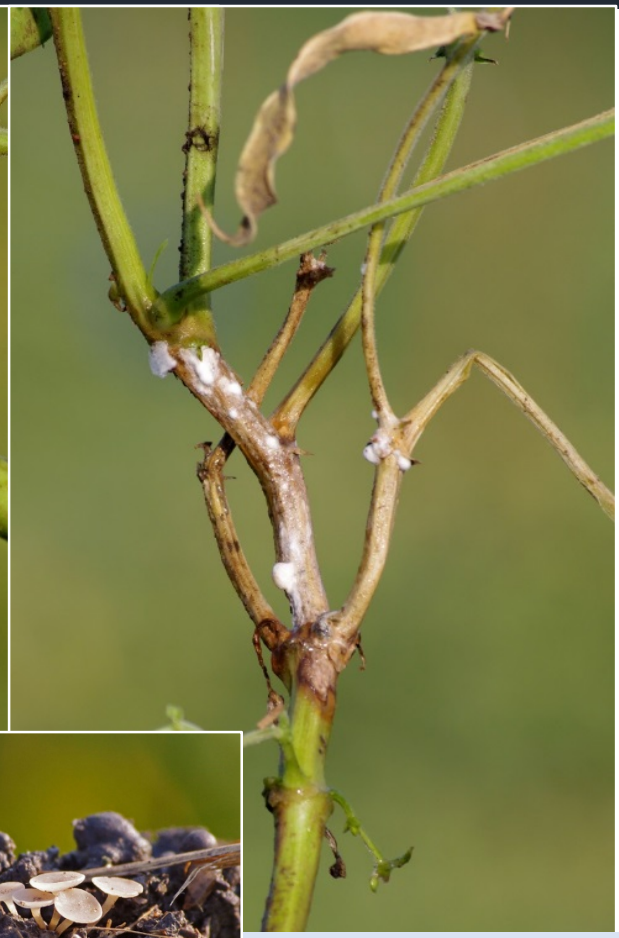
Improving the management of Ascochyta blight of chickpeas and white mold in soybeans and dry beans







Michael Wunsch, Jesse Hafner, Thomas Miorini, Suanne Kallis, NDSU Carrington Research Extension Center

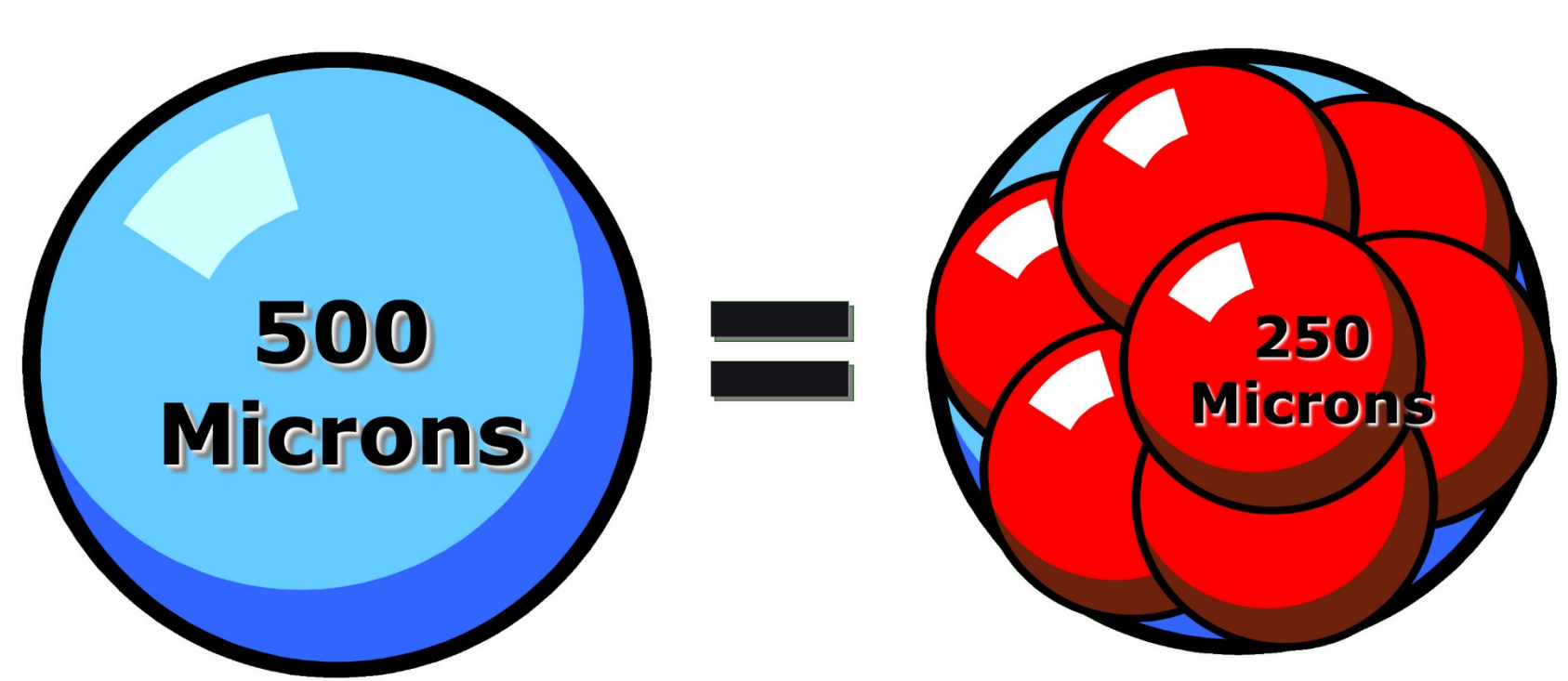
Kelly Cooper, Heidi Eslinger, Seth Nelson, NDSU Robert Titus Research Farm, Oakes

Audrey Kalil, Taheni Gargouri Jbir, Tyler Tjelde, NDSU Williston Research Extension Center

Droplet size

Cutting droplet diameter in half

Results in **eight times as many droplets**



(there is one more droplet in the rear)

Image adapted from a presentation by Bob Wolf (Kansas State Univ.); Bobby Grisso and Pat Hipkins (Virginia Tech Univ.); and Tom Reed (TeeJet)

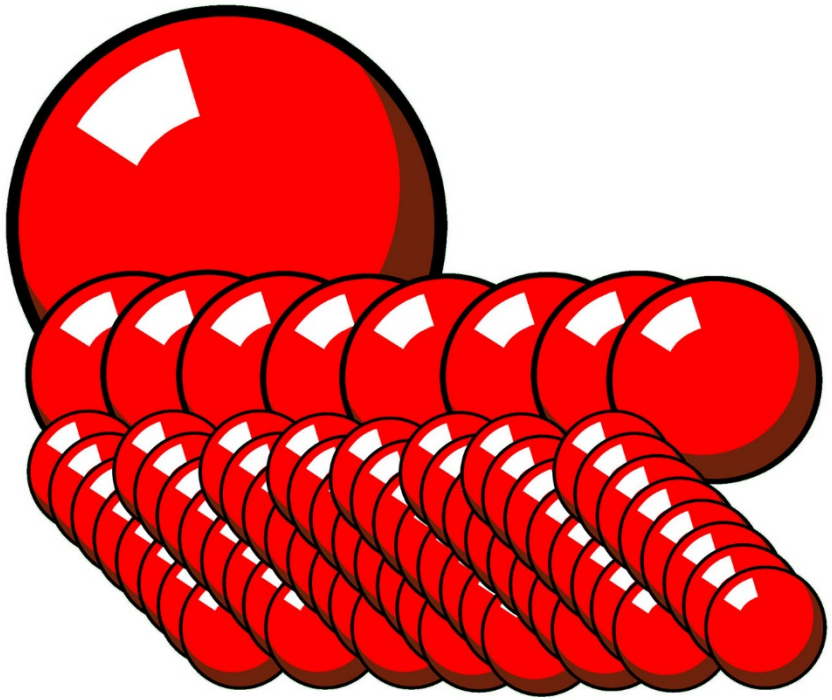
Droplet size

0.065 mm^3 spray volume =

one 500-um diameter droplet

eight 250-um diameter droplets

sixty-four 125-um diameter droplets



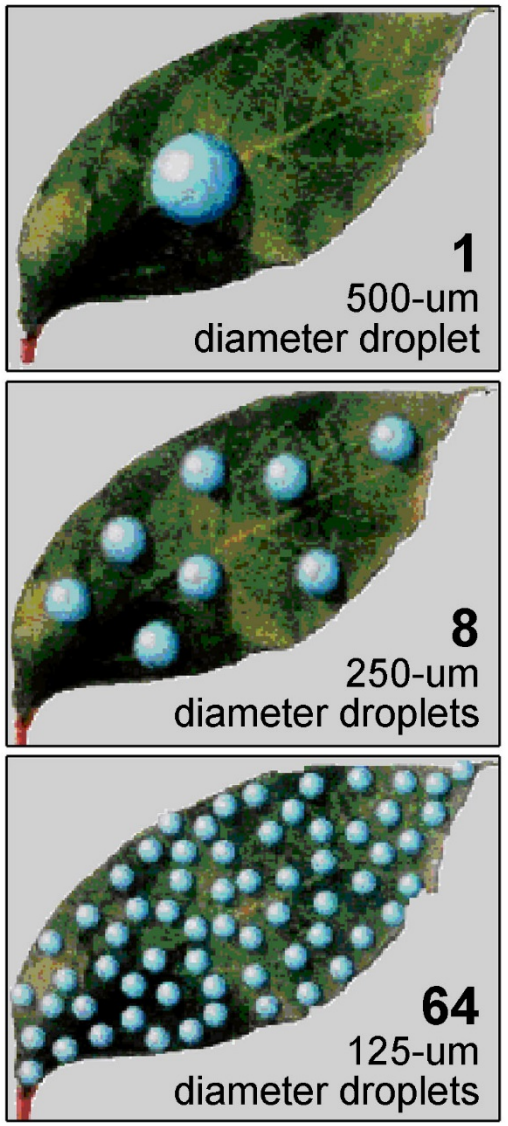
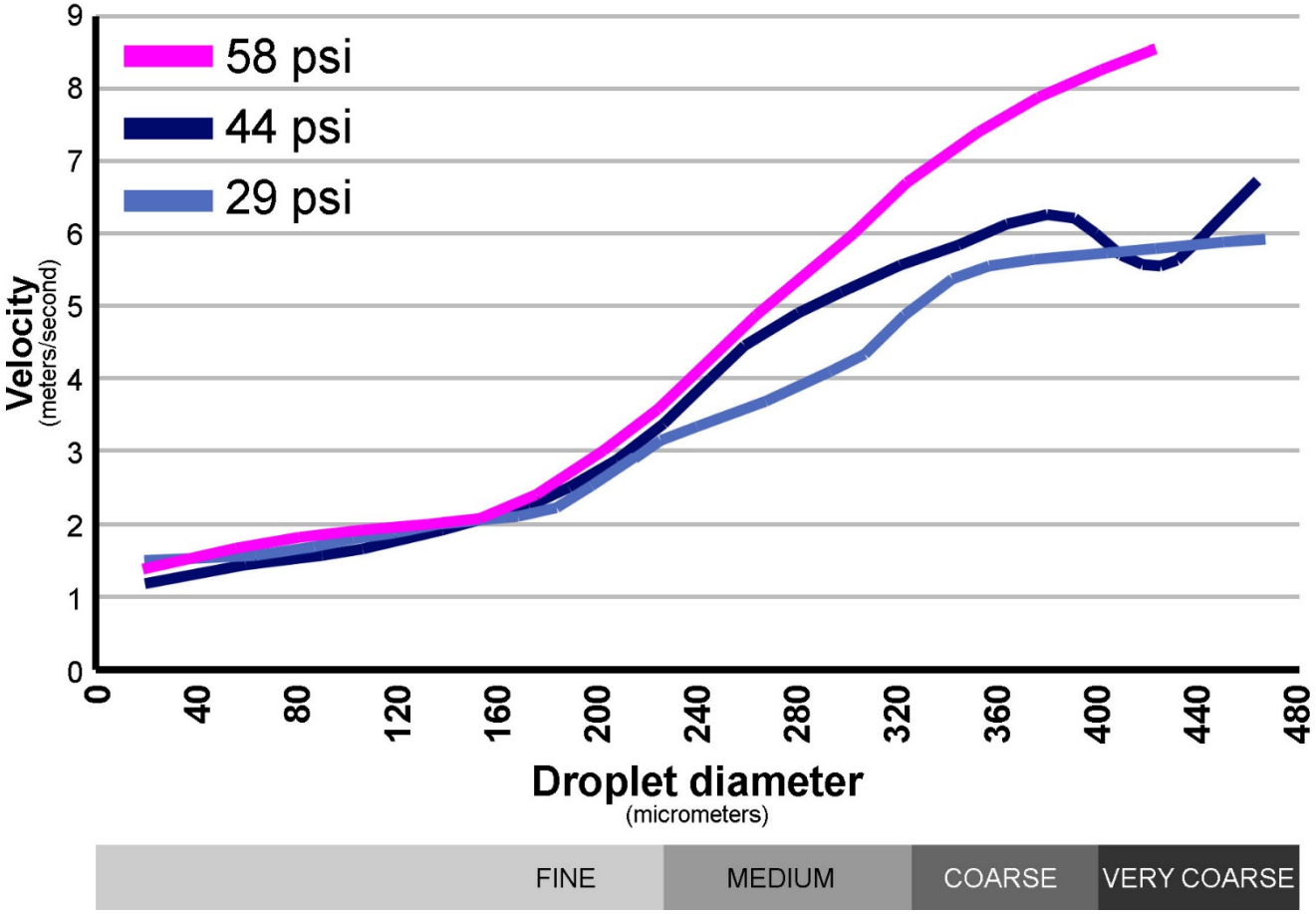


Image adapted from a presentation by Bob Wolf (Kansas State Univ.); Bobby Grisso and Pat Hipkins (Virginia Tech Univ.); and Tom Reed (TeeJet)

Droplet size

… but larger droplets have greater velocity, drift less.

Increased velocity and reduced drift improves canopy penetration.



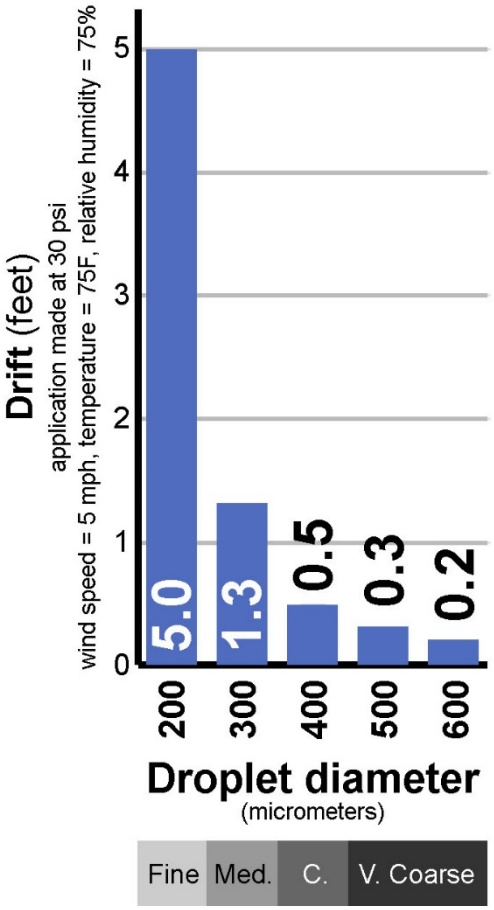


Image adapted from a presentation by Bob Wolf (Kansas State Univ.); Bobby Grisso and Pat Hipkins (Virginia Tech Univ.); and Tom Reed (TeeJet)

Experimental Methods

1. WILGER nozzles

Spray droplet size estimates were based on information provided by the manufacturer.

Tip Cap No.	Flow Rate USGPM	PSI	VMD (Droplet Size in µ); %<141µ (Drift %); %<200µ (Drift %); %<600µ (Small Droplets)															
			110° ER Series				110° SR Series				110° MR Series				110° DR Series			
			VMD	<141	<200	<600	VMD	<141	<200	<600	VMD	<141	<200	<600	VMD	<141	<200	<600
04	0.43	50	209	26%	47%	96%	275	15%	30%	96%	355	8%	17%	91%	447	5%	10%	79%

Fine 106-235µ | Medium 236-340µ | Coarse 341-403µ | Very Coarse 404-502µ

ER110-04
50 psi
FINE DROPLETS

SR110-04
50 psi
MEDIUM DROPLETS

MR110-04
50 psi
COARSE DROPLETS

DR110-04
50 psi
VERY COARSE DROPLETS

Experimental Methods

2. TEEJET nozzles

Spray droplet size estimates were based on information provided by the manufacturer.

XR TeeJet® (XR)

	PSI						
	15	20	25	30	40	50	60
XR11004	M	M	M	M	M	F	F
XR11005	M	M	M	M	M	F	F
XR11006	C	M	M	M	M	M	F
XR11008	C	C	C	C	M	M	M
XR11010	VC	C	C	C	M	M	M

XR11004 50 psi
FINE DROPLETS

XR11005 40 psi
MEDIUM-FINE DROPLETS

XR11006 35 psi
MEDIUM DROPLETS

XR11008 40 psi
MEDIUM-COARSE DROPLETS

XR11010 30 psi
COARSE DROPLETS

Methods

The initial calibration was conducted with water.

Objectives:

1. **Nozzle selection:** Tips with output deviating from advertised specifications discarded
2. **Initial identification of pulse width** needed to deliver 15 gal/ac spray volume at 8.9 mph driving speed

Spot-On sprayer calibrator model SC-1 (Innoquest, Inc.; Woodstock, IL)

The final calibration was conducted with fungicide in the field immediately before application.

Objectives:

1. **Ensure a precise spray volume of 15 gal/ac.** Manual adjustments to pulse width were made as needed.
2. **Confirm that all nozzles are operating correctly** – consistent output across all nozzles; no plugs.

Methods

Applications were made with a tractor-mounted sprayer equipped with a pulse-width modulation system from Capstan AG.

Spray volume: 15 gal/ac Pulse width manually calibrated to maintain a constant spray volume across tips differing in output.

Driving speed: 4.0-10.5 mph depending on the study

Optimizing spray droplet size for improved management of Ascochyta blight in chickpeas

Scope of research – chickpeas

Scope of research – soybeans

2019
Carrington – 6 varieties
 * 10-13 replicates/study
 * 8.7 acres
Oakes – 2 varieties
 * 8-9 replicates/study
 * 1.8 acres

2020
Carrington – 4 varieties
 * 12-13 replicates
 * 5.2 acres
Oakes – 2 varieties
 * 15-16 replicates
 * 3.3 acres

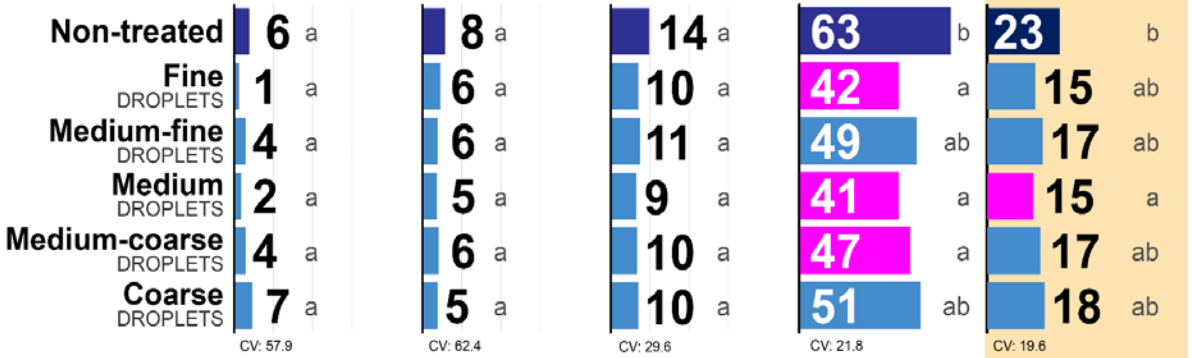
IMPACT OF SPRAY DROPLET SIZE: **TEEJET NOZZLES**

Soybeans

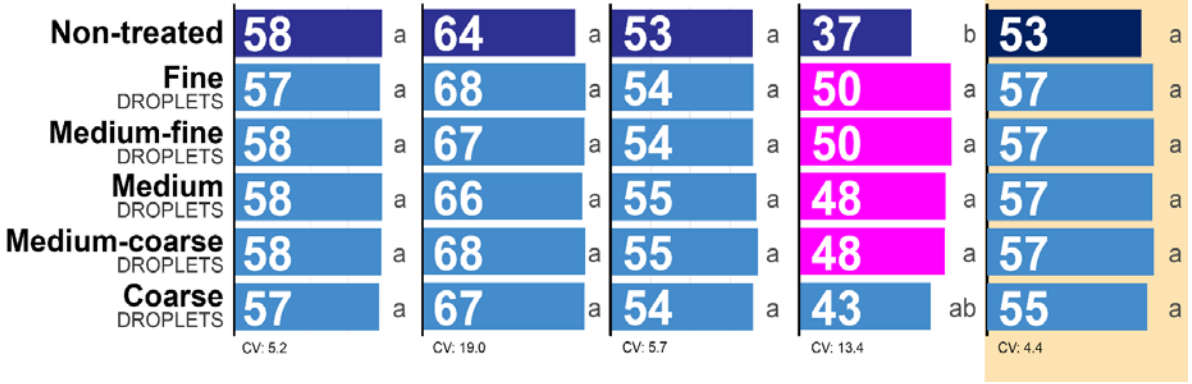
canopy very open when fungicides were applied

Location	Carrington	Oakes	Carrington	Oakes	COMBINED ANALYSIS
YEAR	2020	2019	2020	2019	
soybean variety:	Dairyland 'DSR-0418'	Dairyland 'DSR-1120'	Dairyland 'DSR-0807'	Peterson '18X11N'	**Four varieties**
Canopy Closure Average:	64%	70%	72%	73%	<80%
Range:	47-80%	60-85%	62-88%	60-85%	

White mold severity index (% of canopy diseased)



Soybean Yield (bu/ac; 13% moisture)



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NDSU NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION

Fungicide: Endura 70WG 5.5 oz/ac except studies in Carrington in 2020, when 8.0 oz/ac was applied **Application timing:** 100% of plants at R2 growth stage **Spray volume:** 15 gal/ac
Row spacing: 21 inches **Seeding rate:** 165,000 pure live seeds/ac **Driving speed:** 10.5 mph (Carrington, 2020); 6.0 mph (Oakes, 2020); 8.9 mph (2019); 6.7 mph (2018); 4.0 mph (2017)
Nozzles (2017): XR8004, 60 psi (fine); XR8004, 40 psi (medium-fine); XR8006, 60 psi (medium); XR8010, 40 psi (coarse)
Nozzles (2018): XR8003, 50 psi (fine); XR8004, 40 psi (medium-fine); XR8006, 40 psi (medium); XR8008, 35 psi (medium-coarse); XR8010, 30 psi (coarse)
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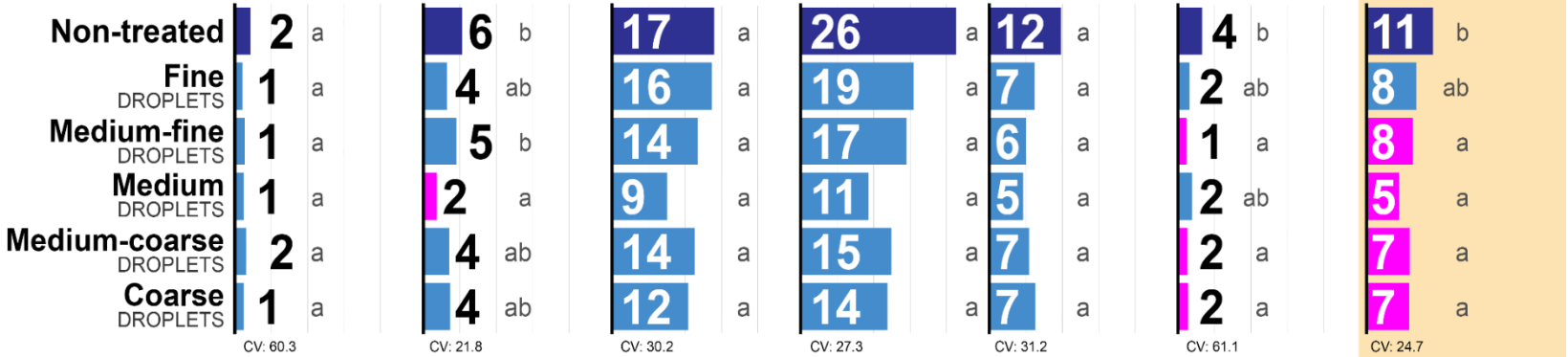
IMPACT OF SPRAY DROPLET SIZE: TEEJET NOZZLES

Soybeans

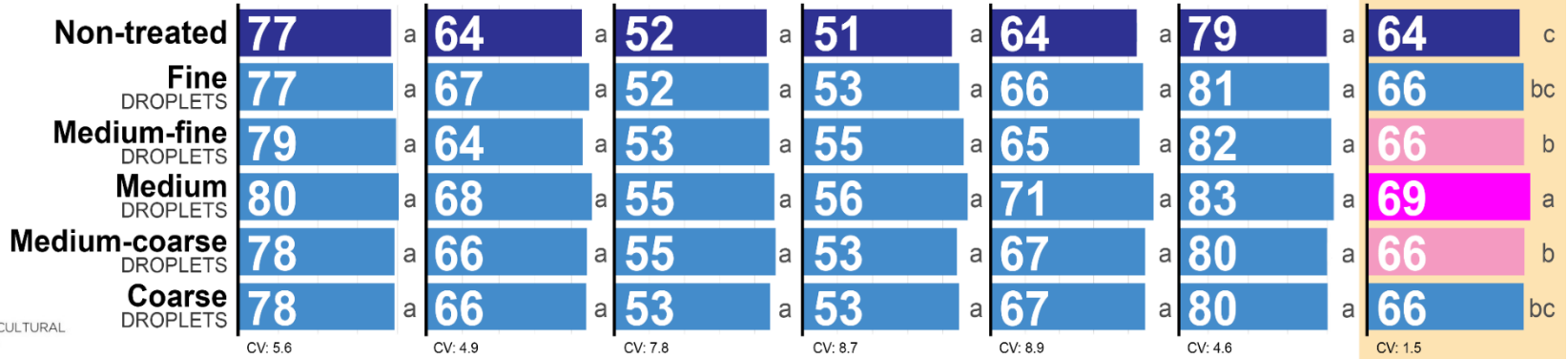
canopy open when fungicides applied

	Location	Oakes	Carrington	Carrington	Carrington	Carrington	Oakes	COMBINED ANALYSIS
	YEAR	2020	2018	2020	2020	2018	2020	
	soybean variety:	Peterson '14R09N'	ProSeed 'XT60-40'	Peterson '18X06N'	Peterson '18X07N'	Peterson '18X06N'	GH '0936X'	**Six varieties**
Canopy Closure	Average:	80.7%	82.5%	84.5%	86.4%	87.5%	88.9%	80.7-88.9%
	Range:	65-90%	75-90%	71-93%	75-93%	80-95%	70-97%	

White mold severity index (% of canopy diseased)



Soybean Yield (bu/ac; 13% moisture)



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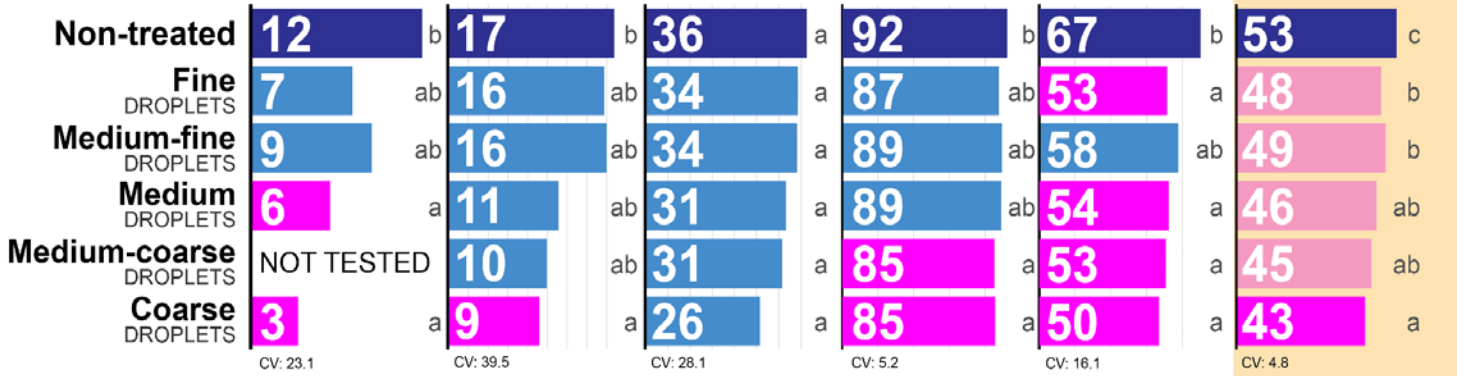
IMPACT OF SPRAY DROPLET SIZE: **TEEJET NOZZLES**

Soybeans

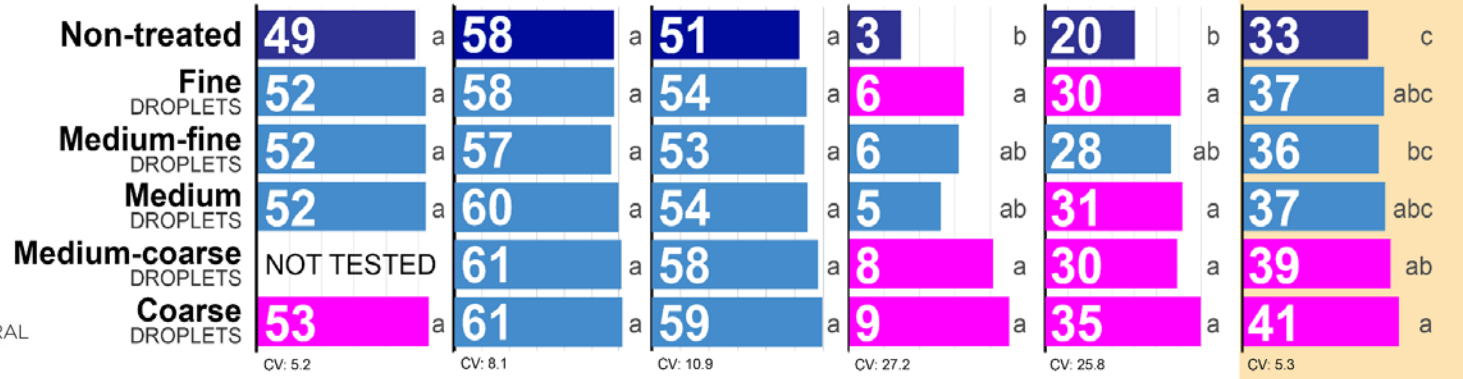
canopy near closure when fungicides applied

	Location	Carrington	Carrington	Carrington	Carrington	Carrington	COMBINED ANALYSIS
	YEAR	2017	2018	2018	2019	2019	
	soybean variety:	Dairyland 'DSR-0619'	Dairyland 'DSR-0904'	Peterson '17X09N'	Peterson '17X09N'	Dairyland 'DSR-0418'	**Four varieties**
Canopy Closure	**Average:**	**92%**	**92.5%**	**92.5%**	**94.9%**	**95.9%**	**92.5-95.8%**
	Range:	**75-97%**	**90-95%**	**90-95%**	**80-100%**	**90-100%**	**canopy closure** (average, studies with all five droplet size treatments)

White mold severity index (% of canopy diseased)



Soybean Yield (bu/ac; 13% moisture)



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Nozzles (Carrington 2020): XR11005, 60 psi (fine); XR11006, 50 psi (medium-fine); XR11006, 35 psi (medium); XR11008, 40 psi (medium-coarse); XR11010, 30 psi (coarse)

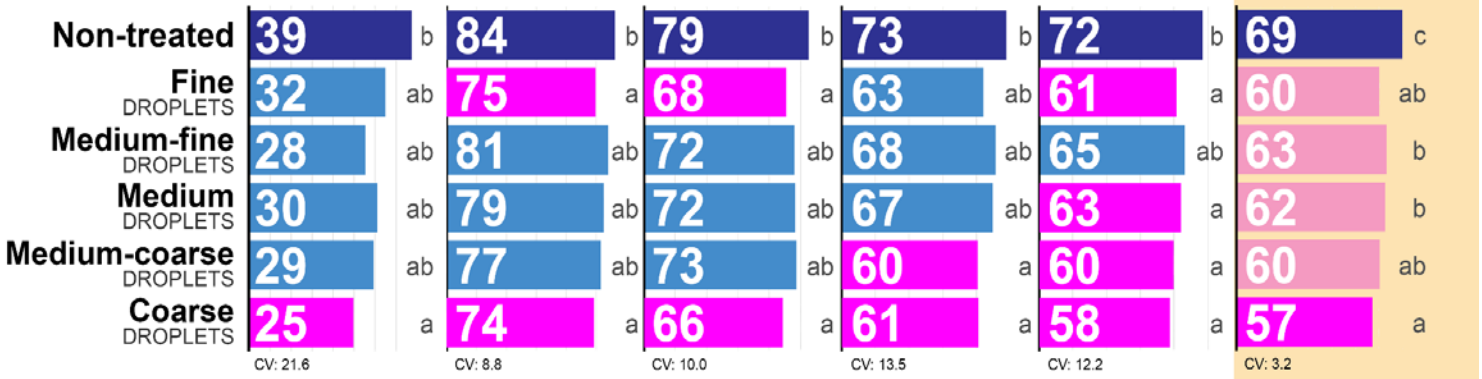
IMPACT OF SPRAY DROPLET SIZE: **TEEJET NOZZLES**

Soybeans

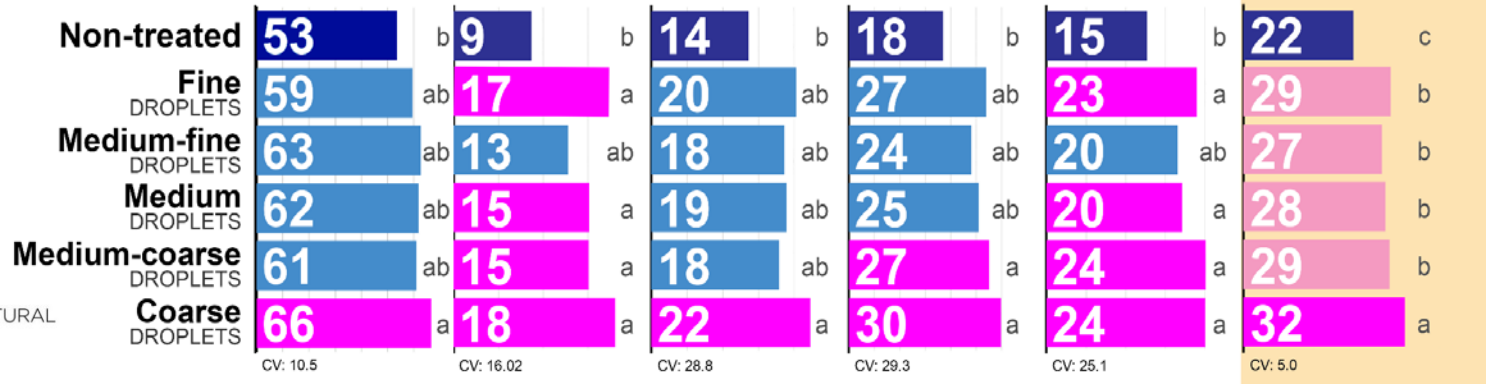
canopy closed when fungicides applied

	Location	Oakes	Carrington	Carrington	Carrington	Carrington	COMBINED ANALYSIS
	YEAR	2018	2019	2019	2019	2019	
	soybean variety:	Pioneer 'P11A95X'	Peterson '14R09N'	Peterson '18X07N'	Dairyland 'DSR-0807'	Peterson '18X06N'	**Five varieties**
Canopy Closure	Average:	98.5%	98.7%	98.9%	99.6%	99.6%	98.5-99.6% canopy closure (average)
	Range:	97-100%	98-100%	97-100%	98-100%	99-100%	

White mold severity index (% of canopy diseased)



Soybean Yield (bu/ac; 13% moisture)



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NDSU NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION

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IMPACT OF SPRAY DROPLET SIZE: **TEEJET NOZZLES**

Soybeans

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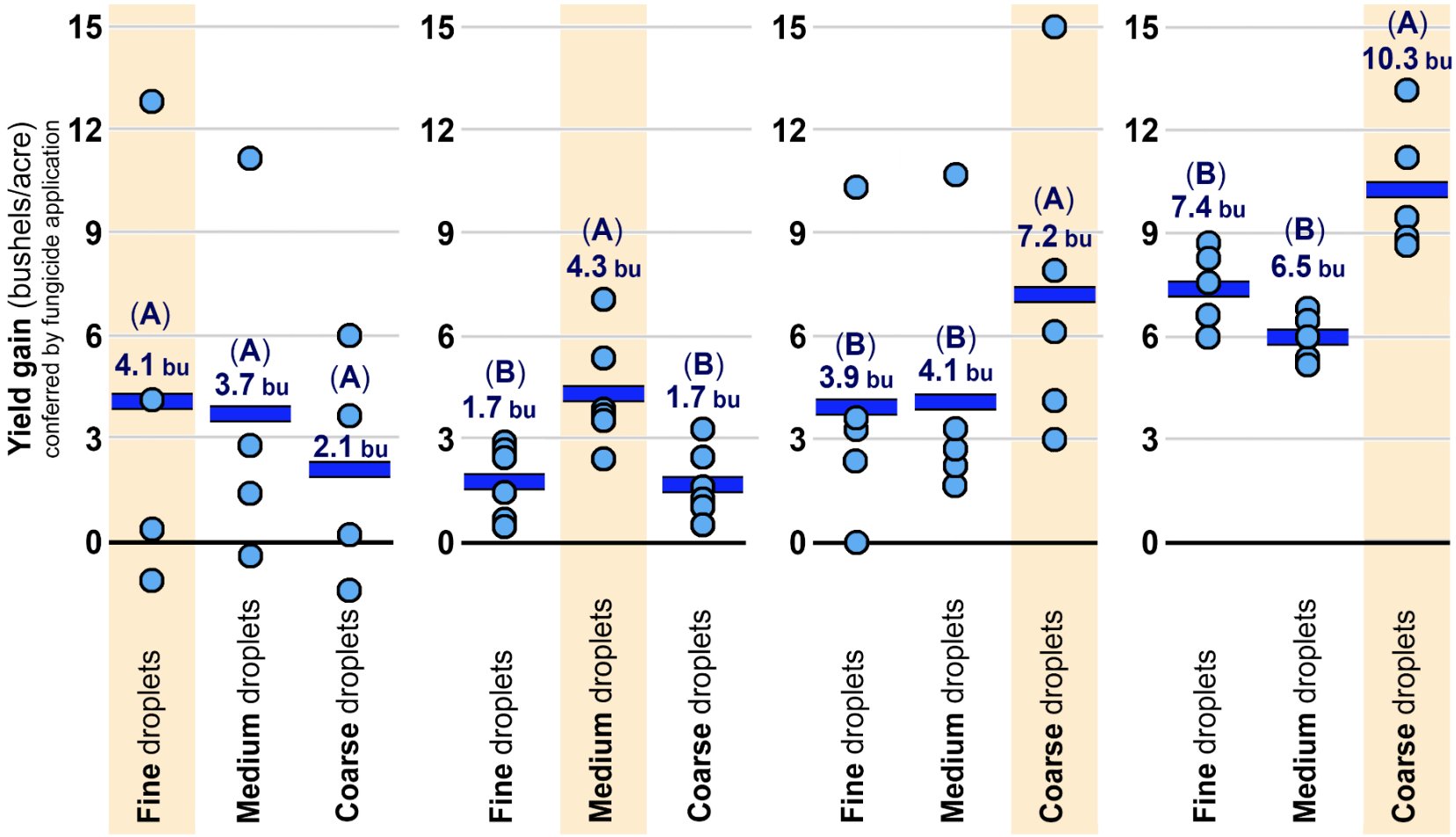
Yield gain conferred by the fungicide relative to canopy closure and spray droplet size



Droplet size rating assigned by nozzle manufacturer
for the nozzles and presures utilized

CIRCLES: results from one soybean variety in one field study **LINES:** average response across all studies

Optimizing fungicide spray droplet size

Soybeans

Soybeans – TeeJet nozzles:

Applying fungicides with **coarse droplets** optimized white mold management in soybeans when the soybean canopy was at or near closure (92-100% average canopy closure).

Applying fungicides with **medium droplets** optimized white mold management in soybeans when the soybean canopy was open (80-90% average canopy closure).

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IMPACT OF SPRAY DROPLET SIZE: **WILGER NOZZLES**

Soybeans: **canopy open** when fungicides applied

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Soybean Row spacing: 21 inches

Seeding rate: 165,000 viable seeds/ac

Location	Carrington	Carrington	Oakes	Oakes	Carrington	COMBINED ANALYSIS
YEAR	2020	2020	2019	2019	2020	
soybean variety:	Dairyland 'DSR-0418'	Dairyland 'DSR-0807'	Dairyland 'DSR-1120'	Peterson '18X11N'	Peterson '18X07N'	
Canopy Closure Average:	63%	69%	70%	73%	79%	63-79%
Range:	42-72%	54-92%	60-85%	60-85%	60-91%	Average across five varieties

White mold severity index (% of canopy diseased)

	Carrington 2020 'DSR-0418'	Carrington 2020 'DSR-0807'	Oakes 2019 'DSR-1120'	Oakes 2019 Peterson '18X11N'	Carrington 2020 Peterson '18X07N'	COMBINED ANALYSIS
Non-treated control	13 a	26 b	16 a	69 b	38 a	32 b
Fine droplets ER110-04, 50 psi	10 a	20 ab	9 a	51 a	30 a	24 a
Medium droplets SR110-04, 50 psi	10 a	17 a	10 a	50 a	28 a	23 a
Coarse droplets MR110-04, 50 psi	8 a	16 a	7 a	42 a	26 a	20 a
Very Coarse droplets DR110-04, 50 psi	8 a	21 ab	6 a	49 a	29 a	23 a
	CV: 11.9	CV: 14.8	CV: 60.4	CV: 17.3	CV: 28.0	CV: 13.7

Soybean Yield (bu/ac; 13% moisture)

	Carrington 2020 'DSR-0418'	Carrington 2020 'DSR-0807'	Oakes 2019 'DSR-1120'	Oakes 2019 Peterson '18X11N'	Carrington 2020 Peterson '18X07N'	COMBINED ANALYSIS
Non-treated control	47 a	38 a	67 a	37 b	32 b	44 b
Fine droplets ER110-04, 50 psi	49 a	41 a	68 a	46 ab	36 a	48 ab
Medium droplets SR110-04, 50 psi	49 a	42 a	67 a	48 a	37 a	49 a
Coarse droplets MR110-04, 50 psi	50 a	41 a	71 a	50 a	38 a	50 a
Very Coarse droplets DR110-04, 50 psi	50 a	39 a	66 a	48 a	39 a	48 a
	CV: 7.0	CV: 9.4	CV: 6.1	CV: 17.1	CV: 9.0	CV: 4.6

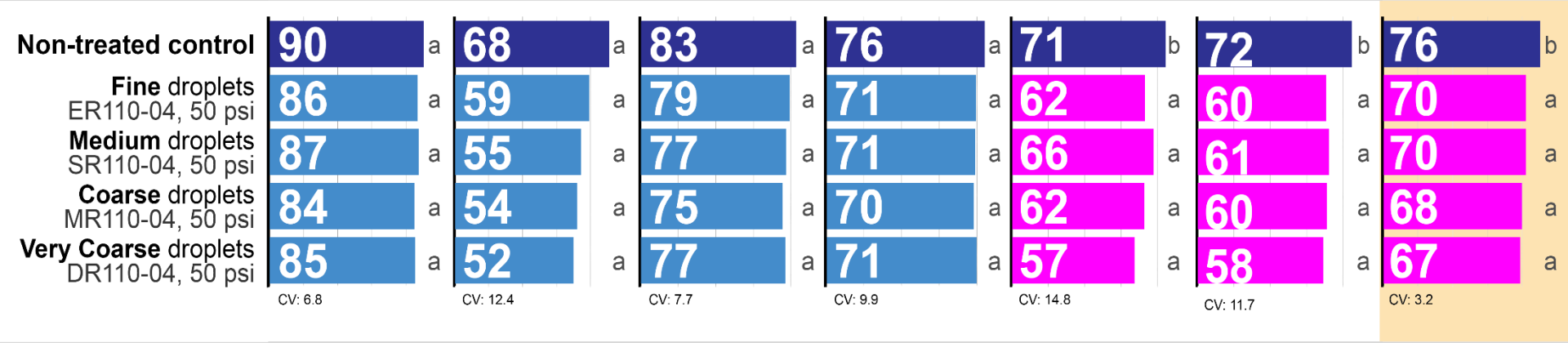
Fungicide: Endura 70WG 5.5 oz/ac **Application timing:** 100% of plants at R2 growth stage **Spray volume:** 15 gal/ac **Driving speed:** 6.0 mph (2020); 8.9 mph (2019)

IMPACT OF SPRAY DROPLET SIZE: **WILGER NOZZLES**

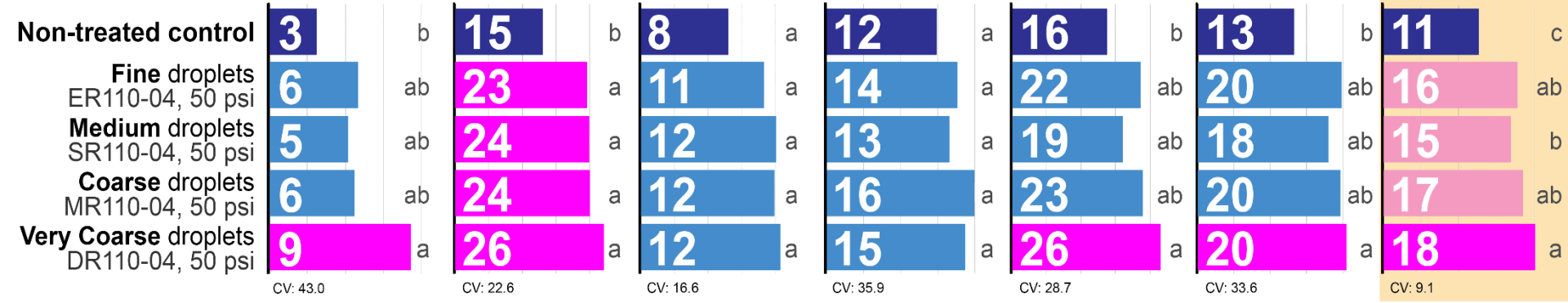
Soybeans: **canopy open** when fungicides applied

	Location	Carrington	Carrington	Carrington	Carrington	Carrington	Carrington	COMBINED ANALYSIS
	YEAR	2019	2019	2019	2019	2019	2019	
	soybean variety:	Peterson '17X09N'	Dairyland 'DSR-0418'	Peterson '14R09N'	Peterson '18X07N'	Dairyland 'DSR-0807'	Peterson '18X06N'	
Canopy Closure	Average:	94.9%	95.9%	98.7%	98.9%	99.6%	99.6%	94.9-99.6%
	Range:	80-100%	90-100%	98-100%	97-100%	98-100%	99-100%	Average across six varieties

White mold severity index (% of canopy diseased)



Soybean Yield (bu/ac; 13% moisture)



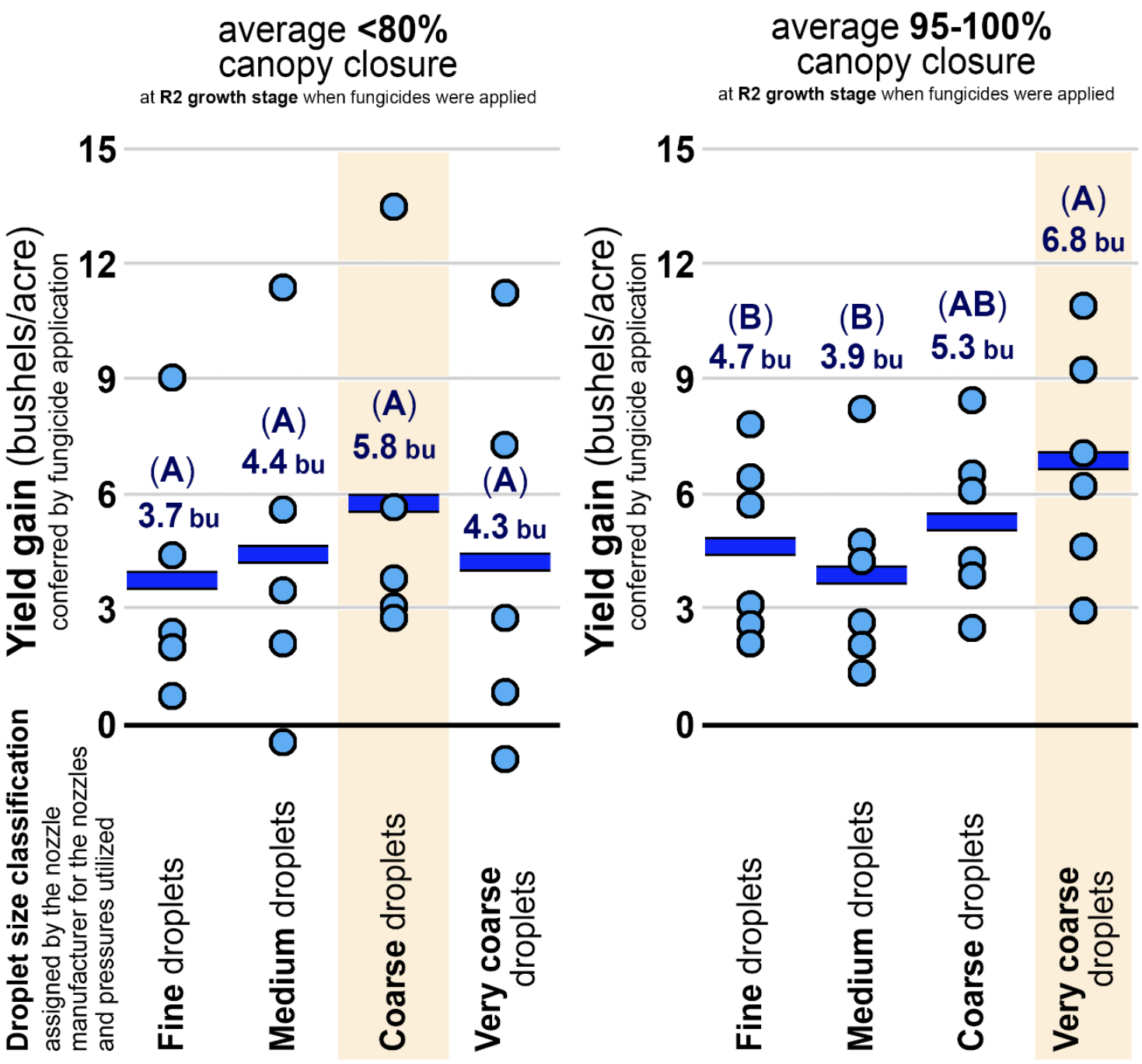
Agronomics - Row spacing: 21 inches **Seeding rate:** 165,000 viable seeds/ac

Fungicide: Endura 70WG 5.5 oz/ac **Application timing:** 100% of plants at R2 growth stage **Spray volume:** 15 gal/ac **Driving speed:** 6.0 mph (2020); 8.9 mph (2019)

IMPACT OF SPRAY DROPLET SIZE: WILGER NOZZLES

Soybeans

Yield gain conferred by the fungicide relative to canopy closure and spray droplet size



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Optimizing fungicide spray droplet size

Soybeans

Soybeans – Wilger nozzles:

Applying fungicides with **very coarse droplets** optimized white mold management in soybeans when the soybean canopy was at or near closure (95-100% average canopy closure).

Applying fungicides with **coarse droplets** appeared to optimize white mold management in soybeans when the soybean canopy was open (<80% average canopy closure), but statistical separation was not achieved.

Different optimum droplet sizes were observed for TeeJet versus Wilger nozzles.

The droplet size spectrum considered to be “medium”, “coarse”, “very coarse”, etc. may be different for Wilger vs. TeeJet.

Quantification of droplet size spectrums will be conducted in 2021.

IMPACT OF SPRAY DROPLET SIZE:
TEEJET NOZZLES

white mold management **pinto beans**

TeeJet nozzles – pinto beans

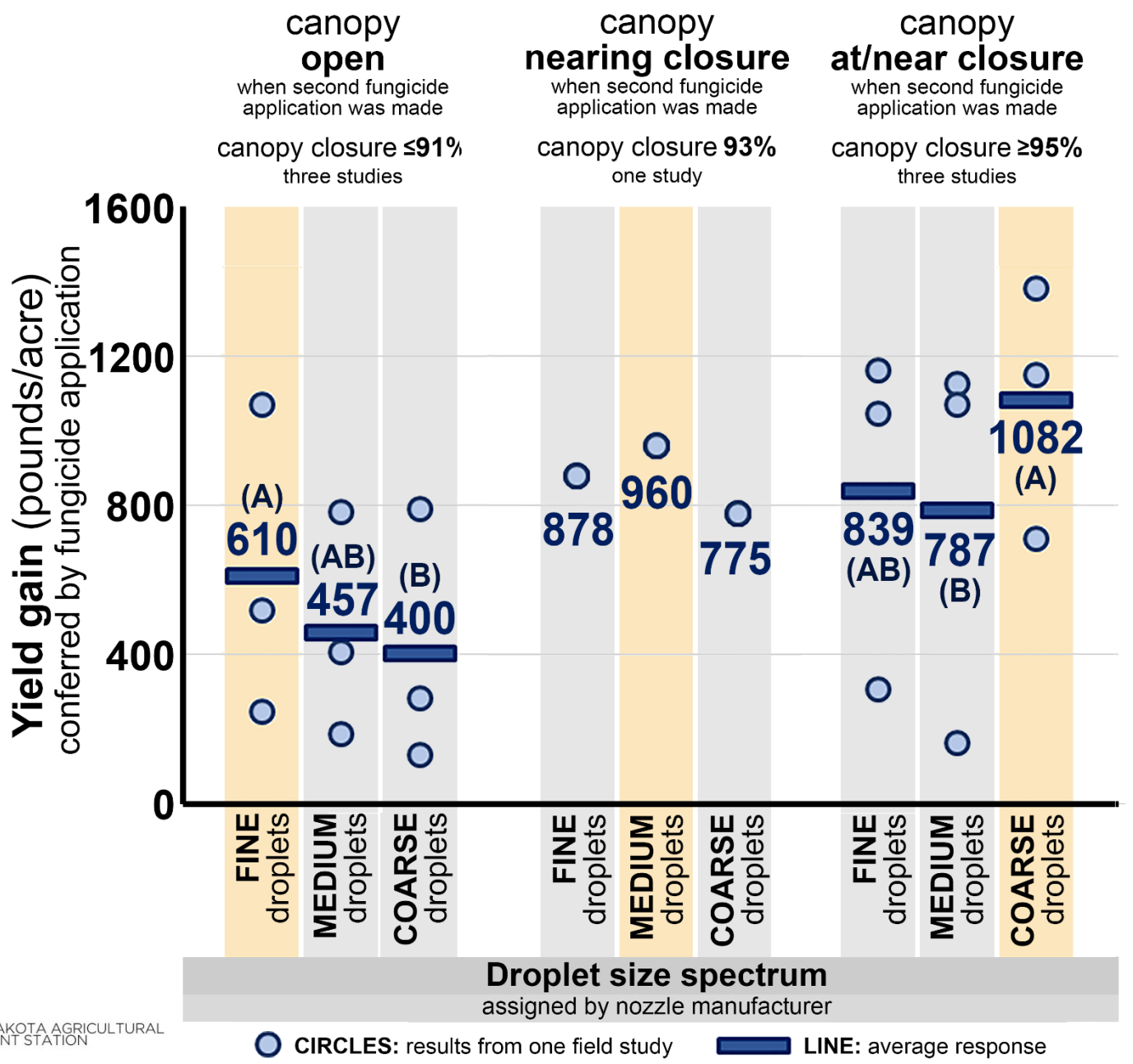
Two fungicide applications were made, with the same droplet size utilized in each application.

Yields were maximized with fine droplets when the canopy was open when the second fungicide application was made.

Yields were maximized with medium droplets when the canopy was nearing closure when the second fungicide application was made.

Yields were maximized with coarse droplets when the canopy was at/very near closure when the second fungicide application was made.

Additional gains in yield would have been likely if droplet size had been calibrated relative to canopy characteristics at each fungicide application.



NORTHARVEST BEANS (MINNESOTA, NORTH DAKOTA)

NDSU NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION

Agronomics - Row spacing: 14 inches **Seeding rate:** 90,000 viable seeds/ac

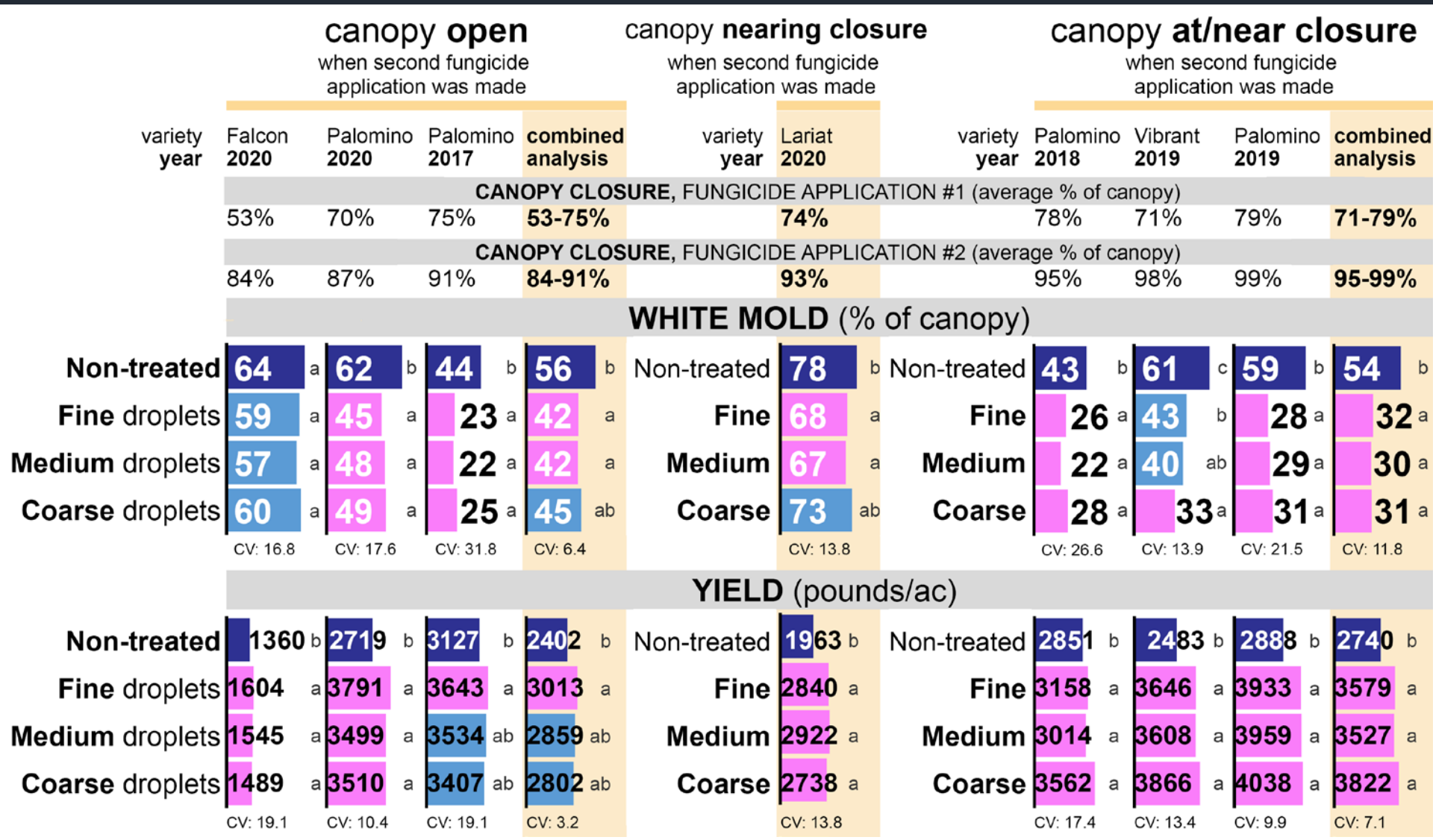
Fungicide: Endura 8 oz/ac followed by Endura 8 oz/ac (2017, 2020); Topsin 40 fl oz/ac followed by Endura 8 oz/ac (2018, 2019)

Application timing: early bloom + 10-14 days later **Spray volume:** 15 gal/ac **Driving speed:** 6.0 mph (2020), 8.9 mph (2019), 6.7 mph (2018), 4.0 mph (2017)

IMPACT OF FUNGICIDE SPRAY DROPLET SIZE: **TEEJET NOZZLES**

white mold management

pinto beans



Agronomics - Row spacing: 14 inches **Seeding rate:** 90,000 viable seeds/ac

Fungicide: Endura 8 oz/ac followed by Endura 8 oz/ac (2017, 2020); Topsin 40 fl oz/ac followed by Endura 8 oz/ac (2018, 2019)

Application timing: early bloom + 10-14 days later **Spray volume:** 15 gal/ac **Driving speed:** 6.0 mph (2020), 8.9 mph (2019), 6.7 mph (2018), 4.0 mph (2017)

IMPACT OF SPRAY DROPLET SIZE:
TEEJET NOZZLES
white mold management
black beans

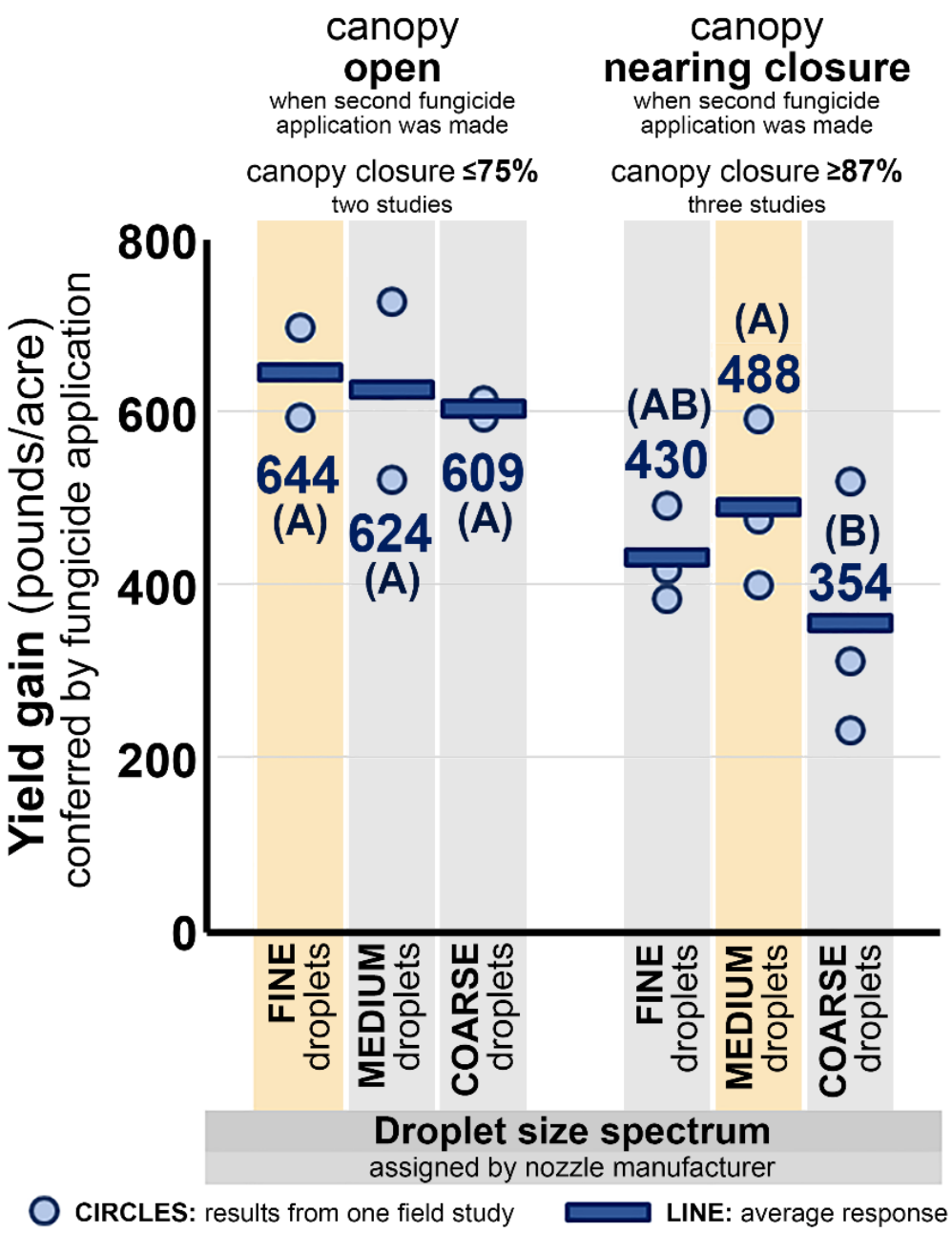
TeeJet nozzles – black beans

Two fungicide applications were made, with the same droplet size utilized in each application.

Yields were maximized with fine droplets when the canopy was open when the second fungicide application was made.

Yields were maximized with medium droplets when the canopy was at/near closure when the second fungicide application was made.

Additional gains in yield would have been likely if droplet size had been calibrated relative to canopy characteristics at each fungicide application.



NORTHARVEST BEANS (MINNESOTA, NORTH DAKOTA)

NDSU NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION

Agronomics - Row spacing: 14 inches **Seeding rate:** 90,000 viable seeds/ac

Fungicide: Endura 8 oz/ac followed by Endura 8 oz/ac (2020); Topsin 40 fl oz/ac followed by Endura 8 oz/ac (2019) ; Endura 8 oz/ac followed by Topsin 40 fl oz/ac (2018)
Application timing: early bloom + 10-14 days later **Spray volume:** 15 gal/ac **Driving speed:** 6.0 mph (2020), 8.9 mph (2019), 6.7 mph (2018)

IMPACT OF SPRAY DROPLET SIZE: **TEEJET NOZZLES**
white mold management in **navy beans**

TeeJet nozzles – navy beans

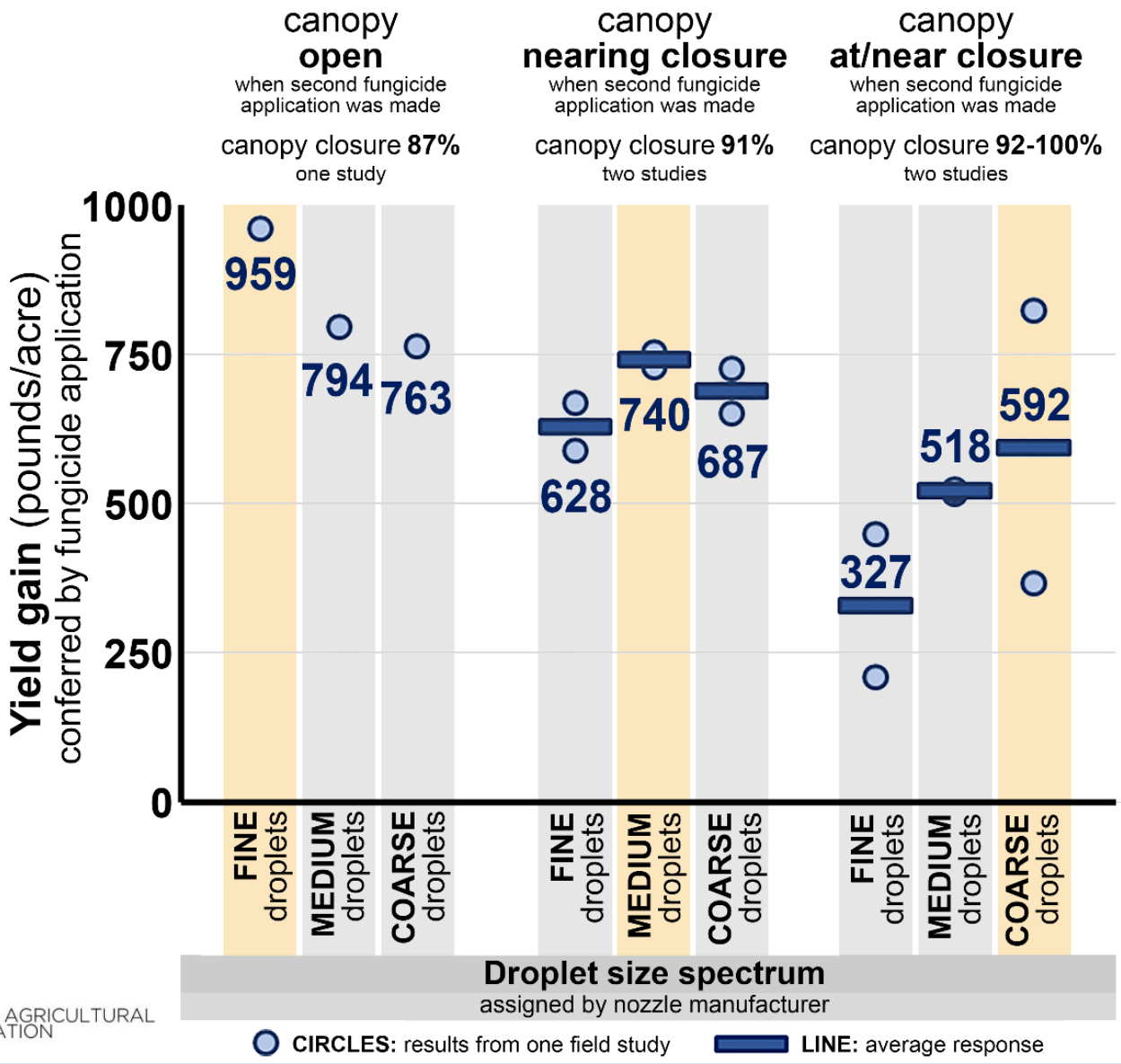
Two fungicide applications were made, with the same droplet size utilized in each application.

Yields were maximized with fine droplets when the canopy was open when the second fungicide application was made.

Yields were maximized with medium droplets when the canopy was nearing closure when the second fungicide application was made.

Yields were maximized with coarse droplets when the canopy was at/near closure when the second fungicide application was made.

Additional gains in yield would have been likely if droplet size had been calibrated relative to canopy characteristics at each fungicide application.



NORTHARVEST BEANS (MINNESOTA / NORTH DAKOTA)

NDSU NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION

Agronomics - Row spacing: 14 inches **Seeding rate:** 90,000 viable seeds/ac

Fungicide: Endura 8 oz/ac followed by Endura 8 oz/ac (2020); Topsin 40 fl oz/ac followed by Endura 8 oz/ac (2019) ; Endura 8 oz/ac followed by Topsin 40 fl oz/ac (2018)

Application timing: early bloom + 10-14 days later **Spray volume:** 15 gal/ac **Driving speed:** 6.0 mph (2020), 8.9 mph (2019), 6.7 mph (2018)

Optimizing fungicide spray droplet size

Dry Beans

Calibrating fungicide droplet size relative to canopy characteristics maximized fungicide performance (white mold control, dry bean yield).

In these studies, two fungicide applications were made, with the same droplet size used in both applications. **Calibrating droplet size relative to the canopy characteristics at <u>each</u> fungicide application is likely to confer additional gains** in white mold control and dry bean yield.

An example: if pinto beans have average 75% canopy closure at the first application and average 98% canopy closure at the second application, fungicide performance is likely to be optimized by using fine droplets on application #1 and coarse droplets on application #2.

In field trials conducted in 2021, testing will be modified, with calibration of droplet size relative to canopy characteristics at <u>each</u> application evaluated.

NDSU NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION

IMPACT OF FUNGICIDE SPRAY DROPLET SIZE: **TEEJET** AND **WILGER NOZZLES**

Ascochyta management in **chickpeas**

Fungicide #1: **Proline** (5.7 fl oz/ac)

The droplet size optimizing performance of Proline was contingent on canopy characteristics.

chickpea variety:	CDC **Leader**	CDC **Frontier**	CDC **Orion**	CDC **Leader**
year that study was conducted:	2019	2019	2020	2020
growth stage when disease developed:	**late vegetative growth**	**late vegetative growth**	**full bloom, early pod-fill**	**full bloom, early pod-fill**

TEEJET nozzles

ASCOCHYTA SEVERITY (0-100)

Non-treated control	49	b	55	c	52	b	44	b
Fine droplets	12	a	20	a	27	a	18	a
Medium-fine droplets	14	a	27	ab	21	a	17	a
Medium droplets	17	a	31	b	21	a	18	a
Medium-coarse droplets	16	a	33	b	26	a	17	a
	CV: 19.0		CV: 7.5		CV: 22.4		CV: 27.9	

CHICKPEA **YIELD** (pounds/acre)

Non-treated control	280	b	49	b	537	b	1008	b
Fine droplets	2066	a	1621	a	2130	a	2135	a
Medium-fine droplets	1973	a	1575	a	2319	a	2200	a
Medium droplets	1896	a	1441	a	2247	a	2197	a
Medium-coarse droplets	1706	a	1440	a	1854	a	2599	a
	CV: 40.3		CV: 33.5		CV: 32.1		CV: 32.0	

WILGER nozzles

ASCOCHYTA SEVERITY (0-100)

Non-treated control	51	b	58	b	32	b	22	b
Fine droplets	13	a	22	a	11	a	7	a
Medium droplets	14	a	23	a	8	a	6	a
Coarse droplets	15	a	24	a	12	a	8	a
	CV: 7.8		CV: 8.4		CV: 19.8		CV: 27.5	

CHICKPEA **YIELD** (pounds/acre)

Non-treated control	231	b	47	b	606	b	983	b
Fine droplets	2182	a	1517	a	2331	a	2058	a
Medium droplets	1982	a	1333	a	2272	a	2277	a
Coarse droplets	2068	a	1354	a	2469	a	2371	a
	CV: 23.2		CV: 36.6		CV: 25.2		CV: 33.8	

Wilger Combo-Jet flat-fan nozzles. FINE DROPLETS: ER110-04, 50 psi (2019); ER110-05, 60 psi (2020); MEDIUM: SR110-04, 50 psi (2019); SR110-05, 60 psi (2020); COARSE: MR110-04, 50 psi (2019); MR110-05, 60 psi (2020). **TeeJet XR flat-fan nozzles.** FINE: XR11004, 50 psi (2019), XR11005, 60 psi (2020); MEDIUM-FINE: XR11005, 40 psi (2019), XR11006, 50 psi (2020); MEDIUM: XR11006, 35 psi (2019, 2020); MEDIUM-COARSE: XR11008, 40 psi (2019, 2020). **Spray volume:** 15 gal/ac **Driving speed:** 8.9 mph (2019), 10.5 mph (2020)

IMPACT OF FUNGICIDE SPRAY DROPLET SIZE: **TEEJET** AND **WILGER NOZZLES**

Ascochyta management in **chickpeas**

Fungicide #2: **Proline** (5.7 fl oz/ac) **+ Bravo WS** (1.38 pt/ac)

Fine droplets (TeeJet) or fine to medium droplets (Wilger) optimized fungicide performance

Wilger Combo-Jet flat-fan nozzles. FINE DROPLETS: ER110-04, 50 psi (2019); ER110-05, 60 psi (2020); MEDIUM: SR110-04, 50 psi (2019); SR110-05, 60 psi (2020); COARSE: MR110-04, 50 psi (2019); MR110-05, 60 psi (2020). **TeeJet XR flat-fan nozzles.** FINE: XR11004, 50 psi (2019), XR11005, 60 psi (2020); MEDIUM-FINE: XR11005, 40 psi (2019), XR11006, 50 psi (2020); MEDIUM: XR11006, 35 psi (2019, 2020); MEDIUM-COARSE: XR11008, 40 psi (2019, 2020). **Spray volume:** 15 gal/ac **Driving speed:** 8.9 mph (2019), 10.5 mph (2020)

Optimizing fungicide spray droplet size

Chickpeas

TeeJet and Wilger Nozzles

For modern locally systemic fungicides, calibrating fungicide droplet size relative to canopy characteristics may maximize fungicide performance (Ascochyta control, chickpea yield).

For contact fungicides or tank-mixes with contact fungicides, fine droplets (TeeJet) or fine to medium droplets (Wilger) may maximize fungicide performance irrespective of canopy characteristics.

The droplet size spectrum considered to be “medium”, “coarse”, “very coarse”, etc. may be different for Wilger vs. TeeJet.

Quantification of droplet size spectrums will be conducted in 2021.

Northern Pulse Growers Association

NDSU NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION

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