2018 Crosses

Parent	White Mold Resistance	Standability
Savoy	-	+
42-136A	-	+
SSR51-70	+	-
91-38	+	+



Selections

- 500 lines → 160 lines
- Agronomic traits:
 - Lodging



Selections

- 500 lines → 160 lines
- Agronomic traits:
 - Lodging
 - Branching
 - Pod Set
 - Plant Height



Future Plans

- Group 1 Yield Trials in 2020
- Group 2 in Chile
- Public line release in the coming years



Take Home Message

- Integrated Management:
 - Wide row spaces will reduce disease
 - Keep populations low
 - Correctly timed fungicide applications profitable
- Genetic Resistance:
 - Potential to save \$\$\$ on fungicide use



Questions?

